APPENDIX A

- **Level 2 Tree Risk Assessment Qualification (TRAQ) evaluation dated June 01, 2015**

- **Basic Tree Risk Assessment Form dated May 14, 2015, Tree B**

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6/1/2015

Jonathan Ferrante
Trees and Right of Way Supervisor
City of Cupertino
10555 Mary Ave
Cupertino, CA 95014

Re: Level 2 TRAQ Assessment for Two Prominent Coast Live Oaks at Cupertino Senior Center

Dear Jonathan,

At your request, I have visited the above property to evaluate the Coast Live Oaks (*Quercus agrifolia*) referenced. This letter summarizes my observations and recommendations.

Summary:

The risk rating of Tree A is Low. This tree is in good condition, with strong response growth at defects.

The risk rating of Tree B is High. This tree in moderate to poor condition, with weak response growth at defects. In the event of failure, the nearby traffic crossing signal will likely be impacted.

The river rock around these trees has likely negatively impacted their health.

Improperly installed cables in both trees may increase their likelihood of limb failure.

Assignment:

I have been asked to perform a Level 2 Tree Risk Assessment Qualification (TRAQ) evaluation on these trees and craft a report detailing my findings.

Introduction:

In addition to determining the likelihood of tree failure[1], TRAQ evaluations address the likelihood of a tree impacting targets such as people or valuable property upon failure. The potential consequences of impact are also considered.

A Level 2 TRAQ evaluation involves examining a tree from the ground with simple hand tools.

Background:

These two Coast Live Oaks predate the Cupertino Senior Center by decades.

Limits of the Assignment:

All observations were made from ground level. No root collar excavation was performed on Tree A. The root collar excavation on Tree B was shallow and did not cover the entire circumference of the tree. No aerial inspections were made on either tree.

Purpose & Use of the Report:

This report will be used to inform the management of these trees going forward, with respect to risk management. This report is not intended to give specific recommendations for management, but only to detail the existing condition of the trees and to broadly outline management scenarios.

Observations:

Poor pruning in the past has resulted in lion's tailing[2] of major branches on both trees (**Image 1**). Copious sprouting has occurred in response (**Images 7, 14**).

River rock is present around the base of both trees, extending out to the curb and to the dripline[3] of Tree A (**Images 2, 5, etc.**). The layer of river rock is several inches thick. Rocks are in contact with both trees' trunks, and some are embedded in the cambium of both trees.

Large decay cavities are present in both trees (**Images 2, 11, etc.**). It is unclear whether these cavities result from limb failures or pruning wounds. All appear many years old.

Cables are present in both trees (**Images 7, 14**). All appear many years old. All are installed incorrectly, with multiple cables sharing attachment points and none being horizontal.

No signs of Oak Root Fungus (*Armillaria mellea*) were found.

Tree A – the DBH[4] of this tree is 57 inches.

[1] Failure: falling down
[2] Lion's tailing: a non-industry-approved pruning practice involving the removal of inner branches; results in a bare branch terminating in a puff of foliage
[3] Dripline: the edge of a tree's canopy, so called because this is the line outside which water drips during rain event
[4] DBH: Diameter at breast height, defined as 1.3 meters above grade; standard arboricultural measurement

This tree is highly vigorous, evidenced by strong shoot extension and a dense, healthy canopy (**Image 1**). All visible defects are surrounded by a great deal of response growth (**Images 2, 3**).

Two cavities at the base of this tree appear to be connected to a cavity approximately eight feet above grade by a column of decay (**Images 2, 3, 4, 5**). Strong response growth is evident along the full length of this area (**Image 2**).

I have been informed anecdotally that sunlight sometimes shines through the upper cavity in such a way that another opening must exist inside the crotch of the tree.

A decay cavity is visible in a scaffold branch on the southwest side of the tree (**Image 6**). A cable was installed in this limb at a previous time.

Five cables are present in the canopy of this tree (**Image 7**).

There is a bleeding area on the east side of the tree, above an eight-inch column of dieback, with no wounding visible (**Image 8**). No other bleeding areas are present.

Tree B – the DBH of this tree is inches.

This tree has low vigor, evidenced by weak shoot extension and a thinning canopy with dieback (**Image 10**). Not all visible defects are surrounded by response growth (**Image 11, 12, 16**).

There are two large decay cavities in the south side of the upper trunk of this tree (**Images 11, 12**). Response growth around these cavities is moderate.

There is one medium-sized decay cavity in a scaffold branch on the north side of this tree (**Image 13**). Decay indicates that the wound is several years old. No reaction growth is visible.

One cable is present in the canopy of this tree (**Image 14**).

A traffic crossing signal was installed several years ago beneath one of this tree's branches. The overhanging branch is approximately six inches above the signal (**Image 15**). I have been informed anecdotally that, in the past, the branch was one to two feet above the signal.

This tree is leaning slightly toward the traffic crossing signal (**Image 10**).

This tree is planted too deep (**Image 16**).

One large girdling root is present (**Image 17**). Another area of the trunk is flat with no visible scaffold roots, suggesting another girdling root (**Image 18**).

Two decay cavities on a major scaffold root on the north side are likely connected by a column of decay (**Images 19, 20**).

Stone was encountered inside two decay cavities in the base of this tree (**Image 21**). It is unclear whether or not this material is concrete, but it does not appear to be river rock. I have been informed anecdotally that there are no records of this tree having been filled with concrete.

Testing & Analysis:

A diameter measuring tape was used to determine each tree's DBH.

A shallow root collar excavation was performed on Tree B using a trowel, handheld hoe, chisel, and mallet.

Decay cavities on both trees were explored with the tools used for excavation.

Oak Root Fungus was sampled for, by chipping off bark in several areas on both trees' root flares.

Both trees were sounded[5] at various points using a mallet.

A linear measuring tape was used to determine the dimensions of cavities.

All other observations were made visually.

Tree risk was assessed using one Basic Tree Risk Assessment Form[6] for each tree (**Appendix 1**). I am TRAQ qualified, and my qualification number is given in my signature, below.

Discussion:

Lion's tailing predisposes branches to failure. Inner branches help to dampen the force created by wind, resulting in reduced pressure on the limb. When all inner branches are removed, wind is only able to act on the outer branches, resulting in large forces at the end of the limb.

When able[7], trees sprout in response to the increased light let through by lion's tailing. These sprouts can help mitigate the effects of lion's tailing, eventually growing into a new set of interior branches.

Sprouts are more weakly connected than normal branches, as they arise in the outer layers of wood rather than in a tree's core. Structural pruning is necessary to ensure that sprouting does not result in poor structure, as this can also predispose trees to branch failures.

River rock, while commonly installed around trees and other plants, is both injurious to roots, and highly detrimental to soil structure. Rocks create compaction and reduce airflow, both of which can directly lead to root dieback and decay. This also creates an unfavorable environment for beneficial soil organisms.

[5] Sounding: tapping a tree with a mallet in order to determine whether or not it is hollow in a given location
[6] Dunster et al., *Tree Risk Assessment Manual*, International Society of Arboriculture, 2013
[7] Ability to sprout varies with tree species and vigor

The most beneficial groundcover under trees and other plants is organic mulch, particularly coarse wood chips. Mulch keeps soil temperatures low and moisture high, creating a favorable environment for both roots and soil organisms. Mulch also acts as a natural fertilizer, improving soil nutrient content as it breaks down.

Most mature trees have some decay in their interiors. For a vigorous tree with strong response growth, internal decay is often not problematic. The outer layers of wood provide most of a tree's structural integrity, so internal decay may not substantially affect structural integrity.

Trees are not able to heal from injury as animals do. Instead, the tree compartmentalizes the wound by callusing over it with specialized wood. This process both closes off the area to prevent the inception and spread of decay, and also provides structural reinforcement.

Highly vigorous trees are better able to adapt to stress and changes in their environment than are those with low vigor. Trees have a limited amount of resources to spend on life functions, and growth is less important than essential functions like pest and disease mitigation. Vigorous growth is therefore a sign of good tree health.

Failing to produce response growth around a defect after many years indicates low tree vigor.

While vigor is important, it is only loosely related to structural stability. A vigorous tree can have poor structure and sometimes decayed wood, and a tree with low vigor can be well-structured with sound wood.

Cabling a tree's branches can reduce its likelihood of failure if cables are installed properly, but improperly installed cables can increase a tree's risk of failure. This occurs when too much force is directed to one area, creating a heavy load.

Cables should be installed no less than two-thirds of the way up the limb in question; should always be horizontal; and should never be installed in groups on a single limb. Under no circumstances should a decayed limb be considered appropriate for cabling, as decay can greatly reduce a limb's structural stability.

Even when cables have been poorly installed in the past, they should not be removed. Trees grow and reinforce themselves in response to loading. Substantial alterations in loading may cause a tree's likelihood of failure to increase.

Trunk bleeding not associated with visible wounding may indicate a decay disease such as Phytophthora (*Phytophthora* spp.). Such infections are not necessarily problematic, as long as tree vigor is high enough to produce sufficient response growth.

Trees lean for a variety of reasons, and this is usually not a problematic condition. However, if a tree appears to be shifting in the direction of the lean, this may indicate structural instability. Shifting indicates that the roots are unable to hold the tree steady in an upright position.

Planting trees too deep results in decay and tree decline, either quickly or over a number of years. Trunks are adapted to aboveground conditions, which are drier and have better air circulation than belowground conditions. Decay fungi are favored by belowground conditions.

Trees may become girdled by their own roots, if they are growing perpendicular to, and in contact with, the trunk. This chokes off the conductive tissue in the trunk, until the tree can no longer transport water and nutrients between the canopy and roots. This results in tree death.

Girdling roots often create flattened areas in the trunk, because the tree is not able to expand normally in that area as it grows. This is often the only visible indication of a girdling root.

Concrete was once commonly used to fill cavities in trees. This practice has been strongly condemned by the industry for many years, as it has no positive effect and may adversely impact a tree's ability to compartmentalize wounds and decay.

Conclusions:

Lion's tailing has likely been injurious to both trees' health in the years since it was performed.

The river rocks around both trees are likely impacting their health negatively.

The cables in these trees are unlikely to have had any positive impact, and may increase both trees' likelihood of limb failure.

Sprouting in these trees' canopies appears sufficient in volume to mitigate the effects of lion's tailing. Structural pruning will be necessary to avoid future sprouting-related structural issues.

Tree A – the risk rating of this tree is Low (**Appendix 1**). Likelihood of failure is Possible. Likelihood of impacting a target is Medium. Consequences of failure would be Significant to Severe.

Response growth around the decay cavities present in this tree appears sufficient to mitigate the structural weaknesses caused by these defects.

The bleeding area and corresponding dieback on this tree's trunk appear to be caused by Phytophthora, or a similar pathogen. Response growth appears sufficient to mitigate these defects. The tree's vigor does not appear to be substantially reduced by the infection.

Tree B – The risk rating of this tree is High (**Appendix 1**). Likelihood of failure is Probable. Likelihood of impacting a target is High. Consequences of failure would be Significant to Severe.

Response growth around the decay cavities present in this tree does not appear sufficient to mitigate the structural weaknesses caused by these defects.

This tree may be shifting in the direction of the traffic crossing signal (west).

Recommendations:

1. Remove all river rocks under and around these trees. Pay particular attention to the area directly around these trees' trunks.
2. Install wood chips to replace river rocks.
3. Consider other site remediation techniques, such as aeration and radial trenching/composting.
4. Craft a plan to manage the risk posed by Tree B. Options to consider include, but are not limited to: tree removal, pruning, prop installation, root crown excavation, and site remediation.
5. Perform structural pruning on Tree A in order to avoid future structure issues created by sprouting. Timing and extent of pruning is at the discretion of the Arborist of the City of Cupertino.
6. Inspect cables in both trees on a regular basis, and consider replacing with through-bolt hardware.

Supporting Photographs

Image 1 – Trees A (right) and B (left), as Seen from Mary Avenue

Image 2 – Tree A 8-foot Column of Decay on South/Southwest Side

Image 3 – Tree A, Closeup of Decay Cavity in Trunk

Image 4 – Tree A 8-Inch Decay Cavity on South Side

Image 5 – Tree A 4-inch Decay Cavity on Southwest Side

Image 6 – Tree A Decay Cavity on Scaffold Branch on Southeast Side

Image 7 – Tree A Cables, Improperly Installed

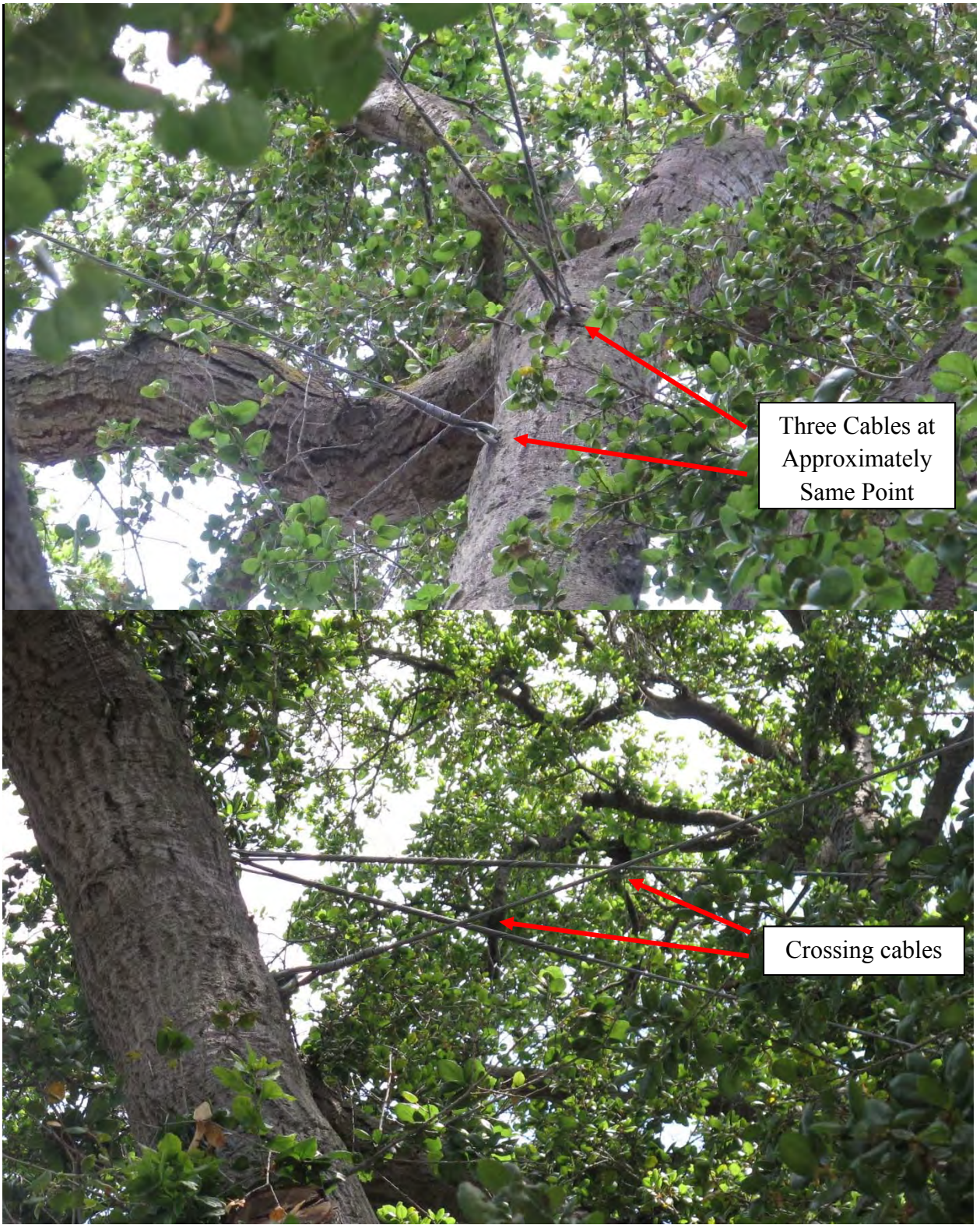

Image 8 – Tree A Bleeding Area and Column of Dieback on East Side

Image 9 – Tree A 8-inch Column of Dieback on East Side