Item No. 11
Town of Atherton

CITY COUNCIL STAFF REPORT – REGULAR AGENDA

TO: **HONORABLE MAYOR AND CITY COUNCIL**

FROM: **GEORGE RODERICKS, CITY MANAGER**

DATE: **APRIL 21, 2021**

SUBJECT: **REVIEW OF RECOMMENDATIONS REGARDING MEDIAN STREET TREES ON TUSCALOOSA AND MT. VERNON; PROVIDE FEEDBACK AND DIRECTION TO STAFF REGARDING THEIR DISPOSITION**

RECOMMENDATION

Review the recommendations regarding median street trees on Tuscaloosa and Mt. Vernon; provide feedback and direction to staff regarding their disposition.

BACKGROUND/ANALYSIS

In late 2020 the Town Arborist conducted an evaluation of the health of two median street trees – Tuscaloosa Avenue and Mt. Vernon Lane. After the Arborist's initial assessment of the trees, West Coast Arborist was engaged to conduct an independent analysis of the health of the trees.

Tuscaloosa Avenue Tree

The subject tree is a large Valley Oak located in the middle of the roadway in front of 184 Tuscaloosa Avenue. The area around the base of the tree has a concrete border that surrounds the tree with 5-feet of bare soil on the north and south side of the trunk. This tree was last evaluated in 2017. At that time, decay was noted as possible within the tree's lateral branches and targeted end weight trimming was conducted. This trimming validated the concerns of decay. The most recent evaluations were conducted toward the end of 2020. The Level 2 Risk Assessment conducted in 2020 determined that the tree poses a moderate risk to the public as well as public and private property. The Assessment noted that the tree would require continued monitoring and maintenance. A Level 3 Risk Assessment was conducted in 2021. Through sonic tomography, it was determined that tree contains significant internal decay along the majority of the northwestern portion of the trunk. Reducing leverage from primary growth would reduce the likelihood of failure for a temporary period. However, this will likely have an impact on the tree's health and aesthetic quality. Extreme weather conditions will hasten the tree's failure.

The Town Arborist recommends that the Town consider end weight trimming and continue to prune the tree each year. Such pruning will affect the aesthetic of the tree. If the tree is not

immediately removed, the trees should have a Level 3 analysis done in one to two years to determine if the decay has advanced and consider additional options at that time.

Mt. Vernon Lane Tree

The subject tree is a Coast Live Oak located in the middle of the roadway in front of 45 Mt. Vernon Lane. The area around the base of the tree has a concrete border that surrounds the tree with an area of bare soil on the sides of the trunk. The most recent evaluations were conducted toward the end of 2020. The Level 2 Risk Assessment conducted in 2020 determined that the tree poses a high risk to the public as well as public and private property. The Assessment noted that the tree would require continued monitoring and maintenance, but such methods may result in tree mortality. It was recommended that the tree be removed. A Level 3 Risk Assessment was conducted in 2021. Through sonic tomography, it was determined that tree contains significant internal decay along the majority of the southeastern portion of the trunk. Extreme weather conditions will hasten the tree's failure.

The Town Arborist recommends that the Town remove this tree. The tree will continue to decay and there are no recommended treatments.

Reports Attached

The Level 2 and Level 3 Risk Assessment Reports for both trees are attached. Surrounding property owners have been advised of tonight's meeting and, particularly with respect to the Mt. Vernon tree, have been engaged in the evaluation process.

POLICY FOCUS

Liability for failure of these trees rests with the Town. These trees are of sufficient size such that their failure may result in significant private property damage; and due to their location, there is the potential for personal injury as a result of their failure. To mitigate risk of failure of Town-owned trees, the Town uses a professional risk assessment process; however, there is no way to guarantee that a tree will not fail. The goal in assessing and managing trees is to strike a balance between the level of acceptable risk that a tree poses and the benefits that individuals and communities derive from trees.

FISCAL IMPACT

Maintenance and/or removal costs would be incorporated into the Town's Street Tree Budget.

PUBLIC NOTICE

Public notification was achieved by posting the agenda, with this agenda item being listed, at least 72 hours prior to the meeting in print and electronically. Information about the project is also disseminated via the Town's electronic News Flash and Atherton Online. There are approximately 1,200 subscribers to the Town's electronic News Flash publications. Subscribers include residents

as well as stakeholders – to include, but be not limited to, media outlets, school districts, Menlo Park Fire District, service provides (water, power, and sewer), and regional elected officials.

COMMISSION/COMMITTEE FEEDBACK/REFERRAL

This item ___ has or _X_ has not been before a Town Committee or Commission.

____ Audit/Finance Committee (meets every other month)
____ Bicycle/Pedestrian Committee (meets as needed)
____ Civic Center Advisory Committee (meets as needed)
____ Environmental Programs Committee (meets every other month)
____ Park and Recreation Committee (meets each month)
____ Planning Commission (meets each month)
____ Rail Committee (meets every other month)
____ Transportation Committee (meets every other month)

ATTACHMENTS

1. December 2020 – Level 2 Assessment of Mt. Vernon Lane Median Tree
2. October 2020 – Level 2 Assessment of Tuscaloosa Avenue Median Tree
3. March 2021 – Level 3 Assessment of Mt. Vernon Lane and Tuscaloosa Median Trees

ATTACHMENT 1

ARBORIST REPORT

Town of Atherton

Tuscaloosa Ave -Risk Assessment

Submitted to:

Sally Bentz Dalton
City Arborist
91 Ashfield Road
Atherton, CA 94027

December 2, 2020

Tree Care Professionals Serving Communities Who Care about Trees www.WCAINC.com

Prepared by:

Glenn O. Whitlock-Reeve
REGISTERED CONSULTING ARBORIST #704 | BOARD CERTIFIED MASTER ARBORIST *WE-10177BTM*
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Table of Contents

Summary

The Town of Atherton has contracted West Coast Arborists Inc, (WCA) for arborist services. Sally Benton (Town Arborist) requested a formal risk assessment of the median tree located on Mt. Vernon Lane. I visited the site originally in August and then again in December of 2020 and observed the tree's condition. On my most recent visit I noticed that decay at the base of the tree appeared to be worsening. I performed a risk assessment and determined that the tree poses a **high-risk**[1]. The extent of decay within the main stem is not completely known and further evaluation may provide more information if the subject tree is desired for temporary retention. My professional opinion is that the tree should be removed as mitigations attempts to retain the tree may result in tree mortality.

Background

The Town of Atherton has contracted WCA for arborist services. The city forester, Sally Bentz Dalton, requested a level 2 risk assessment of the median tree located at 45 Mt. Vernon Lane. Previous inspections and trimming were conducted by myself in 2017 as requested by now retried City Arborist Steven Tyler and formal reports were submitted to the city. My most recent inspection was conducted December 1st, 2020 and have included my findings herein.

Assignment

The Town of Atherton has contracted WCA to perform the following services.

1. Visit the site and evaluate the median tree at Mt. Vernon Lane.
2. Perform a risk assessment and submit a detailed, formal report of findings.

[1] Terms in **bold** are defined in the glossary.

Observations

Subject Tree: Coast Live Oak (*Quercus agrifolia*)

DSH: 51.5-Inches

Health Condition:

- Thinning canopy, with minor to moderate dieback/necrosis.
- Pruning wounds from 2017 trimming show minimal callusing and bark separation, suckers present at large heading cut of southern lateral branch.
- Delignified wood discovered at northern root crown. Bark easily removed with rubber mallet during sounding above decayed wood.

Structural Condition:

- Canopy heavy to the south east.
- Decay visible on southern trunk extending from grade level 7-feet up to first lateral branch. Cavity at base of defect probed to 1-foot depth.
- Sounding of eastern root crown/lower trunk suggests minimal shell wall present.
- Visible decay at northern root crown with delignified decayed wood present (white rot).
- Small 3-inch cavity at western root crown.
- Recent large stress fractures present in canopy.

Dripline Environment:

- Dripline 90% covered in asphalt up to trunk (median tree).
- Within southern drip line has gate for 45 Mt. Vernon Lane, art installation and kepad.
- At southeast dripline a utility pole with high voltage lines and transformer is present.
- Vehicle and pedestrian traffic is occasional.

Risk Assessment

The International Society of Arboriculture *Tree Risk Assessment* program is a system in which to derive an understanding of the risks associated with a given tree and/or tree stand. Factors including *Likelihood of Failure, Likelihood of Impacting Target* and *Consequences of Failure* are determined from information collected during the field assessment. These factors are then run through two matrices to produce a risk rating. (Dunster, 2013)

Limitations of Tree Risk Assessment

According to the *Tree Risk Assessment Manual,* published by the International Society of Arboriculture (ISA), it is impossible to maintain trees free of risk: "There is no way to guarantee that a tree will not fail. Tree benefits increase as the age and size of trees increase; however, some level of risk must be accepted to experience the benefits provided. The goal in assessing and managing trees is to strike a balance between the risk that a tree poses and the benefits that individuals and communities derive from trees."

"A considerable level of uncertainty is typically associated with tree risk assessment due to our limited ability to predict natural processes (rate of progression of decay, response growth, etc.), weather events, traffic and occupancy rates, and potential consequences of failure."

"Conditions affecting trees change constantly; none of us will ever be able to predict every tree failure. Conducting a tree risk assessment neither ensures nor requires perfection. Risk assessment should, however, ensure that all reasonable efforts have been made to identify the *likelihood of failure*, the *likelihood of impact*, and the *consequences of failure* present at the time of assessment."

"Abnormally extreme storms, such as tornadoes, hurricanes, earthquakes and heavy freezing rain, are not predictable and, in most cases, are not considered for categorizing *likelihood of failure*."

Risk Rating

Risk rating estimate based on a 2-year timeframe

Likelihood of Failure

Trunk failure was determined to be the most likely and highest concern of failure. The likely hood of trunk failure was determined ***probable***[2]***,*** as the failure may be expected under normal weather conditions within the specified time frame. Contributing factors to failure are advanced decay and heavy canopy/lean to the south.

Likelihood of impacting target(s)

Static targets in the area include the gate area of 45 Mt. Vernon Ln. and the utility pole east of there. The static targets have a ***High*** likelihood of impact due to being in the predicted direction of failure (underside of lean). Targets are impractical to move. Moving targets such as cars and pedestrians were determined to have a ***Low*** likelihood of impact, as the target area has no thru traffic on the road and cars seldomly park on the road.

Consequences

The consequences of impacting an occupied passing car or pedestrian is ***severe*** as the impact would likely result in hospitalization or death. Consequences of impacting the utility pole was determined to be ***significant-severe*** with service interruptions and potential fire hazards. Impact to the gate and installed art may have ***significant*** repair costs.

Risk Rating

Assigning a tree's overall risk at the highest level of risk for various factors for that tree is suggested by the tree risk assessment manual. Factors were run through the tree risk matrices provided in the appendix of this report and resulted in a ***High-risk*** rating.

[2] Terms ***italicized and bold*** are used in the tree risk matrices, example provided in *Appendix C- Risk Assessment Tables example.*

Discussion

Decay within the subject tree is advancing. I anticipate that more than 40% of the main trunk and root crown have been jeopardized by decay. I have not been able to identify a **fungal fruiting bodies** during any of my inspections, however the delignified wood (white/soft rot) discovered suggests that fungal pathogens are at play. Most commonly soft rots in the area include *Ganoderma* and *spp.*, *Armillaria spp*. and can cause significant impact to tree stability. Determining the extent of the decay column more precisely may be achieved with advanced assessment techniques such as **sonic-tomograph** or **resistance drilling,** however at this time I anticipate that the column accounts for the nearly half of the root crown and extends in a conical pattern upward to the first lateral branch unions. Additionally, the thinning canopy suggests that the tree is in overall decline. Attempts to mitigate loading forces thru extensive weight reduction of the canopy to offset the compromised trunk/root crown, may result in tree mortality.

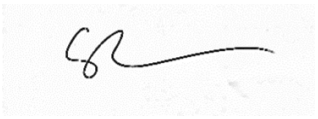
Conclusion

The subject tree in its current state possesses a **high** risk. This tree will require continued monitoring and maintenance if retained. Advanced decay detection methods may provide more information on an estimated amount of wood strength, loss, or extent of decay. Significant crown reduction would reduce the likelihood of failure but will greatly impact the health and aesthetic value of the tree but allow for temporary retention of the tree at a lower risk rating. However, the only way to eliminate all risk as with any tree is to remove it completely. The risk tolerance of the community will determine the trees suitability for retention.

My professional opinion is that the tree should be removed.

Thank you for the opportunity to assist you in your tree assessment needs. If there are any questions or concerns feel free to contact me directly at (408) 835-0438, greeve@wcainc.com

Respectfully,



Glenn O. Whitlock-Reeve
RCA #704
Board Certified Master Arborist
ISA Qualified Tree Risk Assessor

Glossary

fruiting body- the reproductive structures of fungus (conks, brackets, mushrooms).

Resistance drilling- a devise consisting of a specialized micro-drill bit that drills into trees and graphs resistance to penetration; used to detect internal differences in the wood, such as decay.

Sonic tomography- a process of measuring wood density or other mechanical properties, using an instrument that transmits, receives, and records the velocity of sound or electric waves through wood.

High (likelihood of impact) – the failed tree or tree part is likely to impact the target. This is the case when there is a constant target, with no protection factors, and the direction of fall is toward the target.

Probable (likelihood of failure) – Failure may be expected under normal weather conditions within the specified time frame.

High (risk rating) – Defined by its placement in the risk rating matrix (Matrix 2); consequences are *significant* and likelihood is *very likely* or *likely,* or consequences are *severe*, and likelihood is *likely.*

Bibliography

Dunster, J. A. (2013). *Tree Risk Assessment Manual .* Champaign, Illinois: International Society of Arboriculture.

Francis W.M.R. Schwarze, J. E. (2000). *Fungal Strategies of Wood Decay in Trees .* New York: Springer-Verlag Berlin Heidelberg .

Tree Care Industry Association, Inc. (2017). *Tree, Shrub, and Other Woody Plant Management- Standard Practices (Pruning).* New Hapshire : Tree Care Industry Association, Inc.

Appendix A- Map (Approximate Tree location)

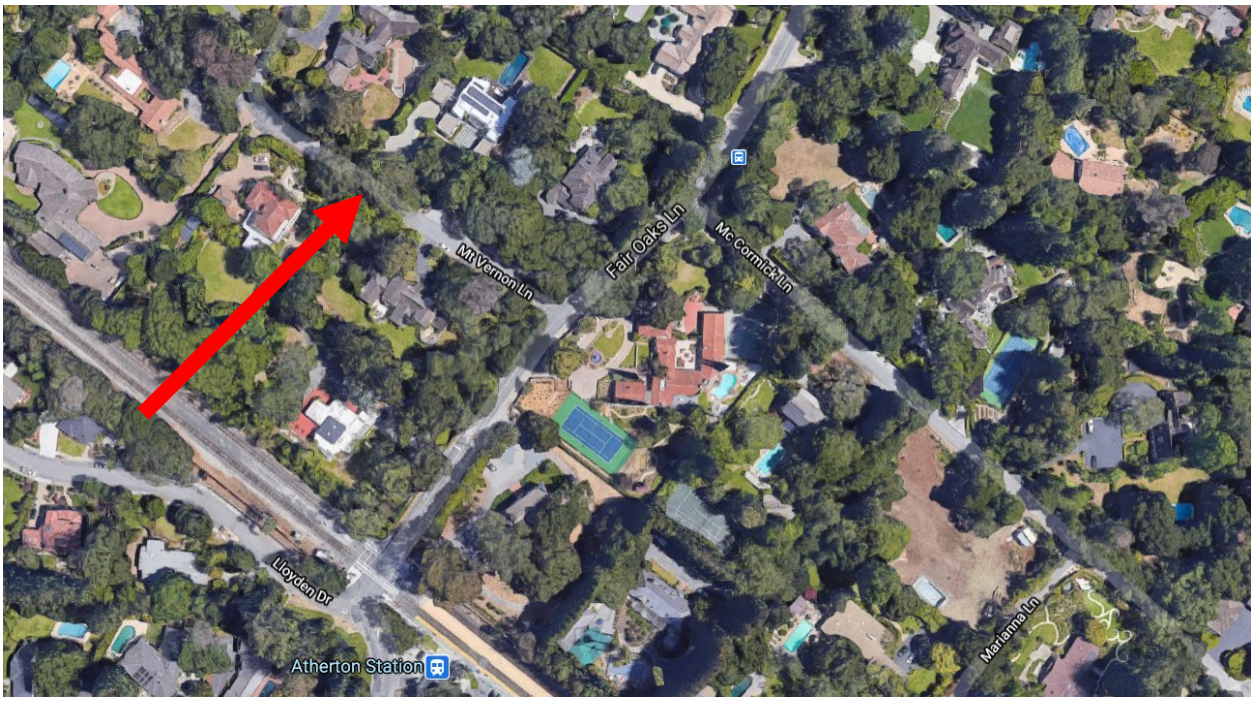


Figure 1: Red arrow indicates approximate location of subject tree.

Appendix B- Observation Photos

Lighting to pictures may have been altered due to shade from canopy.

Figure 2: Looking west at subject tree.

Figure 3: Looking north, red arrows indicate height of visible decay column.

Figure 4: A closer look at the visible decay area on the south area of trunk. Red arrow indicates cavity probed to a depth of 1-foot.

Figure 5: Looking at the northern root crown, bark fell off easily while sounding with a rubber mallet and dead wood was present below. Minor excavation of the northern root crown revealed soft delignified wood (white rot).

Figure 6: Looking southeast at entrance gate of 45 Mt Vernon Lane, red arrow shows where utility pole is located out of frame.

Appendix C- Risk Assessment Matrices

Based on the International Society of Arboriculture "Tree Risk Assessment" Program

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	Low	Medium	High
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

The likelihood of a failure was determined to be ***probable;*** likelihood of impact to utility pole and gate was determined to be ***High.***

Likelihood of Failure and Impact	Consequences			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Impact to the utility lines and private property was determined to have significant consequences.

This tree has a ***High-Risk*** Rating.

Based on a 2 year timeframe

ASSUMPTIONS AND LIMITING CONDITIONS

1. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the Consultant can neither guarantee nor be responsible for the accuracy of information provided by others. Standard of Care has been met with regards to this project within reasonable and normal conditions.

2. The Consultant will not be required to give testimony or to attend court by reason of this report unless subsequent contractual agreements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

3. Loss or alteration of any part of this report invalidates the entire report.

4. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior written consent of the Consultant.

5. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant's fee is in no way contingent upon the reporting of a stipulated result, a specified value, the occurrence of a subsequent event, nor upon any finding to be reported.

6. Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, or coring, unless otherwise stated. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the tree(s) or property in question may not arise in the future.

7. Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. It is highly recommended that you follow the arborist recommendations; however, you may choose to accept or disregard the recommendations and/or seek additional advice.

8. Arborists cannot detect every condition that could possible 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 or safe under all circumstances, or for a specific period of time.

9. Any recommendation and/or performed treatments (including, but not limited to, pruning or removal) of trees may involve considerations beyond the scope of the arborist's services, such as property boundaries, property ownership, site lines, disputes between neighbors, and any other related issues. Arborists cannot take such considerations into account unless complete and accurate information is disclosed to the arborist. An arborist can then be expected to consider and reasonably rely on the completeness and accuracy of the information provided.

10. The author has no personal interest or bias with respect to the subject matter of this report or the parties involved. He/she has inspected the subject tree(s) and to the best of their knowledge and belief, all statements and information presented in the report are true and correct.

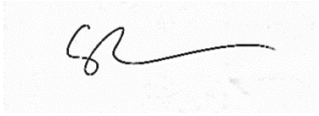
11. Unless otherwise stated, trees were examined using the risk assessment criteria detailed by the International Society of Arboriculture's publications *Best Management Practices – Tree Risk Assessment* and the *Tree Risk Assessment Manual*.

Appendix D- Certification of Performance

I, Glenn O. Whitlock-Reeve, Certify that:

1. I have personally inspected the tree(s) and property referred to in this report and have stated my findings accurately.
2. I have no current or prospective interest in the tree or the property that is the subject of this report and have no personal interest or bias with respect to the parties involved.
3. The analysis, opinions and conclusions stated herein are my own and are based on current scientific procedures and facts.
4. My analysis, opinions and conclusions were developed, and this report has been prepared according to commonly accepted arboricultural practices and standards.
5. No one provided significant professional assistance to me, except as indicated within the report.
6. My compensation is not contingent upon the reporting of 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.

I further certify that I am a member in good standing of the American Society of Consulting Arborists and a Board-Certified Master Arborist with the International Society of Arboriculture (ISA). I have been a Certified Arborist since 2013 and in the practice of arboriculture for over 10 years.

Signed: 

Glenn O. Whitlock-Reeve
RCA #704
Board Certified Master Arborist WE-10177BTM
ISA Qualified Tree Risk Assessor

Date: 12/2/20

ATTACHMENT 2

ARBORIST REPORT

Town of Atherton

Tuscaloosa Ave and -Risk Assessment

Submitted to:

Sally Bentz Dalton
City Arborist
91 Ashfield Road
Atherton, CA 94027

October 12, 2020

Tree Care Professionals Serving Communities Who Care about Trees www.WCAINC.com

Prepared by:

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Table of Contents

Summary

The Town of Atherton has contracted West Coast Arborists Inc, (WCA) for arborist services. A request was made to assess the large Valley Oak (*Quercus lobata*) located in the median island in front of 184 Tuscaloosa Ave. I have assessed this tree previously in 2017 and under direction of the previous town arborist. Reviewing my report from 2017, a ***fruiting body***[1] I previously identified suggested that decay may be present within the lateral branches. I recommended that thorough aerial inspection of the tree raising the requested assessment to a level 3 risk assessment**.** With the approval of town of arborist, I scheduled a WCA trimming crew to assist me in an arial inspection and targeted end weight reduction that would be necessary regardless of my findings. During my inspection, I noted moderate to significant decay within large lateral limbs of the western canopy and discovered a significant decay cavity at the northern base of the tree. I performed a risk assessment and determined that the tree poses a moderate risk to the community currently, however the extent of decay within the main stem is not completely known and further evaluation may be necessary to determine if the subject tree is suitable for long term retention.

Background

The Town of Atherton has contracted WCA for arborist services. The city forester, Sally Bentz Dalton, requested a level 2 risk assessment of the median tree located at 184 Tuscaloosa Ave. The site was evaluated in 2017 by me as requested by now retried City Arborist Steven Tyler.

My most recent evaluation had initial visits at both sites on August 27th, 2020. During this visit I determined that further (advanced) evaluation was necessary for the tree located on Tuscaloosa Ave. I recommended aerial inspection to be performed at the same time as pruning. I revisited the site on September 22, 2020 with the trimming crew and have included my findings herein.

Assignment

The Town of Atherton has contracted WCA to perform the following services.

1. Visit the site and evaluate the median tree at 184 Tuscaloosa Ave.
2. Perform a risk assessment and submit a detailed, formal report of findings.

[1] Terms in **bold** are defined in the glossary.

Observations

Tuscaloosa Avenue

The subject tree is large Valley Oak (*Quercus lobata*) located in the middle of roadway in front of 184 Tuscaloosa Ave. The area around the base of the tree has a concrete border that surrounds the tree with 5-feet of bare soil on the north and south side of the trunk. Occasional vehicle and foot traffic pass under the western and eastern canopy. Utility lines are present over the eastern canopy. The dripline extends over a fence to the east.

The tree has a heavy canopy to the south with overextending branches. A minor lean to the south is visible when looking at the trunk from the west. Minimal branches are present to the north. A cavity is present on the lowest western leader. The dried remains of a **fungal body** are visible adjacent to the cavity. In a previous inspection I conducted in 2017, I noted a live fruiting body in this area, that upon review I suspect to be Canker Rot (*Inonotus spp.*). Sounding of the large lateral limbs suggested decay was present in several large lateral limbs on the western canopy. Large over extended limbs are present on the southern canopy. Minimal dieback was present in the canopy, and foliage appeared healthy with only minor leaf gall present.

I found a decay pocket while inspecting the northern root crown. When I excavated the area revealed decaying wood that resembled a type of white rot, with very wet soft wood. I was able to reveal a decayed area 2-feet tall and 1-foot deep and was able to probe 6 to 8-inches into the tree, at the bottom of the decayed area. Callusing around the cavity was present, however decay appeared to be advancing past **CODIT** walls 2 and 4. The east and west sides of the trunk had irregular texture that appears to be callousing from buttress roots removed along time ago. During root crown excavation on the west and southeast side of the tree, I was unable to locate buttress roots with in the top 12 inches of the tree directly adjacent to the trunk. The concrete perimeter of the planter area measured up to 8-inches thick on the west side of the trunk and heavy base rock was present in the area.

Risk Assessment

The International Society of Arboriculture *Tree Risk Assessment* program is a system in which to derive an understanding of the risks associated with a given tree and/or tree stand. Factors including *Likelihood of Failure, Likelihood of Impacting Target* and *Consequences of Failure* are determined from information collected during the field assessment. These factors are then run through two matrices to produce a risk rating. (Dunster, 2013)

Limitations of Tree Risk Assessment

According to the *Tree Risk Assessment Manual,* published by the International Society of Arboriculture (ISA), it is impossible to maintain trees free of risk: "There is no way to guarantee that a tree will not fail. Tree benefits increase as the age and size of trees increase; however, some level of risk must be accepted to experience the benefits provided. The goal in assessing and managing trees is to strike a balance between the risk that a tree poses and the benefits that individuals and communities derive from trees."

"A considerable level of uncertainty is typically associated with tree risk assessment due to our limited ability to predict natural processes (rate of progression of decay, response growth, etc.), weather events, traffic and occupancy rates, and potential consequences of failure."

"Conditions affecting trees change constantly; none of us will ever be able to predict every tree failure. Conducting a tree risk assessment neither ensures nor requires perfection. Risk assessment should, however, ensure that all reasonable efforts have been made to identify the *likelihood of failure*, the *likelihood of impact*, and the *consequences of failure* present at the time of assessment."

"Abnormally extreme storms, such as tornadoes, hurricanes, earthquakes and heavy freezing rain, are not predictable and, in most cases, are not considered for categorizing *likelihood of failure*."

Risk Rating- Tuscaloosa Ave

Risk rating estimate based on a 2-year timeframe

Likelihood of Failure

Lateral limb failure and catastrophic failure of entire tree from the roots and/or root crown were most concerning due to decay present in both tree parts. The likelihood of both modes of failure was determined to be ***Possible***[2] within the given time frame***.***

Likelihood of impacting target(s)

No formal occupancy study was completed for vehicle or pedestrian traffic. While on site cars and pedestrians within the target area were occasional and determined to have a ***low*** likelihood of impact as they are assumed to be within the target for a brief period. The utility lines on southeast side of the street are static and are in the predicted direction of failure resulting in a ***High*** likelihood of impact.

Consequences

The consequences of impacting an occupied passing car or pedestrian is ***severe*** as the impact would likely result in hospitalization or death. Consequences of impacting the utility lines was determined to be ***significant*****,** with service interruptions and potential fire hazards.

Risk Rating

Assigning a tree's overall risk at the highest level of risk for various factors for that tree is suggested by the tree risk assessment manual. Factors were run through the tree risk matrices provided in the appendix of this report and resulted in a ***moderate-risk*** rating.

[2] Terms ***italicized and bold*** are used in the tree risk matrices, example provided in *Appendix C- Risk Assessment Tables example.*

Discussion

The subject tree is a magnificent specimen that is likely over 200-years old. Reviewing historical satellite images on *Google Earth* the roadway is present around the tree back to the earliest images available from 1948. The subject tree has been able to survive the past 70-years or longer, growing in less than ideal conditions including compacted soils and a dripline covered in asphalt. I do not know when the concrete perimeter the tree resides in was established, but the buttress roots of the tree have been impacted or removed at some point on the east and west sides as noted by the irregular patterns on the bark that resemble callused wounds. I was unable to excavate more than depth of 18-inches on either side of the tree due to compacted base rock (not native soil) that was present. A buttress root is present on the north side of the trunk that suggests that the tree has not had the grade raised around it.

Adjacent to the buttress root I initially noted dead cracking bark, as I pulled it back the cavity that I excavated was discovered. The wet punky wood had white strands of mycelium present. The wound had clear callusing around the edges but when I cutback at the perimeter with a knife it appeared to be decaying back, likely succumbing to a decay pathogen. Directly above this wound is where the fruiting body was noted on the lowest lateral limb in 2017. A noted the fungi resembled Canker Rot (*Inonotus spp.*). This fungi is associated with oak decline and can increase likelihood of failure in native oak trees (Swiecki, 2006). The fungi will degrade the trees health and structural integrity over time and could result in a sudden failure if not monitored. While the extent of the decay is not completely known, there is potential for a decay column within the main trunk. Advanced assessment methods such as **sonic tomography** or **resistance drillin**g could provide a better picture of how far along the decay may be.

While on site I instructed a trimming crew to preform targeted end weight reduction of over-extended limbs and branches when sounded suggested decay might be present. While loads were reduced on several large limbs the overall weight of the canopy was not significantly reduced to offset any serious defects in the main stem or root system (if present). Additionally, large lateral branches on the southern side of the canopy could benefit from more aggressive weight reduction. However, the load reduction that would be necessary to offset loading concerns of these tree parts would have significantly changed the aesthetics of this mature oak, and this requires consideration and approval of city management.

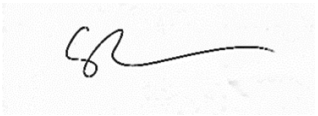
Conclusion

The subject tree in its current state possesses a moderate risk to the public and private property, but it is imperative to understand that as time goes on the likelihood of a failure increases. This tree will require continued monitoring and maintenance if retained. Advanced decay detection methods may provide more information on an estimated amount of wood strength, loss, or extent of decay. Significant crown reduction would reduce the likelihood of failure but will greatly impact the health and aesthetic value of the tree but allow for prolonged retention of the tree at a lower risk rating. However, the only way to eliminate all risk as with any tree is to remove it completely. The risk tolerance of the community will determine the trees suitability for retention.

I strongly recommend advanced decay detection if the tree is retained.

Thank you for the opportunity to assist you in your tree assessment needs. If there are any questions or concerns feel free to contact me directly at (408) 835-0438, greeve@wcainc.com

Respectfully,



Glenn O. Whitlock-Reeve
Board Certified Master Arborist
WE-10177BTM
ISA Qualified Tree Risk Assessor
West Coast Arborists, Inc.

Glossary

Buttress roots- roots at the trunk base that help support the tree and equalize mechanical stress.

CODIT – acronym for **Compartmentalization** of Decay in Trees**,** that consist of 4-walls that represent different types of decay spread.

Compartmentalization – natural defense process in trees which chemical and physical boundaries are created that act to limit the spread of disease and decay organisms.

fruiting body- the reproductive structures of fungus (conks, brackets, mushrooms).

Resistance drilling- a devise consisting of a specialized micro-drill bit that drills into trees and graphs resistance to penetration; used to detect internal differences in the wood, such as decay.

Sonic tomography- a process of measuring wood density or other mechanical properties, using an instrument that transmits, receives, and records the velocity of sound or electric waves through wood.

High (likelihood of impact) – the failed tree or tree part is likely to impact the target. This is the case when there is a constant target, with no protection factors, and the direction of fall is toward the target.

Possible (likelihood of failure) – failure may be expected in extreme weather conditions, nut it is unlikely during normal weather conditions within the specified time frame.

Moderate (risk rating) – defined by its placement in the risk rating matrix. (Matrix 2); consequences are *minor*, and likelihood is *very likely* or likely, or likelihood is *somewhat likely,* and consequences are *significant* or *severe*.

Bibliography

Dunster, J. A. (2013). *Tree Risk Assessment Manual .* Champaign, Illinois: International Society of Arboriculture.

Francis W.M.R. Schwarze, J. E. (2000). *Fungal Strategies of Wood Decay in Trees .* New York: Springer-Verlag Berlin Heidelberg .

Swiecki, T. J. (2006). *A Field Guide to insects and dieses of California oaks.* Albany : U.S. Department of Agriculture .

Tree Care Industry Association, Inc. (2017). *Tree, Shrub, and Other Woody Plant Management- Standard Practices (Pruning).* New Hapshire : Tree Care Industry Association, Inc.

Appendix A- Map (Approximate Tree location)

Figure 1: Red arrow indicates location of subject tree.

Appendix B- Observation Photos

Figure 2: Looking north at subject tree, note utility lines on east side of canopy.

Figure 3: Looking east, WCA trimmer navigates the canopy in an arial lift, large branch removed indicated by red arrow had significant internal decay.

Figure 1: Fruiting bodies on the lowest western lateral limb, circled in orange is an older dead conk.

Figure 4: Left photo shows trimmer inspecting location, where 2017 inspection (photo right) had noted a large fruiting body. The location was sounded with a mallet and a resonating deep note assured internal decay was present.

Figure 5: Decay pocket excavated on north side of trunk. The decay visible here is suspected to have a connecting column to the decay located directly above in the western canopy.

Figure 6: Attempted root crown excavation on western side near concrete curb. The callused wounds on the trunk indicate that buttress roots may have been removed in this area long ago. The concrete curb was measured to a depth of 8-inches but compacted gravel limited efforts to dig further.

Appendix C- Risk Assessment Matrices

Based on the International Society of Arboriculture "Tree Risk Assessment" Program

Likelihood of Failure	Likelihood of Impacting Target			
	Very Low	Low	Medium	High
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

The likelihood of a failure was determined to be ***Possible;*** likelihood of impact to utility lines was determined to be ***High.***

Likelihood of Failure and Impact	Consequences			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Impact to the utility lines and private property was determined to have significant consequences.

This tree has a ***Moderate-Risk*** Rating.

Based on a 2 year timeframe

ASSUMPTIONS AND LIMITING CONDITIONS

1. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the Consultant can neither guarantee nor be responsible for the accuracy of information provided by others. Standard of Care has been met with regards to this project within reasonable and normal conditions.

2. The Consultant will not be required to give testimony or to attend court by reason of this report unless subsequent contractual agreements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

3. Loss or alteration of any part of this report invalidates the entire report.

4. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior written consent of the Consultant.

5. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant's fee is in no way contingent upon the reporting of a stipulated result, a specified value, the occurrence of a subsequent event, nor upon any finding to be reported.

6. Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, or coring, unless otherwise stated. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the tree(s) or property in question may not arise in the future.

7. Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. It is highly recommended that you follow the arborist recommendations; however, you may choose to accept or disregard the recommendations and/or seek additional advice.

8. Arborists cannot detect every condition that could possible 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 or safe under all circumstances, or for a specific period of time.

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10. The author has no personal interest or bias with respect to the subject matter of this report or the parties involved. He/she has inspected the subject tree(s) and to the best of their knowledge and belief, all statements and information presented in the report are true and correct.

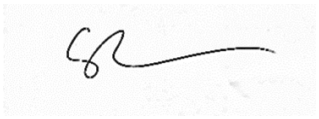
11. Unless otherwise stated, trees were examined using the risk assessment criteria detailed by the International Society of Arboriculture's publications *Best Management Practices – Tree Risk Assessment* and the *Tree Risk Assessment Manual*.

Appendix D- Certification of Performance

I, Glenn O. Whitlock-Reeve, Certify that:

1. I have personally inspected the tree(s) and property referred to in this report and have stated my findings accurately.
2. I have no current or prospective interest in the tree or the property that is the subject of this report and have no personal interest or bias with respect to the parties involved.
3. The analysis, opinions and conclusions stated herein are my own and are based on current scientific procedures and facts.
4. My analysis, opinions and conclusions were developed, and this report has been prepared according to commonly accepted arboricultural practices and standards.
5. No one provided significant professional assistance to me, except as indicated within the report.
6. My compensation is not contingent upon the reporting of 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.

I further certify that I am a member in good standing of the American Society of Consulting Arborists and a Board-Certified Master Arborist with the International Society of Arboriculture (ISA). I have been a Certified Arborist since 2013 and in the practice of arboriculture for over 10 years.

Signed: 

Glenn O. Whitlock-Reeve
Board Certified Master Arborist
WE-10177BTM
ISA Qualified Tree Risk Assessor
West Coast Arborists, Inc.

Date: 10/12/20

West Coast Arborists Inc.
390 Martin Ave
Santa Clara, CA 95050
(408) 855-8660
Wcainc.com

March 24, 2021

Prepared for:
Sally Bentz Dalton
Town of Atherton
91 Ashfield Road
Atherton, CA 94027

Re: Sonic tomography Addendum – 45 Mt Vernon Ln. & 180 Tuscaloosa Ave

The Town of Atherton has contracted West Coast Arborists Inc. for arborist services. The Town arborist Salley Bentz, requested a risk assessment two median trees in 2020. One Coast Live Oak (*Quercus agrifolia*) located at 45 Mt Vernon Ln and a Valley Oak (*Quercus lobata*) 180 Tuscaloosa Ave. This assessment was part of ongoing monitoring of the large mature Oak trees, for public safety. The most recent risk assessment was performed December 2020 and resulted in a *high-risk* rating for 45 Mt. Vernon and a *Moderate* risk rating for 180 Tuscaloosa Ave. I recommended advanced decay detection for both trees, due to visible decay on the trunk of both trees. In March of 2021 Cris Falco (WCA), performed a sonic tomography/resistograph assessment, and submitted his findings (attached to this report). This addendum is intended to summarize our observations and data obtained though the process.

45 Mt Vernon Ln.

The sonic tomography image on page 6 of Mr. Falco's report, displays significant internal decay that accounts for the majority of southeastern portion of the trunk. Incipient decay was detected on the northern side of the trunk noted by smaller yellow and red portions in the image. A large portion of sap wood was dead on the northern side of trunk. I believe it is rational to determine that decay of structural wood is ongoing due to fungal pathogens and natural degradation of the dead tissue. At this point in time the tree appears to have sufficient structural wood, during calm weather conditions to avoid catastrophic failure. However, continued decay of the northern trunk may result in unpredicted failure during normal weather. Previous risk assessments have determined this tree to be a *high* risk to property/utilities in the area, based on the likelihood of failure, impact and consequences. Mr. Falco's report states that the likelihood of failure is *possible* for the 2-year timeline, which results in a *moderate* risk rating based on the risk matrices.

180 Tuscaloosa Ave.

The sonic tomography image on page 8 of Mr. Falco's report, displays significant internal decay that accounts for the majority of northwestern portion of the trunk. Information provided from the tomogram was checked via resistance drilling which did not provide a clear indication of advanced decay. As stated in Mr. Falco's report this may be an indication of early stages of decay, that wood may not yet be completely compromised. Fungal activity is present and has been identified in previous. Continued degradation of structural wood can be expected, and the tree's age suggest that compensative growth will decrease. However, this is the case with any tree in late stages of life. Previous risk assessments have determined this tree to be a *moderate* risk to property/utilities in the area, based on the likelihood of failure, impact and consequences. Additional information from sonic tomography left the likelihood of failure rating unchanged and the tree still poses a *moderate* risk.

Moderate-risk situations may not require mitigation but, if deemed necessary could be mitigated when budget, work schedule, or pruning cycle allows. If the risk is acceptable to managing parties the trees may be retained and monitored. Reducing leverage from primary growth, can significantly reduce the likelihood of failure for a temporary period. This targeted trimming practice is referred to as end-weight reduction. It is important for managing parties to understand that while reducing end-weight can reduce the likelihood of failure, it can impact the health and esthetic qualities of the tree. Impacts to health can be partially mitigated through soil amendments and chemical applications to ward off secondary pests. However, extensive canopy loss can affect the trees' ability to compensate for decay. Additional esthetic values may be significantly impacted in the process.

The amount of decay in the subject trees is anticipated to advance over time. Determining the rate of decay will require follow up imaging in 2-3 years. If the trees are healthy, they may be able to compensate for advancing decay with additional growth, and it is possible to compartmentalize. However, mature oaks such as these in urban settings typically succumb to environmental factors, faster than trees in natural settings. If significant decay advance is detected in the next 2-3 years, this may warrant expedited removal of the trees.

Thank you for the opportunity to assist you in your tree assessment needs, respectfully,

Glenn O. Whitlock-Reeve
Registered Consulting Arborist #704
Board Certified Master Arborist WE-10177BTM

West Coast Arborists Inc. - 390 Martin Ave Santa Clara, CA 95050 - (408) 855-8660 Wcainc.com

ASSUMPTIONS AND LIMITING CONDITIONS

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11. Unless otherwise stated, trees were examined using the risk assessment criteria detailed by the International Society of Arboriculture's publications *Best Management Practices – Tree Risk Assessment* and the *Tree Risk Assessment Manual*.

Town of Atherton

3.3.21Oak Assessment

SUBMITTED TO:

The Town of Atherton

PREPARED BY:

Cris Falco
Board Certified Master Arborist WE-7490B
Registered Consulting Arborist #557
Pest Control Adviser #128017
Qualified Tree Risk Assessor

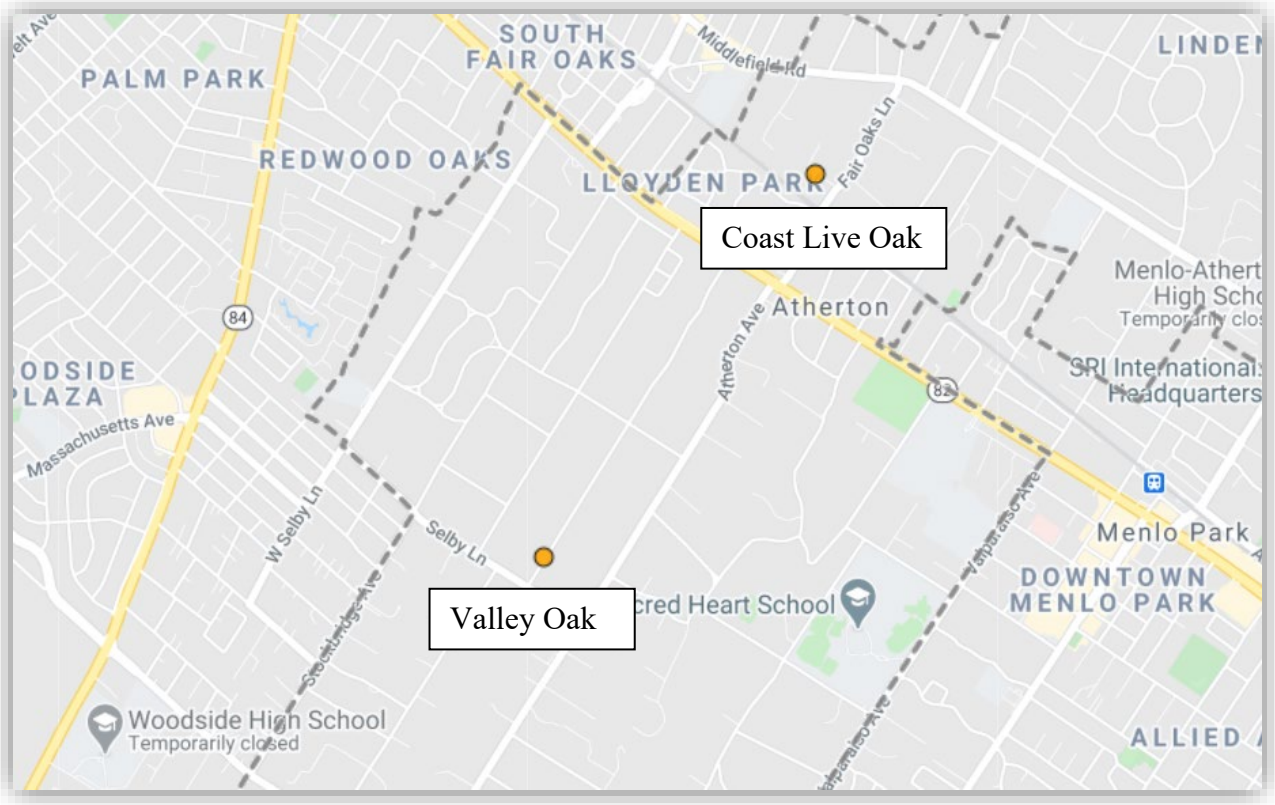
MARCH 16, 2021

Table of Contents

SUMMARY

I was contacted by Mr. Glenn Whitlock Reeve from WCA to perform a sonic assessment and Resistograph® drilling on a coast live oak and a valley oak in the Town of Atherton (orange dots in map below). A full risk assessment was not included in the assignment, only the categorization of the "likelihood of failure" for the bases of the subject trees. This categorization is valid for a period of three years from the date of the assessment and is based on the conditions present at the time of assessment.

I performed the assessment on March 3, 2021. Based on my observations and testing results, my opinion for both trees is that the load bearing capacity of their bases is compromised to the point where failure may be expected in extreme weather conditions, but it is unlikely during normal weather conditions within the specified three-year time frame. I categorize the likelihood of failure for the bases of both trees as "possible."



BACKGROUND AND ASSIGNMENT

I was contacted by Mr. Glenn Whitlock Reeve (consulting arborist with WCA) regarding two oaks located within the Town of Atherton. The first is a coast live oak (*Quercus agrifolia*) identified in ArborAccess (WCA's tree inventory database) as "Median 1 at 45 X MT VERNON LN," and the second is a valley oak (*Quercus lobata*) identified as "Median 1 at 180 X TUSCALOOSA AV." A map of the trees is located in Appendix A.

It was requested that I perform a **sonic assessment**[1] (right photo) and **Resistograph®** drilling on the subject trees to gather data on the extent of **decay** located in their bases. This equipment is described under the "Observations" section below.

A full-scale **Level 2 or Level 3 Tree Risk Assessment** was not included in this assignment. For this report, only the "likelihood of failure" for the bases of each tree will be categorized[2]. The categorization found in this report is valid for a period of three years from March 3, 2021 and is based on the conditions present at the time of assessment. This time frame should not be considered a guarantee period. This report is to be used by Mr. Whitlock Reeve and the Town of Atherton to assist in tree management decisions.

[1] Terms appearing in boldface type are defined in the Glossary at the end of this report.

[2] Please refer to the *Tree Risk Assessment Manual (Second Edition)* for more information on tree risk categorization.

OBSERVATIONS

On March 3, 2021 I assessed the subject oaks with an Arbotom and Resistograph® 650 -EA[3] (see photo below). The Arbotom performs sonic tomography, using the relative velocity of sound waves, induced across the trunk of a tree, to construct a two-dimensional picture (tomogram) that shows zones of different sound-transmission properties. The zones are color-coded and indicate degrees of mechanical strength loss. The Resistograph® is a drill that measures wood resistance as the bit enters a tree. The patterns of resistance indicate changes in wood density that are caused by internal issues such as woody decay caused by fungi. An explanation of how to interpret Arbotom and Resistograph® readings is included in Appendix C – "Interpretation of Level 3 Data."

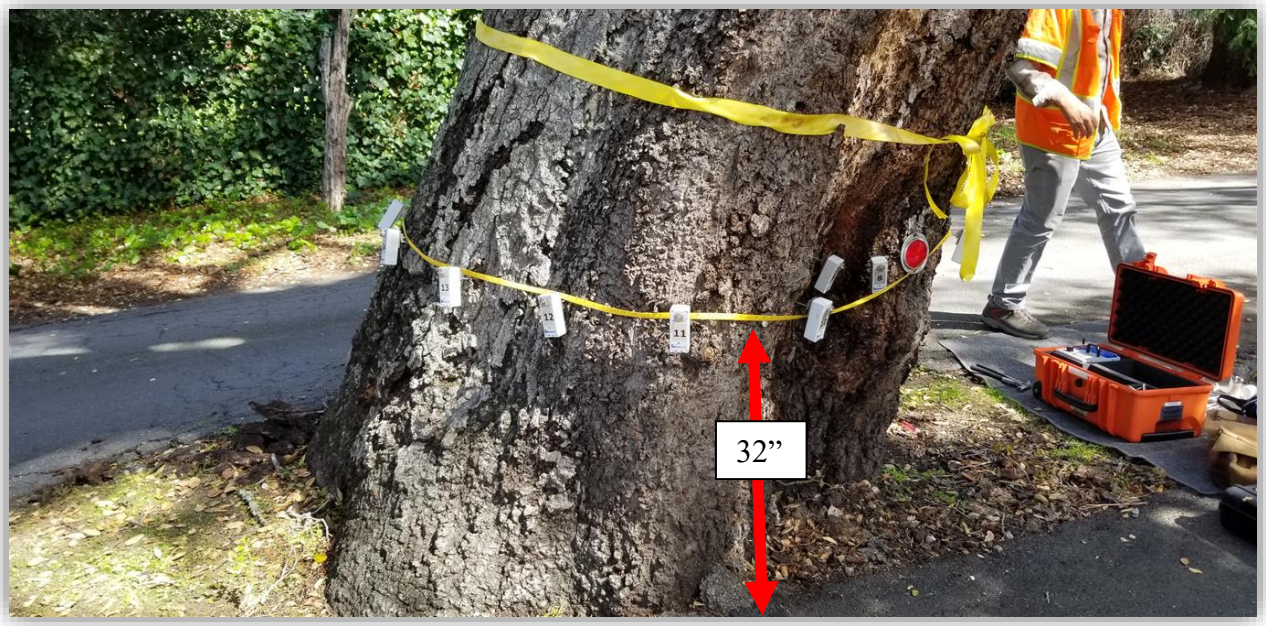
On site, I observed the following:

Coast Live Oak

The foliage of the tree is in fair health judging by its color and density for the given species. The base of the tree is missing bark tissue on its north side (see Photo #1 in Appendix A). There is also a **cavity** on the south side of the trunk which looks to be surrounded by **woundwood** or **response growth** (see Photo #2 in Appendix A).

[3] These are products of Rinntech (http://www.rinntech.de/content/blogcategory/2/28/lang,english/index.html).

The tree's center of gravity looks to be the to the south of the trunk based on **canopy** weight. I took a tomogram of the trunk at 32 inches up from the ground based on what I judged to be the weakest section in the trunk (see photo below). I also took one Resistograph® reading of the trunk, next to sensor #11. The readings are seen in the "Testing & Analysis" section below.



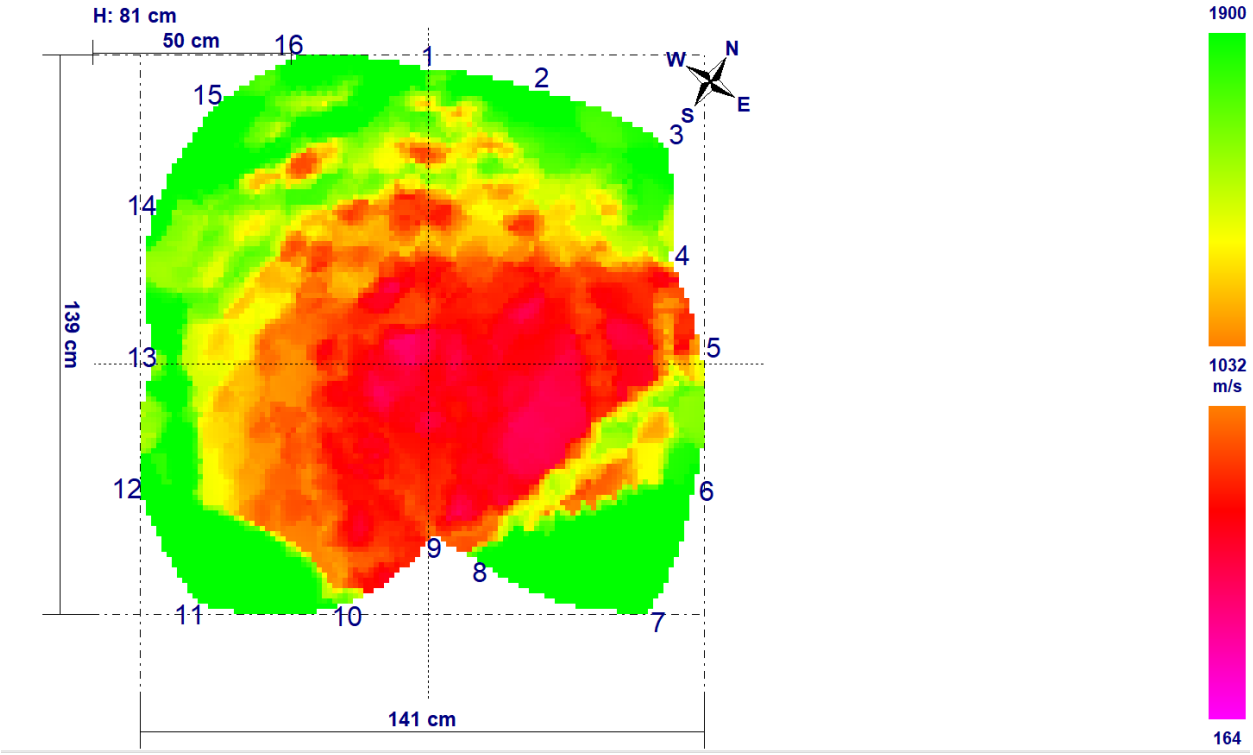
Valley Oak

At the time of inspection, this deciduous oak was without leaves (right photo). I observed a couple small, ground-level cavities on the west and south sides of the trunk (see Photo #3 in Appendix A).

I took a tomograph reading seven inches up from the ground. I also took two Resistograph® readings, behind sensors #4 and #11.

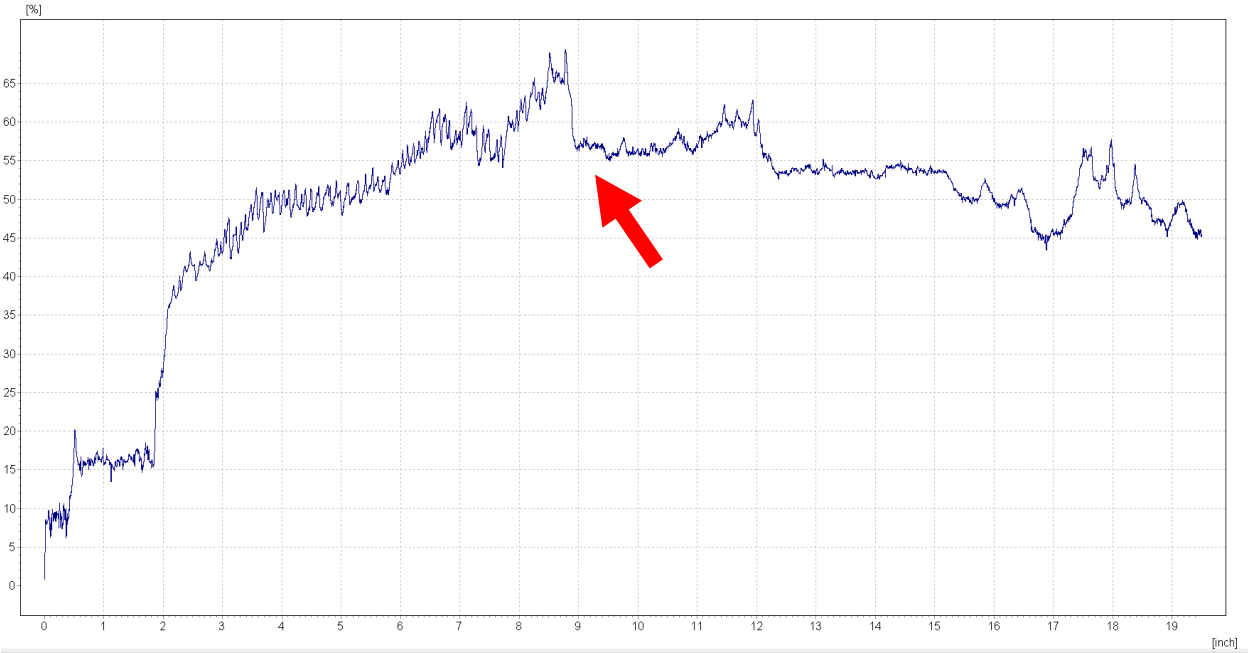
TESTING & ANALYSIS

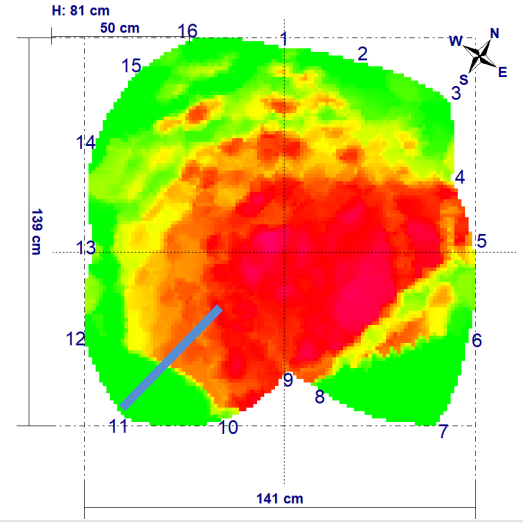
Coast Live Oak



The above tomogram shows a large amount of structurally compromised wood (red areas). Sounds waves traveled faster (meters per second) through structurally sound areas of the trunk and are represented by the green coloring. The wood on the northwest side of the tree, where the bark is missing, looks to be mostly structurally sound, with the red splotches most likely indicating incipient decay. The cavity located behind sensor #9 seems to be bolstered by response growth indicated by the green areas behind sensors # 7 and #11.

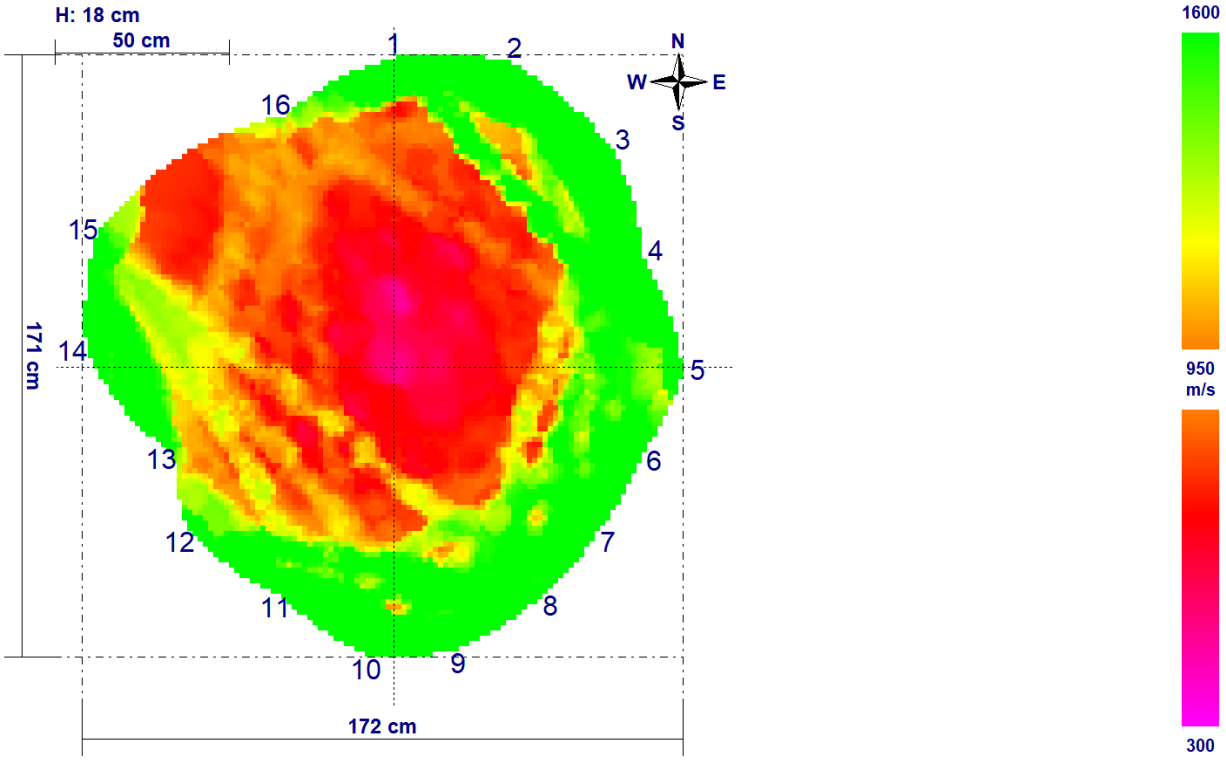
Resistograph® Reading Behind Sensor #11





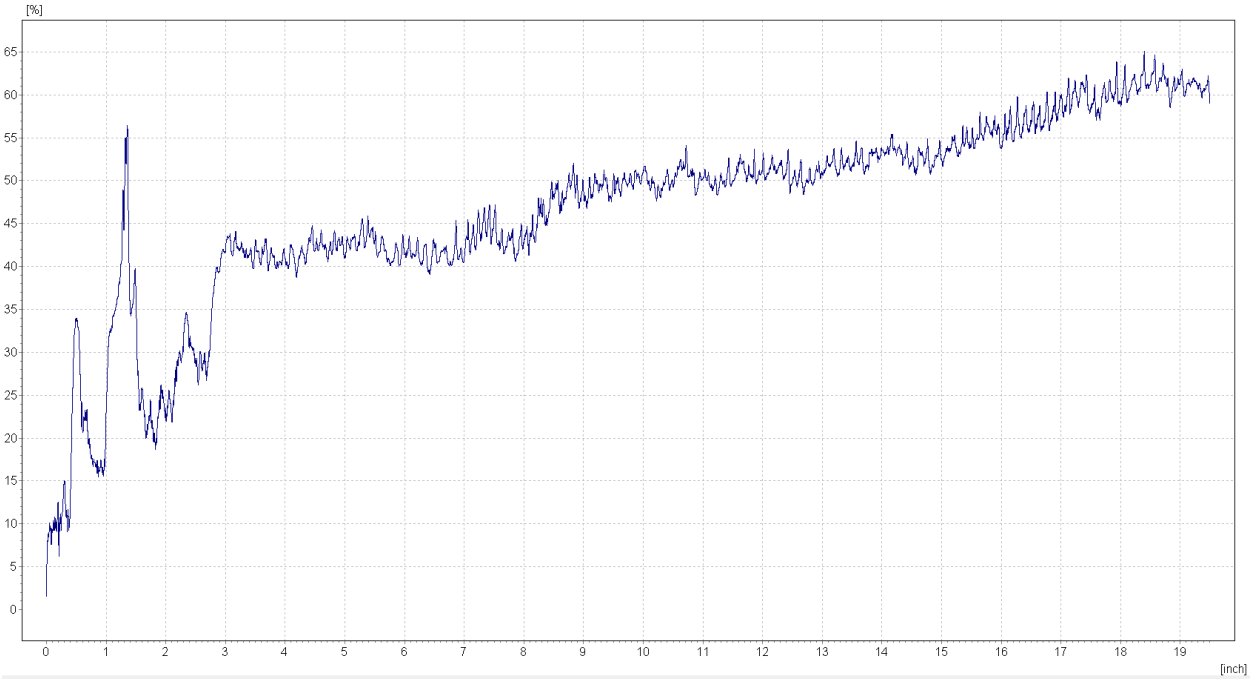
The above Resistograph® reading was taken from sensor #11 towards sensor #2 (see **blue line** in tomogram to the left). The reading correlates with the tomogram in that wood quality begins to degenerate at about 9 inches into the trunk (**red arrow above**). Resistance is lower when compared to solid wood and the peaks are less defined and more linear. The first inch or two of tissue is bark tissue which does not show the same resistance as wood tissue.

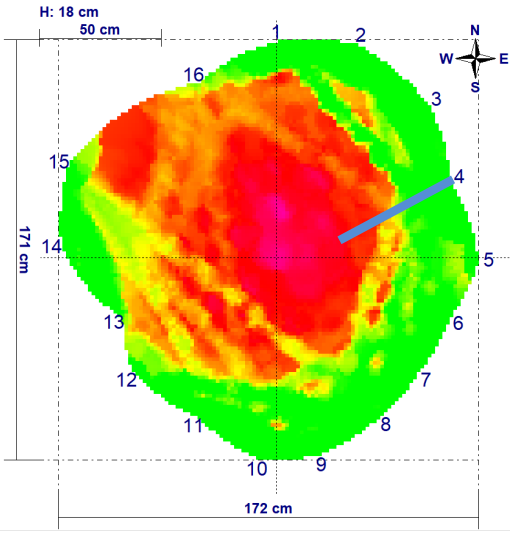
Valley Oak



The above tomogram also shows a large amount of structurally compromised wood (red areas). Sounds waves traveled faster (meters per second) through structurally sound areas of the trunk and are represented by the green coloring. The dysfunctional wood reaches the surface between sensors #15 and #16 (location of cavity), but the remainder of the trunk has solid wood around the perimeter.

Resistograph® Reading Behind Sensor #4

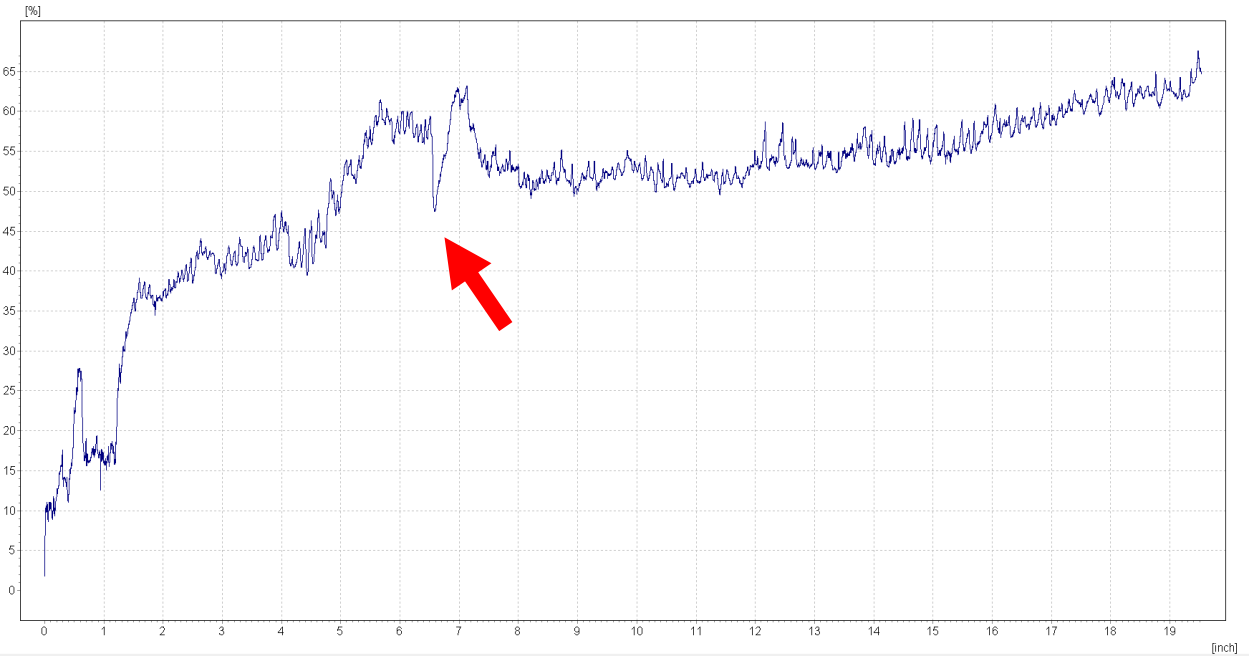


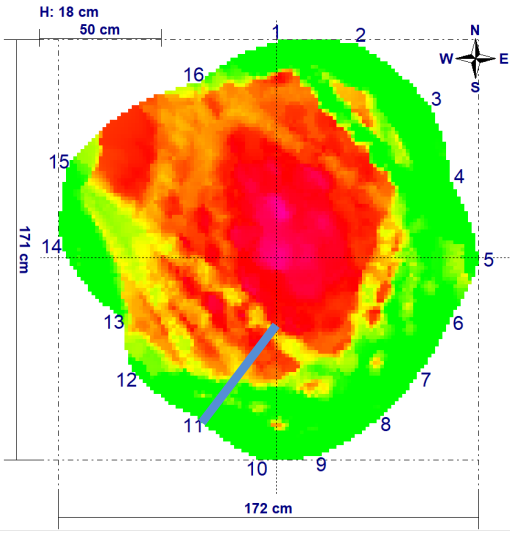


The above Resistograph® reading was taken from sensor #4 towards sensor #13 (see **blue line** in tomogram to the left). The reading does not indicate any obvious changes in wood quality going from the red area to the green area. It may be that the red area has incipient decay that is still too subtle to register significantly via resistance drilling.

Valley oak wood is very dense and heavy, which also may explain why the wood in the red area is still showing a good amount of resistance even though sound did not travel through it as fast as the unimpacted wood in the green areas. The first inch or two of tissue is bark tissue which does not show the same resistance as wood tissue.

Resistograph® Reading Behind Sensor #11





The above Resistograph® reading was taken from sensor #11 towards sensor #2 (see **blue line** in tomogram to the left). The reading correlates with the tomogram in that wood quality changes at around 6.5 inches into the trunk. The peak in resistance at 7 inches may indicate that the decay has been **compartmentalized.**

Valley oak wood is very dense and heavy, which may explain why the wood in the red area is still showing a good amount of resistance even though sound did not travel through it as fast as the unimpacted wood in the green areas. The first inch or two of tissue is bark tissue which does not show the same resistance as wood tissue.

CATEGORIZATION OF LIKELIHOOD OF FAILURE FOR SUBJECT TREES

The *Tree Risk Assessment Manual (Second Edition)* lists four categories for likelihood of failure:

Imminent:

> Failure has started or is most likely to occur in the near future, even if there is no significant wind or increased load. This is an infrequent occurrence for a risk assessor to encounter and may require immediate action to protect people from harm. The imminent category overrides the stated time frame.

Probable:

> Failure may be expected under normal weather conditions within the specified time frame.

Possible:

> Failure may be expected in extreme weather conditions, but it is unlikely during normal weather conditions within the specified time frame.

Improbable:

> The tree or tree part is not likely to fail during normal weather conditions and may not fail in extreme weather conditions within the specified time frame.

In determining the likelihood of failure for the bases of the subject trees, two critical factors are involved in strength loss assessment. First, it is important to consider how much strength is lost due to the defect. Second, the load required to cause failure must be considered. Tomographic data, supported by Resistograph® data, confirm that both trees have a large amount of dysfunctional wood in the interior of their trunks, but they both also have sound, unimpacted wood around most of their perimeters. Regarding the location of the decay, the *Tree Risk Assessment Manual (Second Edition)* states that, "Loss of outer wood is considered more important to stem strength than is internal decay; outer xylem tissue contributes significantly more than internal fibers to stem strength."

From *Tree Structure and Mechanics Conference Proceedings: How Trees Stand Up and Fall Down*:

> "The formulas currently available for determining strength loss in tree stems have been adopted from beam mechanics and modified to account for the inherent differences between green wood in trees and conventional engineering materials." However, "applying strength loss formulas from beam mechanics to trees is complicated and imprecise. Beam mechanics formulas are derived for perfect geometric shapes and bodies made of homogenous material. While a tree resembles a cylinder, it is not geometrically perfect. Similarly, wood is not a homogenous material, exhibiting a suite of variables that affect strength properties."

Strength loss formulas that have yet to be precise in predicting urban tree failure, and it is impossible to determine the exact remaining load bearing capacity of the bases of the subject trees, just as it is impossible to determine the potential loads being placed on the trees (e.g., dynamic wind loading).

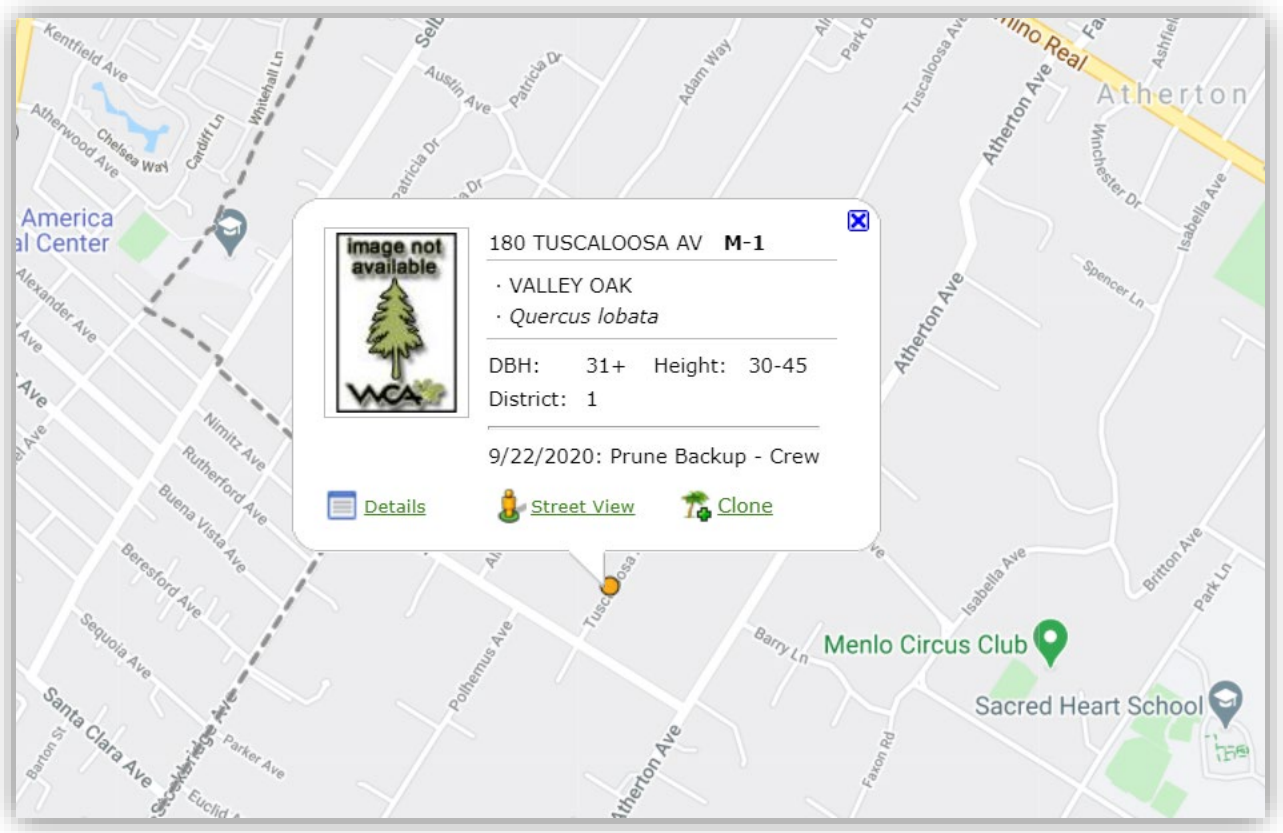
Coast Live Oak

My opinion is that the load bearing capacity of the base of the subject coast live oak is compromised to the point where failure may be expected in extreme weather conditions, but it is unlikely during normal weather conditions within the specified three-year time frame. In conclusion, I categorize the likelihood of failure for the base of this tree over the next three years as “possible.”

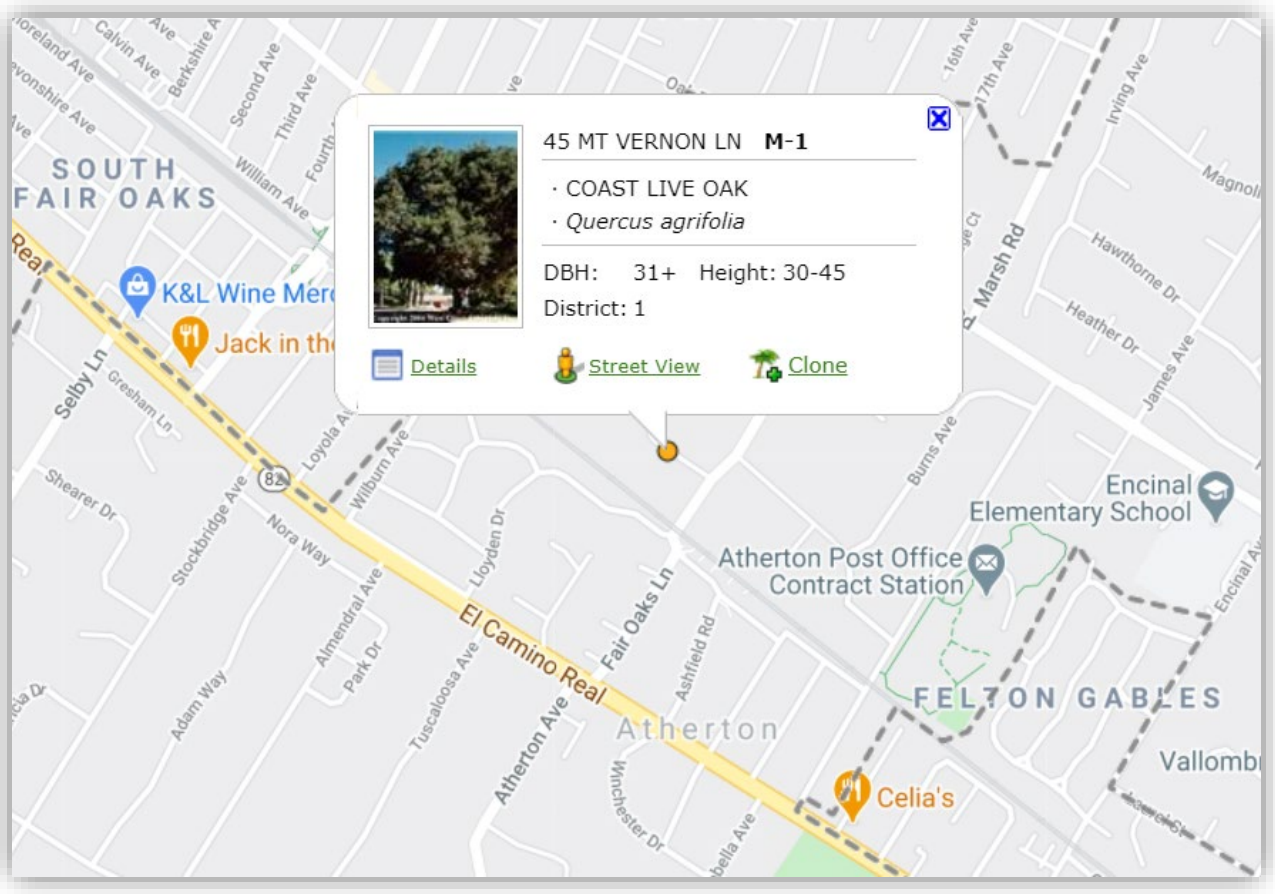
Valley Oak

My opinion is that the load bearing capacity of the base of the subject valley oak is compromised to the point where failure may be expected in extreme weather conditions, but it is unlikely during normal weather conditions within the specified three-year time frame. In conclusion, I categorize the likelihood of failure for the base of this tree over the next three years as “possible.”

APPENDIX A – TREE MAPS



APPENDIX A – TREE MAPS



APPENDIX B – PHOTOS

Photo #1

Coat Live Oak (looking southwest)
The base of the tree is missing bark tissue on its north side (**red arrow**).

APPENDIX B – PHOTOS

Photo #2

Coast Live Oak (looking northeast)
There is a cavity (**red arrow**) on the south side of the trunk which looks to surrounded by woundwood or response growth.

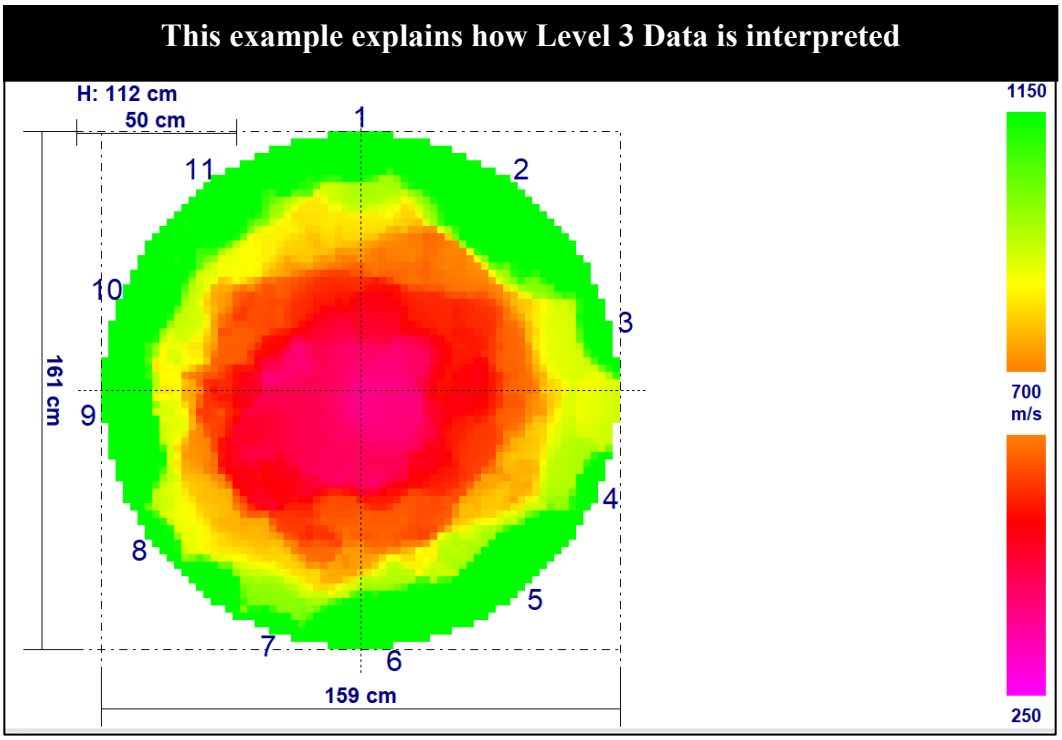
APPENDIX B – PHOTOS

Photo #3

Valley Oak (looking northeast**)**

I observed a couple small, ground-level cavities (**red arrows**) on the west and south sides of the trunk.

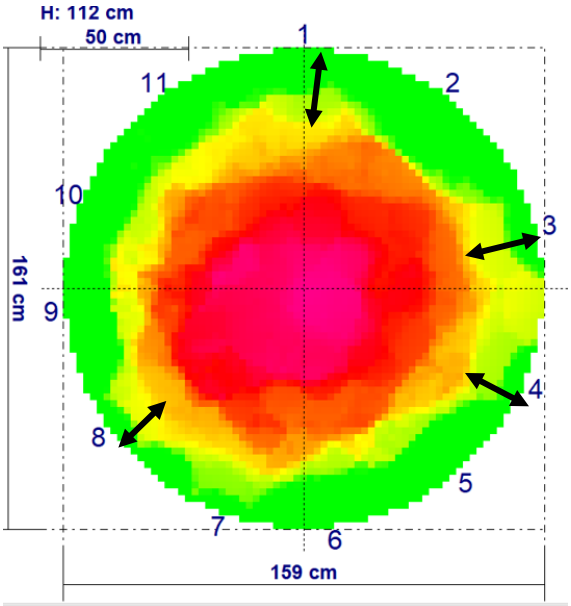
APPENDIX C – INTERPRETATION OF LEVEL 3 DATA



The example graph (tomogram) above represents a 2-dimensional diagram of the trunk of a tree — at the location where the measurement was taken (e.g., 44 inches from the ground). The numbers 1 through 11 indicate where the sensors were placed around the trunk. Sensor #1 is on the north side of the tree (see photos at the end of this section).

Without knowing the weakest point of the tree trunk under external loading, every localized measurement is just an approximation and cannot describe the mechanical behavior of the whole cross section, trunk, or even tree. This limitation is valid for all technical methods and devices in a specific certain way.

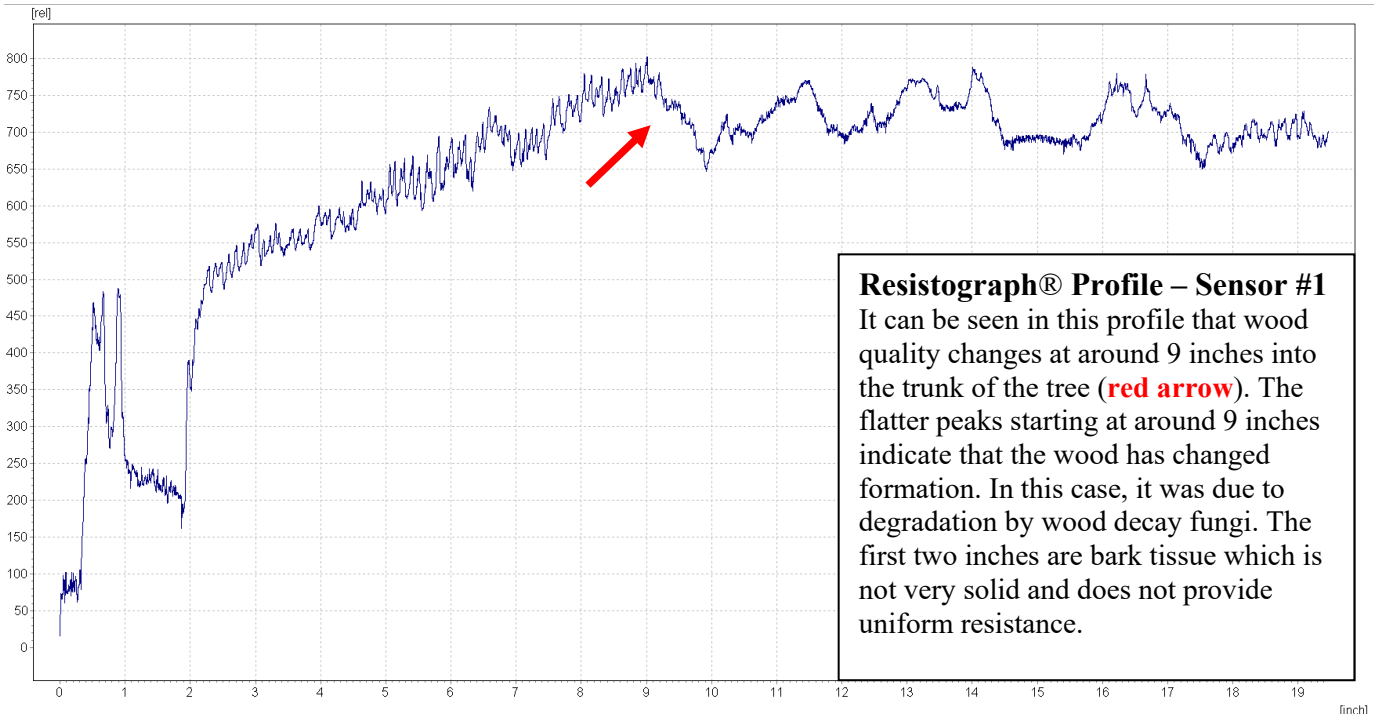
The green areas correspond to faster stress waves (meters per second), and red areas to slower ones. Wood that has decay transmits stress waves slowly. The red / purple wood represents areas where the stress waves are slower than in green areas, and that is interpreted to suggest wood quality that has less load carrying capacity.



This tomogram shows a tree that has a large amount of mechanically dysfunctional wood in its center. However, the shell of the tree has about 9 inches of sound wood around the circumference (the black arrows in the image to the left roughly scale to 9 inches each).

To verify the findings of the tomogram, a Resistograph® was used to drill next to 4 sensors: #'s 1, 3, 4 & 8 – corresponding to the black arrows.

The 4 Resistograph® (resistance drilling) profiles also indicate that there are around 9 inches of sound wood around the perimeter of the trunk. Below is the profile taken next to sensor #1. At about 9 inches into the trunk (**red arrow below**), the graph shows that the density/quality of the wood changes, verifying the change captured in the tomogram.



Resistograph® Profile – Sensor #1
It can be seen in this profile that wood quality changes at around 9 inches into the trunk of the tree (**red arrow**). The flatter peaks starting at around 9 inches indicate that the wood has changed formation. In this case, it was due to degradation by wood decay fungi. The first two inches are bark tissue which is not very solid and does not provide uniform resistance.

This photo shows the Arbotom sonic tomography system. The sensors can be seen placed around the trunk of the tree.

These photos show a Resistograph® 650 – EA.

ASSUMPTIONS AND LIMITING CONDITIONS

1. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the Consultant can neither guarantee nor be responsible for the accuracy of information provided by others. Standard of Care has been met with regards to this project within reasonable and normal conditions.

2. The Consultant will not be required to give testimony or to attend court by reason of this report unless subsequent contractual agreements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

3. Loss or alteration of any part of this report invalidates the entire report.

4. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior written consent of the Consultant.

5. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant's fee is in no way contingent upon the reporting of a stipulated result, a specified value, the occurrence of a subsequent event, nor upon any finding to be reported.

6. Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, or coring, unless otherwise stated. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the tree(s) or property in question may not arise in the future.

7. Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. It is highly recommended that you follow the arborist recommendations; however, you may choose to accept or disregard the recommendations and/or seek additional advice.

8. 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 or safe under all circumstances, or for a specific period of time.

9. Any recommendation and/or performed treatments (including, but not limited to, pruning or removal) of trees may involve considerations beyond the scope of the arborist's services, such as property boundaries, property ownership, site lines, disputes between neighbors, and any other related issues. Arborists cannot take such considerations into account unless complete and accurate information is disclosed to the arborist. An arborist can then be expected to consider and reasonably rely on the completeness and accuracy of the information provided.

10. The author has no personal interest or bias with respect to the subject matter of this report or the parties involved. He/she has inspected the subject tree(s) and to the best of their knowledge and belief, all statements and information presented in the report are true and correct.

11. Unless otherwise stated, trees were examined using the risk assessment criteria detailed by the International Society of Arboriculture's publications *Best Management Practices – Tree Risk Assessment* and the *Tree Risk Assessment Manual (Second Edition)*.

BIBLIOGRAPHY

Dunster, Julian A., E. Thomas Smiley, Nelda Matheny, and Sharon Lilly. *Tree Risk Assessment Manual (Second Edition).* Illinois: International Society of Arboriculture, 2017. Print.

Smiley, Thomas E., Nelda Matheny, and Sharon Lilly. *Best Management Practices: Tree Risk Assessment.* Illinois: International Society of Arboriculture, 2011. Print.

Harris, Richard W., James R. Clark, and Nelda P. Matheny. *Arboriculture: Integrated Management of Landscape Tree, Shrubs, and Vines.* New Jersey: Prentice Hall, 2004. Print

Smiley, Thomas E., Kim D. and Kim D. Coder. *Tree Structure and Mechanics Conference Proceedings: How Trees Stand Up and Fall Down.* Illinois: International Society of Arboriculture, 2002. Print.

GLOSSARY

Barrier Zone – a chemical and anatomical barrier formed by the cambium present at the time of wounding in response to wounding. Inhibits the spread of decay into xylem tissue formed after the time of wounding.

Best Management Practices (BMPs) – The International Society of Arboriculture has developed a series of Best Management Practices (BMPs) for the purpose of interpreting tree care standards and providing guidelines of practice for arborists, tree workers, and the people who employ their services.

Canopy – The part of the crown composed of leaves and small twigs (Harris, Clark, and Matheny 526).

Cavity – An open wound, characterized by the presence of decay and resulting in a hollow (Harris, Clark, and Matheny 527).

Codominant – Equal in size and relative importance, usually associated with either the trunks/stems or scaffold limbs/branches in the crown (Harris, Clark, and Matheny 527).

Compartmentalization – natural defense process in trees by which chemical and physical boundaries are created that act to limit the spread of disease and decay organisms.

Crown – The leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree (Harris, Clark, and Matheny 527).

Decay – Process of degradation of woody tissues by fungi and bacteria through the decomposition of cellulose and lignin (Harris, Clark, and Matheny 527).

Dieback – The gradual dying of plant shoots starting at the tips as a result of disease, physiological dysfunction, or climatic conditions such as drought.

Epicormic Sprouts - Epicormic buds lie dormant beneath the bark, their growth suppressed by hormones from active shoots higher up the plant. Under certain conditions, they develop into active shoots, such as when damage occurs to higher parts of the plant, or light levels are increased following removal of nearby plants.

Failure – Breakage of stem, branch, roots, or loss of mechanical support in the root system (Smiley, Matheny, and Lilly 48).

Fungal Fruiting Bodies – Any complex fungal structure that contains or bears spores.

Included Bark – Pattern of development at branch junctions where bark is turned inward rather than pushed out (Harris, Clark, and Matheny 529).

Level 1: **Limited Visual Assessment Process –** A visual assessment of an individual tree or population of trees near specified targets, conducted from a specified perspective in order to identify certain obvious defects or specified conditions. A limited visual assessment typically focuses on identifying trees with *imminent* and/or *probable* likelihood of failure.

Level 2: **Basic Assessment –**The standard assessment performed by arborists in response to most client requests for tree risk assessments. It consists of a detailed visual inspection of a tree and its surrounding site and a synthesis of the information collected.

Level 3: **Advanced Assessment –** Advanced assessments are performed to provide detailed information about specific tree parts, defects, targets, or site conditions.

Resistograph® – a device consisting of a specialized micro-drill bit that drills into trees and graphs resistance to penetration, used to detect internal differences in the wood, such as decay.

Response Growth – New wood produced in response to loads to compensate for higher strain in outermost fibers; includes reaction wood and woundwood.

Risk – The combination of the likelihood of an event and the severity of the potential consequences. In the context of trees, risk is the likelihood of a conflict or tree failure occurring and affecting a target, and the severity of the associated consequence—personal injury, property damage, or disruption of activities (Smiley, Matheny, and Lilly 50).

Root Flare - The root flare is the area at the base of the trunk that swells out to become buttress roots entering the soil; and is also known as the root collar (Wikipedia).

Sonic Assessment – A process of measuring wood density, or other mechanical properties, using an instrument that transmits, receives, and records the velocity of sound or electric waves through wood (Dunster, Smiley, Matheny, and Lilly 185)

Stem – The main trunk of a tree or other plant (Harris, Clark, and Matheny 533).

Target – People, property, or activities that could be injured, damaged, or disrupted by a tree (Smiley, Matheny, and Lilly 50).

Target zone – The area where a tree or branch is likely to land if it were to fail (Smiley, Matheny, and Lilly 50).

Woundwood – Lignified, differentiated tissues produced on woody plants as a response to wounding.