MIAMIBEACH

City of Miami Beach, 1700 Convention Center Drive, Miami Beach, Florida 33139, www.miamibeachfl.gov

Jimmy L. Morales, City Manager
Tel: 305-673-7010 , Fax: 305-673-7782

NO. LTC # 596-2017

LETTER TO COMMISSION

TO: Mayor Dan Gelber and Members of the City Commission

FROM: Jimmy L. Morales, City Manager

DATE: December 14, 2017

SUBJECT: Removal of Two Australian Pines on Pine Tree Drive

This Letter to Commission (LTC) is a follow-up to an LTC dated October 23, 2017, which summarized the results of a tree risk assessment conducted along Pine Tree Drive (attached).

On September 24, 2017, two master arborists certified by the International Society of Arboriculture completed a tree risk assessment of the 271 Australian pines located in the median and right-of-way along Pine Tree Drive between 30th Street and 46th Street. Per the results of the assessment, there are two Australian pines located on Pine Tree Drive, one on the 4200 block and one on the 4400 block, that pose an imminent hazard and must be removed. Pine Tree Drive is a county road. Therefore, following the city's tree assessment Miami-Dade County was notified of the two high-risk trees and the city requested emergency action for their removal.

The work is scheduled to begin on Tuesday, December 19 and is anticipated to take approximately one day, with the potential of up to two additional work days as warranted by the on-site and weather conditions. Temporary closure of one lane may be required on northbound and southbound Pine Tree Drive. However, no lane closures or work will occur during rush hours (before 10 a.m. or after 3:30 p.m.). Residents will be notified via e-mail and on social media. Additionally, a copy of this LTC will be hand delivered to homeowners in the immediate vicinity of the two trees to be removed.

Should you have any questions, please contact Omar Leon, Urban Forester, at 305-673-7722.

Attachments:
A — Letter to the Commission – Pine Tree Drive Tree Assessment – October 23, 2017

ATTACHMENT A

MIAMIBEACH

City of Miami Beach, 1700 Convention Center Drive, Miami Beach, Florida 33139, www.miamibeachfl.gov

Jimmy L. Morales, City Manager
Tel: 305-673-7010 , Fax: 305-673-7782

NO. LTC # **509-2017** LETTER TO COMMISSION

TO: Mayor Philip Levine and Members of the City Commission

FROM: Jimmy L. Morales, City Manager

DATE: October 23, 2017

SUBJECT: Hurricane Irma Tree Assessment and Next Steps

The purpose of this Letter to Commission is to update the Mayor and City Commission on the tree assessments completed after Hurricane Irma, including an assessment of the Australian pines along Pine Tree Drive between 30th Street and 46th Street, and on the city's short-term and long-term plans to recover the urban forest from the losses experienced during the storm.

Last month Hurricane Irma damaged many trees throughout the city. Urban Forestry staff, in coordination with Greenspace Management staff and Parks and Recreation staff, assessed all the trees impacted within the public right-of-way and in public parks to determine which could be saved and which had to be removed. Viable trees are being re-staked, pruned and watered, as appropriate, to improve their chances of survival. Through these interdepartmental efforts, the city has saved many trees. However, several trees were deemed imminent hazards or were severely damaged and are being removed. A final count will be provided by the end of January when all of the hurricane debris has been cleared.

Pine Tree Drive Tree Assessment

On September 24, 2017, two master arborists certified by the International Society of Arboriculture completed a tree risk assessment of the 271 Australian pines located in the median and right-of-way along Pine Tree Drive between 30th Street and 46th Street (Attachment A). The trees along this corridor are approximately 100 years old and have exceeded the average lifespan of Australian pines in Florida, which ranges from 40 to 50 years. As such, the city conducts a risk assessment every three years to determine their condition and what, if any, maintenance work is needed to lower their risk for failure (toppling over or losing a branch). Based on the results of these assessments, the city works with Miami-Dade County, since this is a county road, to ensure high-risk trees are properly maintained or removed.

The assessment completed last month was scheduled as an update to the prior assessment completed in January 2014. Its goal was to confirm whether weight reduction pruning conducted in January 2017 was effective in increasing tree stability and reducing risk. However, since the new assessment was completed after Hurricane Irma, it also captures any impacts caused by the storm.

Per the arborists' report, the Australian pines along the corridor have significant structural problems, resulting primarily from decay at their base. Of the 271 Australian pines evaluated, one toppled over during Hurricane Irma and two trees were deemed imminent hazards to be removed immediately. Additionally, 254 trees must be substantially pruned to make them less top-heavy and better able to support the weight of their canopy, particularly during periods of heavy winds. The city has notified the County of the need to conduct this work and has requested the two emergency tree removals be scheduled as soon as possible. The maintenance pruning of the 254 trees is anticipated to cost $200,000.00 and is currently unfunded.

Photo 1 – Decay and Crack on Imminent Hazard

Photo 2 – Properly Pruned Australian Pine

The maintenance pruning will build off of the weight reduction pruning conducted earlier this year, which was deemed insufficient. The goal is to reduce the potential of the trees to fall during a storm before the start of next hurricane season. It is anticipated that the pruning can extend the useful life of these 254 trees for up to 10 years. Even after the pruning is completed, the city will need to continue evaluating the risk of the Australian pines on an on-going basis to determine how each tree responds to the weight reduction pruning, as well as how the decay in each tree progresses. Future assessments may determine that additional removals and/or pruning will be necessary depending on the risk factor of each tree's condition.

It is recommended that the city begin developing a long-term plan for this corridor as these trees reach the end of their life. This plan should take into account that Australian pines are categorized as a Class I invasive species that cannot be replanted or sold in Miami-Dade County. Additionally, Australian pines change the chemistry of their surrounding soil to prevent competition from other species. The replanting plan will need to include restoration of the soil, as well as a minimum buffer between existing Australian pines and new plantings to ensure they survive.

Recovery Reforestation

Once the removal of damaged trees and vegetative debris is completed, Urban Forestry staff will be conducting a before and after comparison using satellite imagery to determine the percentage of canopy loss from Hurricane Irma throughout the city. They will also be reviewing pre- and post-storm inspection photos and conducting field inspections to ground truth their analysis. In addition to quantifying loss, these efforts will identify locations in the right-of-way and city parks that need to be replanted.

Based on initial observations, there has been a substantial loss of trees, which will take several years to fully replace. This fiscal year the City Commission approved $75,000 for citywide reforestation. The city also was awarded Neat Streets grant funding to plant 44 high-quality trees in pre-selected locations within the city's right-of-way. The availability of reforestation funds allows the city to begin recovery reforestation quickly and, when combined with funding from Greenspace, Parks and FEMA, speeds up the rate at which our urban canopy can recover.

This fiscal year the City Commission also approved $25,000 for the development of the city's first ever Street Tree Master Plan. The Plan will create a vision for prioritizing trees in our neighborhoods and for meeting present needs while considering the needs and challenges of the future, such as sea level rise. In its development, Urban Forestry staff will work with community stakeholders to define tree species diversity street-by-street, creating cohesive neighborhoods with the right tree planted in the right place. Once completed, the Plan will guide reforestation efforts moving forward.

Should you have any questions, please contact Omar Leon, Urban Forester, at 305-673-7722.

Attachments:
A – Pine Tree Drive Risk Assessment Report

Cc: City of Miami Beach Historic Preservation Board

SMT/MKW/OJL

ATTACHMENT A

Pine Tree Drive

Tree Risk Assessment Report

by

Daniel Lippi
ISA Board Certified Master Arborist #FL6145B
ISA Tree Risk Assessor Qualification (TRAQ)

and

Chuck Lippi
ISA Board Certified Master Arborist #FL0501B
ASCA Registered Consulting Arborist #443
ISA Tree Risk Assessor Qualification (TRAQ)

September 24, 2017

Introduction

Summary

Overall the Australian pine population on Pine Tree Drive is healthy but has some significant structural problems mostly basal decay, which is difficult to measure, columns of internal trunk decay and long sprawling lateral branches that create increased leverage force on the decayed trunk areas of the trees. The first significant pruning done since we started the tree risk assessment of the Australian pines in 2010 was in January 2017, seven years after the original request. Unfortunately, the pruning done in January 2017 was insufficient in scope to achieve the desired effect of significant crown reduction. Recent revisions to the ANSI A300 Pruning Standards which are integral guidelines to the Miami-Dade County Tree Ordinance permit increased amount of pruning that we recommend. The old ANSI A300 Pruning Standards did not. The Australian pine trees growing in the wide median north of 41st Street have more root space and are generally in better structural condition than the trees growing south of 41st Street mostly in the narrow 9-foot wide median where roots are restricted by pavement and curbing. Looking forward, we need to seriously consider aggressive canopy reduction as a realistic option for many of the trees and in some cases tree removal.

Background

Previous tree risk assessments were done in 2010-2011 by Chuck Lippi and 2014 by both Chuck and Daniel Lippi. Each report called for the removal of a few trees and severe crown reduction on remaining trees to reduce lever forces of wind of the sprawling branches and on the compromised trunks that have been weakened by decay over the years. After the 2014 tree assessment and report, we gave a short presentation to the Miami Beach Historic Preservation Board indicating that crown reduction was imperative to avoid continued tree failures. That crown reduction pruning was finally done, we understand, in January 2017. Unfortunately, the crown reduction done in January was insufficient providing less than 15 or 20 percent crown reduction instead of the 40 to 50 percent crown reduction we recommend. Because there has been no significant mechanical change to the structure of the trees, their level of risk has not been reduced and in effect the pruning was not successful.

Assignment

In August, 2017, Advanced Tree Care was given the assignment by the City of Miami Beach to perform a Tree Survey and Risk Assessment, our third on this street since 2010, for approximately 271 historic Australian pines (*Casuarina equisetifolia*) on Pine Tree Drive.

Our assignment was to:
1. Assess the current condition of the trees.
2. Make recommendations to reduce risk
3. Make recommendations to maintain healthy trees and mitigate structural problems and risk as much as possible.

Because of the timing of Hurricane Irma, we were able to re-evaluate the structural condition of 145 Australian pines which were evaluated before the hurricane hit and again shortly following the hurricane to have a sense of the Australian pine reaction to a very stressful wind event. One Australian pine tree failed during Hurricane Irma (tree #33806) and another tree (#33384) cracked horizontally at the base and is in line for removal as soon as possible.

***Important Note*: The terminology used in this report to describe tree defects observed, maintenance recommended and risk score rating is designed for the use of ISA Certified Arborists who are trained in Risk Assessment protocol and ANSI A-300 Pruning Standards. Property owners and residents concerned about the health and structural condition of the trees near their property or public right of way may find the arboriculture terminology used confusing. Likewise, tree service workers who are not trained in Risk Assessment protocol and ANSI A-300 Pruning Standards may also find the terminology confusing, in which case they should not be hired to perform the maintenance work recommended.**

Limits of the Assignment

We visually inspected each tree for the inventory and risk assessment. We did not survey any other trees on or near the site. Tree evaluations and data gathering was done on September 5, 2017 just prior to Hurricane Irma and September 18, 2017 following Hurricane Irma. Our observations and conclusions are as of those days.

The first half of the Australian pine trees evaluated on September 5 were re-evaluated on September 17 following the hurricane to determine damage and effects of the hurricane. A severe storm or other environmental factors can change the observations and maintenance recommendations

Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not always fully understand. Conditions are often hidden within trees, below ground or not clearly visible from the vantage point on the ground. Arborists cannot guarantee that a tree will be healthy, safe or adequately protected under all circumstances or for a specified period of time. Likewise, remedial, protective and mitigating treatments and recommendations cannot be guaranteed.

Purpose and Use of the Report

This report is prepared for the City of Miami Beach. The main purpose of the tree inventory is risk assessment, which identifies apparent tree problems and provides valuable information for a long-term management plan, allowing for effective use of tree funds and more accurate budget projections. This tree inventory and assessment provides information on the condition of the Australian pine trees on Pine Tree Drive between West 46th Street and West 30th Street. An additional benefit is that the City of Miami Beach is on record as having risk assessment procedures in place and an on-going risk assessment program.

Testing and Analysis

The Risk Assessment was done in accordance with ***ANSI A300 Standards on Tree Risk Assessment*** and the companion publication ***Best Management Practices, Tree Risk Assessment***.[1],[2] Tree health recommendations follow procedures and techniques of two of the country's leading arboricultural researchers: Dr. Ed Gilman, professor emeritus (retired) of environmental horticulture at the University of Florida and Dr. Kim Coder, professor at the University of Georgia. Health evaluation techniques were adapted from Dr. Jerry Bond.[3] Pruning recommendations follow the 2017 updated ANSI A300 Pruning Standards,[4] which contain some important changes from the previous 2008 version, and these changes will affect our recommendations. Pruning recommendations also follow the authoritative pruning guide by Dr. Gilman, ***An Illustrated Pruning Guide.***[5]

On each tree evaluated we performed a **Level 2 Basic Assessment**, which is a detailed visual inspection of a tree and its surrounding site. The **Level 2 Assessment** includes a 360-degree visual inspection from ground level on each tree and sound testing of the lower trunk and root flares with a rubber mallet to listen for tonal variations that may indicate dead bark or internal hollows. When there is sufficient evidence gathered under a Level 2 Assessment for additional evaluation of a tree found to have significant structural defects such as visible cavities, decay or indications of possible decay from a sounding test, we sometimes recommend a **Level 3 Advanced Assessment** with a resistance drill test to determine the extent of internal decay and strength loss. A resistance drill is a drilling device that measures and graphs decay as the narrow ⅛-inch drill bit passes through the different layers of solid and decayed wood. Level 3 Advanced Assessment was part of the scope of this assignment but in our opinion the resistance drill was not needed based upon our current observations, past experience and the advice of wood decay expert Francis W.M.R. Schwarze.[6] According to Dr. Schwarze, the Resistograph cannot distinguish differences between solid wood and wood decayed with *Kretzschmaria deusta*, which is the one of the main suspected basal decay organisms infecting the Pine Tree Drive Australian pine trees.

ID Tags - During the first tree risk assessment done in 2010, each tree was given a uniquely numbered black nylon tag secured to the trunk with a stainless steel nail. Approximately 15 of the tags had come off since 2010 but the tree identification numbers were discernible by checking the numbers of adjacent trees. On the next risk assessment of the Pine Tree Drive trees, new tags should be used to replace missing tags. Although the numbers will no longer be sequential, the trees missing tags will then be more easily identified by work crews when maintenance work has been assigned to a specific tree. New tags can be installed before the next assessment If desired by the City of Miami Beach.

Figure 1 *Inonotus dryadeus* conks are regularly seen on the lower trunks and decaying galls on Pinetree Drive. It is a butt rot or basal rot fungi. Identification is easy because of the amber droplets that form on a fresh conk (arrows).

Fungal Conks - During the previous assessment and the current assessment of the trees, two decay organisms were identified in the field. The first is *Inonotus dryadeus* commonly called "weeping conk" for the amber droplets that form on the surface of fresh conks (Figure 1). It is a root and butt rot fungi and is considered a white rot but shows symptoms of soft rot by preferentially degrading cellulose first making the tree brittle. According to F.W.M.R. Schwarze, et. al., *Inonotus dryadeus* infected trees do not exhibit any symptoms in the crown for a long time "and apparently healthy trees can be suddenly blown down by the wind because their roots are destroyed."[7] The second fungus found at the site is *Kretzschmaria deusta*, commonly called "brittle cinder" for the burnt appearance (Figure 2) and the characteristic of making infected wood brittle. *Kretzschmaria deusta* is a soft rot that preferentially degrades cellulose before degrading lignin making the butt area brittle much like a ceramic. Our visual diagnosis is guided by the photographs and description provided by Sinclair's authoritative textbook.[8]

Figure 2 Pieces of black crusty psuedosclerotial plates of what I believe to be the pathogen *Kretzschmaria deusta* litter the ground below a basal cavity. These black crusty plates are found near the base of many of the Australian pines on Pinetree Drive.

Data Collection

Both empirical data as well as subjective data were gathered on each tree. Data was collected on HanDBase, a data collection database application used on our handheld smartphones and downloaded to a MS Excel spreadsheet.

Empirical data included:
1. tree tag number

The Subjective data included:
1. **Basal condition** (*none apparent, suspected cavity but not visible, visible cavity - large, visible cavity - moderate,* and *visible cavity - small*) Basal decay is one of most difficult areas of decay to identify because the damaged area is

often well hidden beneath the trunk and some of the main pathogens do not register with some of the Level 3 diagnostic equipment. We visually measured the amount of decay at the base of the tree and also used a 4-foot fiberglass probe to see if the probe could be inserted beneath the base of the trunk.

2. **Gall condition** (*No galls present, solid galls, some decay,* and *extensive decay*). Galls, also known as burls, are large growths usually on the trunk. They normally do not affect tree structure unless the galls are heavily decayed. For more information on the cause and effects of galls, go to page 10 of this report under DBH Measurements.
3. **Mallet test** (*negative, positive* or *inconclusive*) provides results by hitting the trunk at various locations and heights with a rubber mallet to measure tonal variations. A positive mallet test indicates a decayed area or hollow area in the trunk.
4. **Tree health** – An evaluation of tree health provides another perspective for determining a Risk Score. Tree health was divided into three separate categories:
   - ***Tree opacity*** is the percentage of light visibly blocked by branches, foliage and reproductive structures of the actual upper live crown. Opacity provides an estimate of the actual photosynthetic tissue within the crown of the tree. A higher percentage is most desirable.
   - ***Tree vitality*** – is the percentage of the upper crown that is free from recent mortality on branches with fine twigs, beginning at the terminal portion of a branch in proceeding toward the trunk. This is exemplified by dead branches in the mid and upper crown. A higher percentage (few or no dead branches) is most desirable.
   - ***Crown to trunk ratio*** — is the ratio of the live crown height to the total live tree height, expressed as a percentage. Again, a higher percentage is most desirable (Figure 3).

Figure 3 The crown to trunk ratio is the ratio of the height of the tree's crown (red vertical line) compared to the overall height of the tree trunk (yellow vertical line) Photo from Dr. Jerry Bond, ***Urban Tree Health: A Practical and Precise Estimation Method***, Urban Forest Analytics LLC, 2012.

5. **Structural problems** (a list of defects including: *sprawling branches, extensive decay, moderate decay, nominal decay, hangers, dead branches, fungal conks, cracks*)
6. **Work Recommended** (*None recommended, Priority 1 remove, Priority 2 remove, Priority 3 remove, End Weight Reduction, Priority 1 prune, Priority 2 prune*) A description of the maintenance activities recommended is found on page 20 of this report (Figures 17 and 18, page 20).
7. **Observations** (other notations on tree defects and conditions including: *column of decay; fungal conks including Inonotus dryaedus, Kretzschmaria deusta; missing tag, old lightning strike, bee colony, strangler fig*)
8. **Likelihood of Failure** (*improbable - 1, possible - 2, probable - 3* and *imminent - 4*)
9. **Size of part** the size of the tree part likely to fail (*1 - small, 2- medium, 3 - large*)
10. **Decay** (*1 - small, 2- medium, 3 - large*)
11. **Health Condition** (*good - 1, fair - 2*, and *poor - 3*)
12. **Structural Condition** (*good - 1, fair - 2*, and *poor - 3*)

Risk Assessment Rating System

The risk rating score in the last column of the data sheets is used to provide a relative measure of tree health and structural condition of the tree population utilizing the items 8 through 12 above. We scored each tree according to a risk assessment rating system developed by the ANSI A-300 risk assessment standards and adapted by us to better assess the special conditions of the Pine Drive trees.

Trees were rated in each category and the sum of the five categories represents the Risk Score. The higher score means a higher risk for that category. The highest risk tree could attain a hazard rating of 16. The lowest risk tree could have a hazard rating of 5. The risk ratings for all the trees are shown in Figure 19 on page 21 of this report.

According to Clark and Matheny,[9] "Thus hazard ratings cannot strictly define a numerical line for action between either removal and retention or treatment and no treatment. This must be an administrative decision, one made by owner and manager. In municipal situations, where an agency might manage a very large number of trees, there may be practical limits to the amount of work that can be undertaken and only the most severe and significant hazards may be addressed.

Some level of risk will always be present when people live among trees. The decision of how much risk is tolerable remains with the owner and manager."

Figure 4 Large galls are prevalent on most of the Australian pine trees on Pine Tree Drive.

Tree Health and Structural Condition - Each tree was also evaluated as to its overall health and structure. It is important to understand that health and structure are two separate and independent considerations. A tree can be healthy yet have poor and hazardous structure. Live trees with lots of green foliage can fail and sometimes do. Structurally sound trees sometimes decline and die from poor health.

DBH Measurements - A tree measurement normally taken during tree evaluations, **DBH,** was not taken because the trees are heavily infested with large trunk galls or tumors, which we believe are caused by the bacterium *Agrobacterium tumefaciens*. The galls are technically called crown galls or crown gall tumors, but for simplicity we will refer to them as galls in this report. The large galls are often located on the trunk where the DBH measurement should be taken and the presence of the galls makes accurate DBH measurements difficult if not impossible. A majority of the trees (93 percent) had medium to very large galls on their trunks. Only seven percent of the trees were free of galls. Galls are not pathogenic and usually do not negatively affect the structure and strength of a tree as long as the galls are solid. However, if the gall begins to decay, as is the case with many of the galls on trees on Pine Tree Drive, we have observed the decaying galls can provide an entry point for a decay organism to enter the tree trunk and degrade the trunk tissue.

Pruning and Maintenance Categories

Trees that were marked for some form of maintenance received one of the following descriptive classifications in item 6 on page 8 above. All work should follow ANSI A300 Pruning Standards:

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

- ***Priority 2 Removal*** Trees that should be removed but do not pose a liability as great as the first priority will be identified here. This category would need attention as soon as "Priority 1" trees are removed and Priority 1 Prune is done.
- ***Priority 3 Removal*** Trees that should be removed, but pose minimal liability to persons or property, will be identified in this category.
- ***Priority 1 Prune*** Trees that require priority one pruning are recommended for trimming to remove hazardous deadwood, hangers, or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead, dying, or diseased limbs on leaders greater than four inches in diameter.
- ***Priority 2 Prune*** These trees have dead, dying, diseased, or weakened branches between two and four inches in diameter and are potential safety hazards.
- **End Weight Reduction Pruning** These trees require routine horticultural pruning to correct structural problems, reduce crown size, remove dead branches, strangler fig plants or vines, or correct growth patterns which would eventually obstruct traffic or interfere with utility wires or buildings. Large Tree Routine Pruning is often used to describe this process. But in this case the authors wanted to emphasize end weight reduction to reduce crown size as the primary goal.

Observations

General Tree Species Characteristics

In our initial report dated November 7, 2010 and our subsequent report in 2014, we provided some basic background information on the history of the trees, information about the species and information about the site. Some of this background information has been repeated in this report under Observations "The Trees" and "The Site" for the benefit of those who have not seen the first report.

The Trees

The Australian pines growing along Pine Tree Drive in Miami Beach are a dichotomy. On the one hand, the 271 trees examined are all *Casuarina* *equisetifolia,* which is a Category I invasive exotic plant. Category I invasive exotic plants are those that are altering native plant communities based on the documented ecological damage. On the other hand the same trees were also designated as historic trees and the street, Pine Tree Drive, a historic site by the Miami Beach City Commission in June, 2001.[10] According to early records[11], John Collins, was one of the first settlers in what was to become Miami Beach. In 1910, Collins planted Australian pines as a windbreak to protect his young avocado and mango groves. The same pines planted in 1910 now stand along what has become Pine Tree Drive in the City of Miami Beach.

According to Dr. Ed Gilman, University of Florida Professor of Urban Trees & Landscape Plants in the Environmental Horticulture Department and one of the country's leading arboricultural researchers, "Long-favored for use in erosion control along beaches, the Australian pine tree is now outlawed in many parts of Florida due to its invasive nature, rapid growth rate, and non-native status. It is not a true pine tree and is not related to the pines. A straight, upright tree capable of reaching 70 to 90 feet in height and possessing rough, fissured, dark-gray bark, Australian pine has what appear to be long, soft, gray/green needles but these 'needles' are actually multi-jointed branchlets, the true leaves being rather inconspicuous." [12]

The trees along Pine Tree Drive range in diameter from approximately 16 inches to an estimated 42 inches with a predominance of the smaller diameter trees growing in the narrow median to the south of 41st Street. We presume from the historical records provided to me in 2010 by Dr. Chris Latt (now deceased) that all the trees are approximately the same age. The large range in trunk diameter may be readily explained by the difference in root space by the relatively narrow 9-foot wide median south of 41st Street and the more root friendly 30-foot wide median north of 41st Street. Or possibly some of the trees especially on the south end may have been planted at a later date.

According to the records used to designate the trees as historic, the trees are approximately 100 years old. Some experts[13] say the average life span of Australian pines in Florida is around 40 to 50 years with some specimens reportedly living "hundreds of years in parts of their native range."[14] The Australian pines appear to be well over their average age and should be treated as veteran trees, in our opinion.

According to the Smithsonian Marine Station at Ft. Pierce, "Early on, Australian pine was also utilized in Florida as a a lumber species and in ditch and canal stabilization. It ultimately proved to be poorly suited to this latter use, again due to its shallow root system and its tendency to be blown down. More troubling than its poor utility as a purpose-cultivated species, *C. equisetifolia* revealed itself to be a highly invasive species in Florida. The species' ability to colonize disturbed and nutrient-poor sites, its high fecundity, protracted reproductive season, broadcast seed dispersal, and tendency to form monospecific stands are traits that make it a highly competent invader." And the article continues, "Australian pine is generally the dominant species in competitive interactions with native Florida vegetation. Dense thickets of Australian pine can outcompete and displace mangroves and other native coastal vegetation in Florida. There is evidence that the fallen branchlets are allelopathic in nature, containing chemical compounds that inhibit growth, survival, or recolonization by native plant species."[15]

Predominant Failure The type of tree failures that have been reported along Pine Tree Drive have been entire trees falling over due to root or basal decay. According to verbal accounts, five Australian pine trees fell during the hurricanes of 2004 and 2005. Then a large Australian pine fell on September 15, 2010 across Pine Tree Drive at 34th Avenue. The cause of this failure on a calm day also appears to have been basal rot. Some small lateral branch failures have occurred from time to time but these are not documented and appear to be without incident and minor in nature. Apparently there has been another tree failure on Pine Tree Drive sometime after the previous 2010-2011 assessment. However, that incident occurred before the City's previous Urban Forester Mark Williams was hired so there is no historical information available on the exact cause of the failure. One more tree failed during Hurricane Irma earlier this month with some property damage. It is tree #33806 located on the west swale. Another tree #33384 had a large horizontal crack in the base, a sign of imminent failure. That tree crack was noticed during our reevaluation of the north section of trees following Hurricane Irma. The crack did not exist during our pre-hurricane evaluation of the north section of Pine Tree Drive. Tree #33384 was marked for a Priority 1 removal.

On Sept. 18, 2017 after the hurricane we were able to observe tree #33806 that had been partially removed and cut into pieces. Because the basal portion of the tree and stump had been pulled out of the ground by the time we reached the tree, we could not tell if the entire tree had failed by falling over or if the trunk had snapped at a weakened area caused by decay higher on the trunk. We did observe that there was significant basal decay as well as a column of decay which extended well up into the upper canopy. According to the homeowner who spoke to us, the tree broke at a decayed area about 20 feet above the ground. Before it was removed the tree was very near the street and we observed few roots had grown into the street below the asphalt. Although roots growing into the street below the asphalt cause infrastructure damage and make an uneven surface, those lateral roots help make the tree more stable. So a more stable tree will have more lateral roots that will conflict with nearby infrastructure.

Site

There are now 271 trees growing in the right-of-way with trees growing in a double row in a 30-foot wide median between 41st Street and 46th Street, and trees are growing in a single row in an approximately 9-foot wide median between 41st Street and 30th Street. There are also approximately 20 Australian pine trees growing on the west side of the street in the right-of-way between 30th Street and 34th Street. The narrow median has a curb at the edge of the street on the east side and no curb on the west side of the median. On the west side of the street tree roots are lifting the asphalt pavement in some places. On the east side of the median there is little evidence of root damage to the pavement which raises the probability that at one time the tree roots had been cut for the installation of the curb. The north end of the double row of trees just south of 46th Street is approximately 4 feet higher than the street grade. This berm gradually lowers to street grade approaching 41st Street.

Problems and Defects Observed

Basal Decay and Gall Decay

Basal decay and the somewhat related gall decay provide an indication of the structural condition of the tree. The condition of the base of the trunk and the condition of the galls coincides (Figures 5 and 6). Basal decay is difficult to measure because a small opening at the base of the trunk may be the only indication that a large decayed area exists. A probe is still the best tool for locating basal decay. Because so many of the Australian pine trees on Pine Tree Drive have galls (97 percent of the trees), monitoring decay on the galls is useful. We have observed that often gall decay is a precursor of trunk decay. Figures 7 and 8 show how basal decay colonizes the lower trunk and Figure 8 shows why diagnosing basal decay is so difficult.

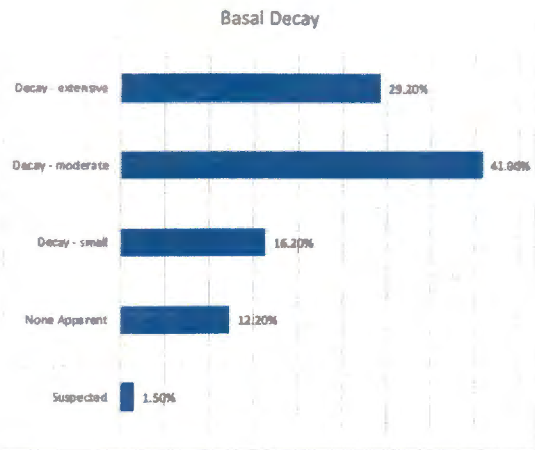

Figure 5

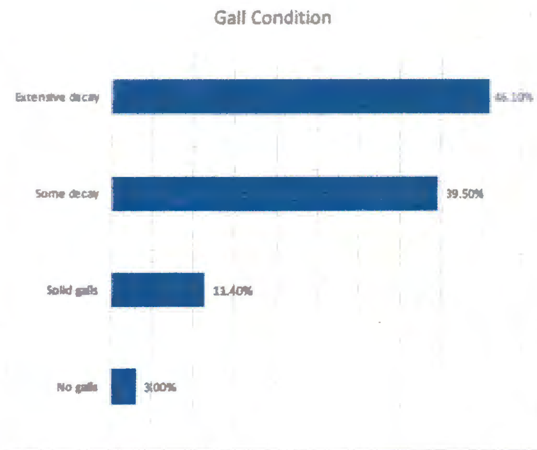

Figure 6

Figure 7 Basal decay also called root and butt rot caused by Kretchmaria deusta appears on the lower part of the trunk and upper roots. Drawing from Schwarze, Engels and Mattheck, ***Fungal Stategies of Wood Decay in Trees.***

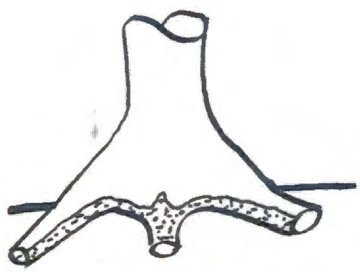

Figure 8 Basal decay also called root rot caused by Inonotus dryadeus appears on the lower part of the trunk and underside of roots. Drawing from Schwarze, Engels and Mattheck, ***Fungal Stategies of Wood Decay in Trees.***

Mallet Test

The simple rubber mallet test is still a useful tool is locating decay on the trunk. Sixty four percent of the trees had a positive mallet test result on some portion of the trunk (Figure 9). Sometimes the decay or hollow area was in one section and one side of the trunk and other times the mallet test showed that there was a column of decay extending from low in the trunk upward. A column of decay is usually of greater concern than a localized hollow area or area of decay on the trunk because it indicates a lack of vertical compartmentalization.

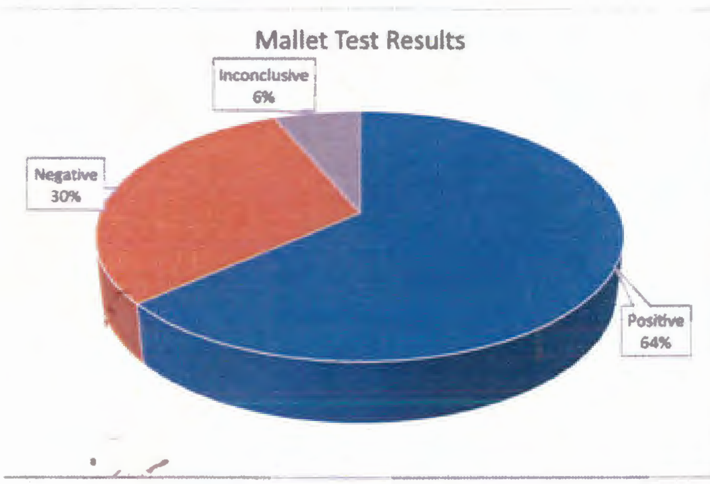

Figure 9

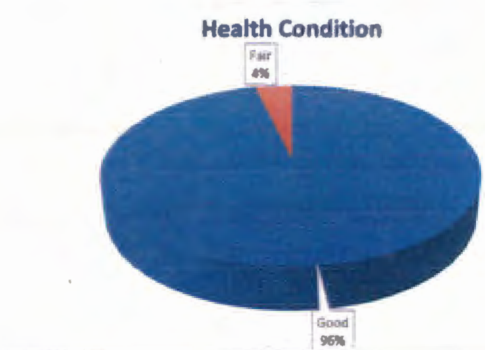

Figure 10

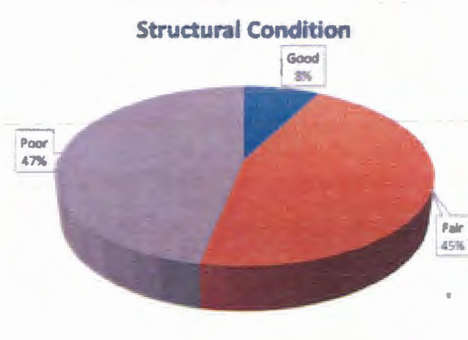

Figure 11

Health and Structural Condition

The health condition (Figure 10) of a very high percentage, 96 percent, of the Australian pine trees is good with only four percent evaluated as fair. Structural condition, however, is not so good because of the widespread decay found on the trunks, basal areas and galls. Only eight percent of the trees are in good structural condition while 45 percent are fair and 47 percent are poor (Figure 11). Breaking down the data between the north section and south section (Figure 12), more trees are in poor structural condition on the south section.

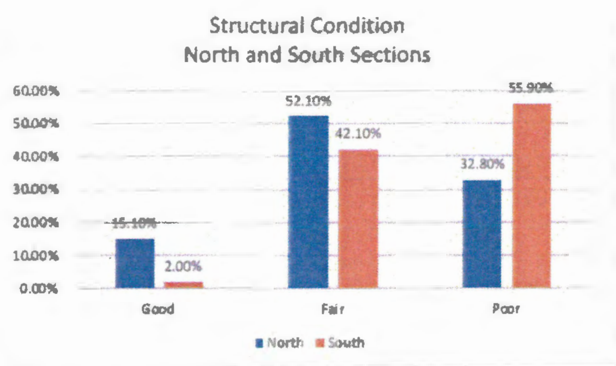

Figure 12

Size of Part Likely to Fail and General Decay Condition of the Tree

Because of the location of most of the decay in the trunk or basal area, the part of the tree most likely to fail is the entire trunk or a large branch. Seventy-eight percent of the tree parts likely to fail are large (Figure 13).

Breaking down the decayed trees into those that have a column of decay and further breaking the data down into trees in the north section (with the wide median) and trees in the south section (with the narrow median), 26.1 percent of the north trees have a column of decay while 44.7 percent of the trees south of 41st Street had a column of decay (Figure 14).

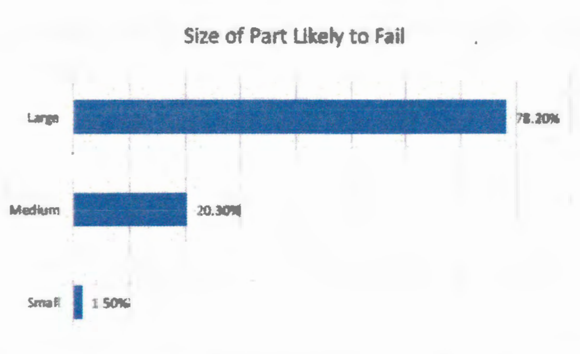

Figure 13

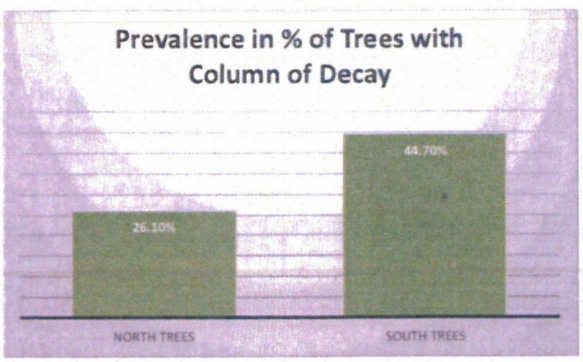

Figure 14

Likelihood of Failure

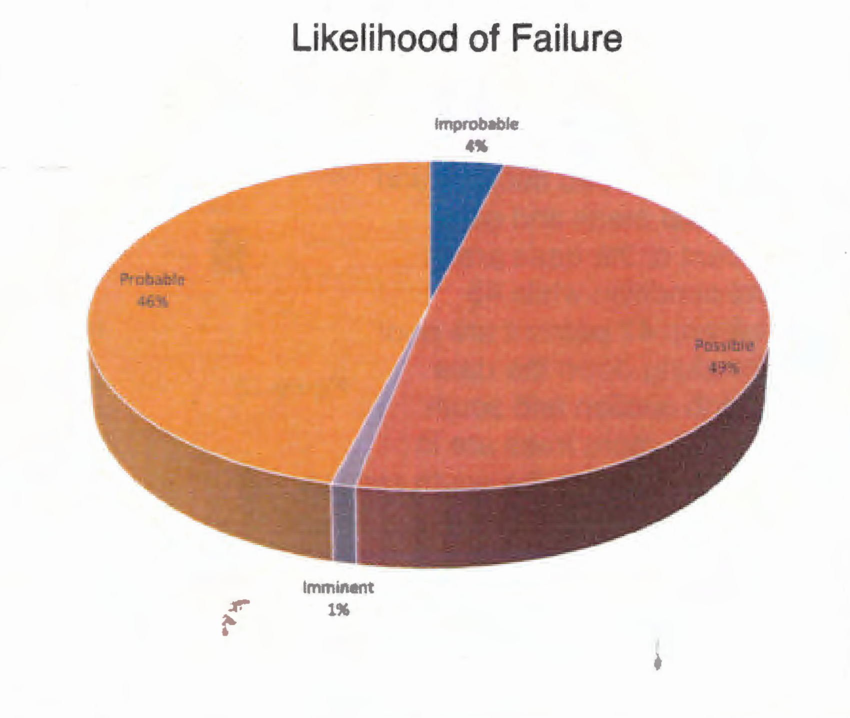

Figure 15

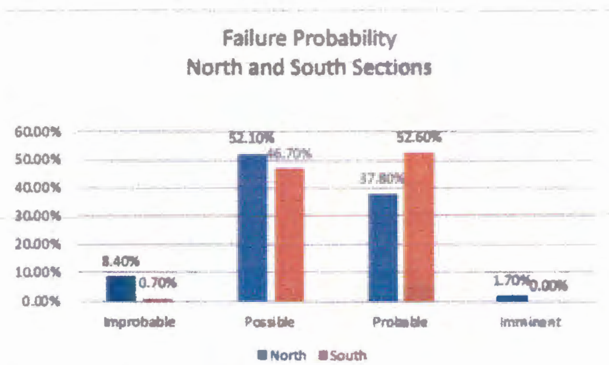

Figure 16

The likelihood of failure of the tree or part of the tree is another measurement of risk. Figure 15 shows that Probable Risk of Failure and Possible Risk of Failure are nearly the same. However when looking at the Failure Probability based upon the north section and the south section (Figure 16), the south section has 52.6 percent “Probable” compared to 37.8 percent “Probable” in the north section. Again our data is showing increased risk in the south section.

Figure 17

Maintenance Recommended

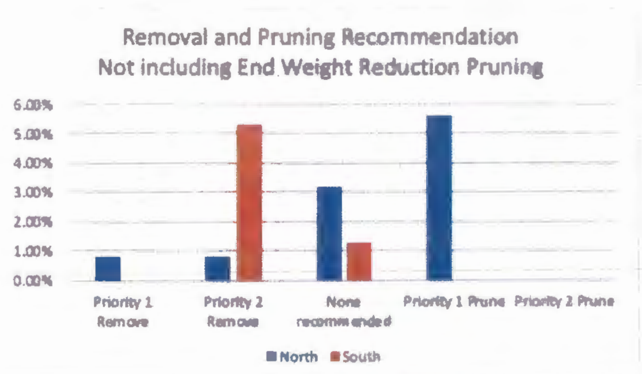

Figure 18

When examining the maintenance or work recommended for all the trees, only 3.69 percent of the trees (10 trees) were recommended for removal (Figure 17). And 93.73 percent of the trees were recommended for aggressive, significant end weight branch reduction pruning. The caveat here is there must be significant branch end weight reduction in the realm of 50 percent of the crown. If this aggressive pruning cannot be done soon, then we recommend that most of the trees, especially those with a high risk score and/or a column of decay be removed. Figure 18 is an enlargement of the different maintenance recommendations after the End Weight Reduction Pruning is removed from the graph. Most of the removals are on the south section. The high number of Priority 1 Prune are to remove hangers in the north section following the hurricane. No dead branches were observed during the current evaluation while previous assessments found dead branches over the street to be a significant problem.

Risk Rating Distribution

The distribution of the risk scores in Figure 19 shows that the relatively high rating of 13 included the largest number of trees of any single rating. These scores alone do not always warrant removal or other maintenance treatment. But the ranking is another way of viewing the cumulative scores of several individual defects.

Discussion

Figure 19

The Australian pines along Pine Tree Drive in Miami Beach have survived many years and are in healthy condition, but it is important to remember that all trees have a lifespan. Most of these trees will not fail from declining health. Rather structural failures will be the demise of these historic trees. The Australian pine trees will eventually break apart or tip over. This structural failure is from large crowns on compromised trunks and trunk bases. This falling-apart process can be delayed significantly with proper crown management. According to what we have been observing over the past seven years, the Australian pines are too big, too heavy, too sprawling for the deteriorating trunks and trunk bases and the restricted root space south of 41st Street. To avoid breaking apart or falling over, these Australian pines should not be 50 to 60 feet tall but rather maintained at a height closer to 30 feet tall if their trunks are going to support the crowns.

Aggressive crown reduction is not an unusual pruning treatment for healthy veteran trees. Ideally it would be best for the trees for crews to perform the crown reduction annually at the rate of approximately 20 to 25 percent. However, we have lost seven years waiting for the initial significant crown reduction pruning that was requested in our 2010/2011 report. When the pruning was performed, it was inadequate and did not solve any of the structural problems we described. Based upon this experience, it is very unlikely that annual pruning could be a viable option over a period of years.

The maintenance recommended has a very high percentage of trees that we recommend aggressive end weight reduction pruning on all lateral and vertical branches. Reduction should be approximately 50 to 60 percent. The trees are healthy and can very likely tolerate that much crown removal. These trees are gradually collapsing and failing at a relatively high rate when considering catastrophic consequences on this very busy street. If the reductions will not be 50 to 60 percent as we recommend, then in our opinion the trees should be removed. After two previous reports in which crown reduction has been strongly recommended, one light crown reduction has been done and that was only recently. This is our third report and our advice is unequivocal to aggressively reduce the crowns or remove the trees.

Conflict Between Arborist Recommendation and Tree Ordinance

It is very likely the tree crews contracted to prune the Australian pines on Pine Tree Drive in January, 2017 were cautious not to prune too much because the Miami-Dade County Tree Ordinance specifically follows the latest version ANSI A300 Pruning Standards, the version in effect at the time of pruning.

The old ANSI A300 Standards - The ANSI A300 Pruning Standards in effect since 2008 specifically limited pruning to not more than 25 percent:

> 5.5.3 Not more than 25 percent of the foliage should be removed within an annual growing season. The percentage and distribution of foliage to be removed shall be adjusted according to the plant's species, age, health, and site.
>
> 5.5.4 Not more than 25 percent of the foliage of a branch or limb should be removed when it is cut back to a lateral. That lateral should be large enough to assume apical dominance.

Even though "the percentage and distribution of foliage to be removed shall be adjusted according to the plant's species, age, health and site," the "not more than 25 percent of foliage" was interpreted to be the maximum allowed under any circumstances.

New ANSI A300 Standards - Fortunately, the new ANSI A300 Pruning Standards released this year (2017) clarify and remove the "25 percent" rule. According to the new revised Pruning Standards, "These were both advisory 'should' statements with the understanding that 25 percent may be too much or too little, depending upon the tree and the objectives." The new standards go on to say, "Though not the intent, 25 percent was often considered to be the maximum allowable amount regardless of other factors."[16]

The new Standards continue, "The 2017 revision removes the 25 percent guideline, and provides the arborist with the flexibility to exercise professional judgement in determining pruning amount based upon 'species, size, age, condition and site.' ". The pruning amount can be expressed as an estimated percentage of foliage to be removed from certain locations, number of pruning cuts of certain sizes or types or by other means."[17]

Reduction Pruning The trees along Pine Tree Drive must be managed as the aging veteran trees that they are. Dr. Kim Coder, arboriculture professor at the University of Georgia, writes articles and speaks regularly to Florida arborists about maintenance of aging veteran trees. In addition to structural problems caused by sprawling branches and decay, Dr. Coder says veteran trees also have:[18]

- reduced photosynthesis
- vascular problems
- increased sapwood respiration

Coder goes on to describe how branch end weight reduction and crown size reduction achieve the goals of reducing risk of structural failure and improving vascular pathways. He adds that branch reductions "should be timed so that a number of years occur between treatments."[19] In other words reducing the crown size and spread of aging trees will reduce risk of failure and reduce vascular problems caused by damage to long vascular pathways. But crown reduction must be done carefully. Pruning that removes too many leaves, which produce carbohydrates, and branches, where carbohydrates are stored, can weaken a tree.

Figure 20 This Australian pine at 41st Street had it trunk broken years previously likely in a wind event. It is now about the size we recommend for Pine Tree Drive. Veteran trees tend to become smaller and more wind resistant through random limb failures. We can assist this natural process through crown reduction pruning.

Our preferred method of mitigation was in 2010/2011, 2014 and now is crown reduction which can reduce the forces placed on the trunk and base of the tree by wind events, excessive lean or long, sprawling lateral branches. Crown reduction can be even more useful where more of the trees exhibit higher probability of failure and root space is limited for the trees such as in the 9 foot wide median south of 41st Street.

Conclusions

Aggressive crown reduction pruning is still the primary maintenance tool for prolonging the life of this slowly decaying tree population. End weight reduction pruning will reduce the stress of excessively large crowns on the lower trunk. Even trees that have some signs of basal decay will benefit from end weight reduction pruning to increase their stability.

Of course there is a balance between not enough pruning and too much. Not removing enough branch end weight will not significantly reduce the risk as is the current situation. Removing too much end weight from the trunks and branches can impact the health of the trees by removing leaves where carbohydrates are produced and young branches where the carbohydrates are stored for future use by the tree. The more aggressive end weight reduction pruning we call for should be carefully supervised and monitored by us or a qualified arborist who is a Board Certified Master Arborist to assure the correct dose of pruning is done. If left unmonitored, many tree pruning crews will not remove sufficient branch end weight as is the current situation or they may remove lower branches not end weight. And when pruned incorrectly, this lions tailing or over-lifting type pruning can actually make the trees more prone to failure.

Appendix A Definitions

Basal Decay -- (also called **Butt Rot** or **Butt Decay**) decay caused by fungi that invade the lower trunk from below and root crown area of a tree.
Codominant Leaders – a tree with multiple trunks often beginning as a single leader and dividing into two or more leaders of similar size higher up on the trunk. Codominant leaders are considered a structural defect because they can be prone to failure (splitting)
Compartmentalization – the ability of a tree to isolate (wall off) damage and decay and continue to grow around the damaged area. Trees that are good compartmentalizers are better able to withstand damage from injuries such as pruning cuts, gashes, lightning strikes, etc.
Condition – an evaluation of a tree's structure and health
Critical Root Zone – this an area around a tree where roots must be protected and is another term for Tree Protection Zone
DBH – diameter at breast height, a measurement of a tree's diameter usually measured approximately four and one half feet above the ground
Dripline – the outer edge of a tree canopy
End Weight Reduction Pruning — A recommended pruning method that reduces (subordinates) codominant leaders and large side branches by reducing their size from the outside in. Reduction pruning is often the preferred method of taking weight off the ends of branches versus the commonly utilized but undesirable method known as "lion tailing" which removes interior branches and keeps only the branches out at the end creating instability and increasing risk of branch or trunk failure.
Epicormic sprouts – Excessive sprouting. Short twigs and small leaves growing along the upper surface of one or more main branches. The presence of epicormic sprouts is an indication of poor tree health, over-pruning, and/or a weakened tree.
Reduction Pruning – see **End Weight Reduction Pruning**
Resistance drill – a diagnostic tool that utilizes a 1/8-inch diameter drill bit to measure decay inside a tree trunk or branch by measuring and graphing the resistance of the drill bit as it moves through the wood.
Root Flare – also called **Root Crown** -- the area at the base of the tree trunk that becomes wider (flares out) where roots grow horizontally in the soil. The individual root flares are where the roots are connected to the base of the tree trunk.
Root Plate – a circular area with an outer boundary that is usually considered to be a distance from the tree trunk that is three times the diameter of the tree.

Certification of Performance

We, Daniel Lippi and Chuck Lippi, certify that:

- Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy, safe or adequately protected under all circumstances or for a specified period of time. Likewise, remedial, protective and mitigating treatments and recommendations cannot be guaranteed.
- We have no current or prospective interest in the vegetation or the property that is the subject of this report and have no personal interest or bias with respect to the party or parties involved.
- We certify that all the statements made in this report are true, complete and correct to the best of our knowledge and belief and are made in good faith.
- The analysis, opinions and conclusions stated herein are our own and are based on current scientific procedures and facts.
- Our analysis, opinions and conclusions were developed and this report has been prepared according to commonly accepted arboricultural practices.
- Our compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client or any other party nor upon the results of the assessment, the attainment of stipulated results or the occurrence of any subsequent events.
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants or property in question may not arise in the future.
- We reserve the right to change our reports/opinions on the basis of new or different evidence.
- Loss or alteration of any part of this report invalidates the entire report.

We further certify that we are members in good standing of the International Society of Arboriculture (ISA) and the Florida Urban Forestry Council and are ISA Board Certified Master Arborists FL-6145B and FL-0501B and Chuck is an ASCA Registered Consulting Arborist #443.

References

[1] American National Standards Institute (ANSI) A300 Risk Assessment Part 9 Tree, Shrub, and Other Woody Plant Management Standard Practices (***Tree Risk Assessment*** a. Tree Structure Assessment), 2011.

[2] Thomas Smiley, Nelda Matheny and Sharon Lilly, ***Best Management Practices Tree Risk Assessment***, International Society of Arboriculture, Champaign, Illinois, 2011.

[3] Jerry Bond, ***Urban Tree Health: A Practical and Precise Estimation Method,*** Urban Forest Analytics, LLC, 2012.

[4] American National Standards Institute (ANSI) A300 Pruning, American National Standard for Tree Care Operations Tree, Shrub and Other Woody Plant Maintenance, Standard Practices (Pruning) Part I,
2017

[5] Dr. Ed Gilman, ***An Illustrated Guide to Pruning***, 3rd Edition, Delmar Cengage Learning, 2012

[6] Francis W.M.R. Schwarze, ***Diagnosis and Prognosis of the Development of Wood Decay in Urban Trees,*** En Spec Environment and Risk, Australia, 2008. p. 196.

[7] F.W.M.R. Schwarze, J. Engels, and C. Mattcheck, ***Fungal Strategies of Wood Decay in Trees***, Springer, Germany, 2000, pp. 133-137.

[8] Dr. Wayne Sinclair and Dr. Howard Lyon, ***Diseases of Trees and Shrubs***, Second Edition, Cornell University Press, Ithaca pp. 206-207.

[9] Dr. James R. Clark and Dr. Nelda P. Matheny, ***A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas***, 2nd edition, International Society of Arboriculture, 1994, pp. 37 – 57.

[10] ***Pinetree Drive History Roadway, Miami Beach Historic Site Designation Report***, Prepared by City of Miami Beach Planning Department, Design, Preservation & Neighborhood Planning Division, February 28, 2001, Adopted June 6, 2001 (Ordinance No. 2001-3310)

[11] *Ibid.* p. 19.

[12] Dr. Ed Gilman and Dr. Dennis Watson, ***Casuarina spp.: Australian Pine***, University of Florida publication ENH288, 2007.

[13] Elfers S.C. 1988. ***Element Stewardship Abstract for Casuarina equisetifolia.*** The Nature Conservancy. Unpublished report prepared for The Nature Conservancy on Australian pine. Winter Park, FL. from the website downloaded Oct. 30, 2010.

[14] Linda Conway Duever from the Floridata website http://www.floridata.com/ref/c/casu_equ.cfm downloaded Oct. 30, 2010. Linda is a conservation ecologist with nearly 30 years experience in resource inventory/evaluation and natural area management.

[15] Smithsonian Marine Station at Ft. Pierce http://www.sms.si.edu/irlspec/casuarina_equisetifolia.htm Website downloaded Oct. 30, 2010

[16] American National Standards Institute (ANSI) A300 Pruning, American National Standard for Tree Care Operations Tree, Shrub and Other Woody Plant Maintenance, Standard Practices (Pruning) Part I, 2017, p. 29.

[17] *Ibid.*, p. 29

[18] Dr. Kim Coder, University of Georgia, School of Forest Resources, Athens, GA, Managing Tree Aging, Arborist News, June, 2005, pp. 36 - 40.

[19] Ibid., p. 40.