Flood County Park, Coast Live Oak Inspection

Date: January 6, 2021

Background:

During a routine inspection of recent tree work at Flood County Park staff observed a fungal growth growing from an area of exposed wood on the lower trunk of a large coast live oak (*Quercus agrifolia*). Staff contact me for an inspection of the tree due to concerns for the safety of the Park visitors. The area surrounding the tree is frequently used by visitors which utilize a multi-use trail beneath the wide-spreading dripline of the oak. The tree is located southeast of the adobe Park Headquarters.

Assignment:

Provide a level two tree risk assessment to identify general condition of the subject tree and conduct a level 3 risk assessment using an IML Resistance Drill to evaluate internal wood density and extent of decay, make conclusions on overall tree risk level and provide recommendations for risk mitigation.

Methods:

The coast live oak was inspected on Wednesday, January 6, 2021. Time of the inspection was 1:30pm. Weather conditions were overcast with periods of occasional drizzle and spotty sun.

Measurements of the tree were taken to verify size.

Tree Diameter: 59", measured at Breast Height. Using a foresters diameter tape

Height of the tree was measured using a Nikon 550 Hypsometer.

Tree Height: 50'.

Canopy spread was estimated by pacing the ground beneath the tree's dripline where possible. Two measurements are taken to provide to accurately represent variability in canopy growth due to impacts from local environment, or in some instances prior pruning. Measurements are recorded at the widest and narrowest canopy span.

Canopy spread: 66' x 66'

The subject oak has a relatively round canopy which is interesting provided the tree's proximity to adjacent electrical distribution lines to the northwest.

Observations:

At a distance canopy vigor is fair for the size and species. Retrenchment, a natural state of decline in mature trees is presumed.   Signs of this natural canopy decline include flattening of the trees upper canopy and sporadic die-back on branch ends around the canopy. A visual comparison was made to similar oaks in the immediate vicinity to quantify the general state of canopy condition. Interestingly, although adjacent coast live oak exhibit symptoms of foliar diseases such as cryptocline canker or anthracnose no significant infections were observed on the subject tree.

Closer inspection of scaffold and secondary limbs detail signs of excessive branch weight including presence of stress cracks on vertically growing limbs over the multi-use trail. Coast live oak have the capacity to grow rapidly during spring which can cause the outer bark to fissure. However, stress cracks differ from rapid-growth cracks in their visual appearance and orientation of development.   Growth cracks may appear anywhere around the circumference of a stem or scaffold limb whereas stress cracks most commonly manifest at the convergence of compression and tension wood. Visual difference between the two types of cracks are apparent in color of the bark within the deepest point of the fissure. Growth cracks will appear brightly colored, either beige or orange, while stress cracks are generally observed as having a dark gray or black appearance.

Stress crack located on a primary stem, 8' above ground level.

Seven static load cables were observed in the canopy at varying heights. Static load cables are generally installed in trees which are observed as having a defect of concern. Purpose of cable installation is to add support between two co-dominant stems or to support a subordinate stem exhibiting signs of structural weakness, such as included bark, hollow, or poor branch attachment. Provided location of cables and level of callusing around attachment points it is assumed the cables were installed by arborists over the course of several years. Although installation history of cable for this tree is unknown we can assume installation was reactionary to previous limb failure of the subject or neighboring trees. Several other large diameter oak within Flood Park have cables installed in their canopies. Unfortunately, efficacy of cables diminishes as the tree grows resulting in the need to replace and reposition cables. The subject tree's broad retrenching canopy is unlikely to accommodate cable repositioning due to poor attachment angles and an insufficient level of sound wood within the decaying limb structure in the upper canopy to anchor cabling hardware. (lags or eye-bolts)

Four of the 7 cables highlighted in orange. Position of highlight is purposefully offset of position of cable for reference.

Primary branch attachment and main stem of the tree exhibit signs of internal decay and secondary stressors. A closed callus is visible on the northwest side of the tree where a large limb had been removed many decades ago. Location of this limb is in line with a visible cavity at the base of the tree where fungal fruiting bodies were observed.

The trees lower bole details an extensive history of insect activity by common secondary pests including bark beetles and native clearwing borers. When present on healthy trees native borers and bark beetles cause minimal damage to cambial tissues. However, when trees become overly stressed due to age or influence by external factors these opportunistic pests will utilize declining trees as mass breeding grounds. A mix of sawdust and excrement (frass) generated by these pests are pushed out through pin-sized exit/entry holes visible through the bark surface. Although the tree showed no signs of mass-attack by these pests at the time of my inspection, the detection of their presence combined with the overall condition of the tree further suggests the tree is in a state of significant decline.

Basal cavity and visual evidence of wound closure above main crotch.

Fresh frass from clearwing borers, foraging activity by woodpeckers, old bark beetle exit holes.

Extensive borer frass within cracks 5’ above ground level on north side of tree.

Extensive surface scarring of outer bark caused by chronic borer activity.

Thorough inspection of the fungal growth growing within the basal cavity displays characteristics consistent with a common wood decay fungi of oak *Laetiporus gilbertsonni var. pallidus*. This fungi is responsible for cubical brown rot of heartwood, which may lead to tree failure at the main stem or root flare. Presence of this fungi is considered a serious and irreparable condition due to the potential for extensive internal decay (Glaeser and Smith). Probing the exposed wood above the fruiting body was met with light resistance and confirming extensive internal decay. To better understand the severity of internal decay inspection with a IML Resistance Drill was conducted immediately after the initial visual risk assessment.

Dried fruiting bodies of *Laetiporus gilbertsonii var. pallidus*.

Growth of callus on either side of wound indicates internal decay as a long-running issue. Tree also exhibits lack of root flare on west northwest sides of tree which also indicates signs of potential root decay.

Maintenance History:

The canopy was last pruned in 2019 to remove large dead limbs and reduce excessive weight on branch ends. This work was conducted by an ISA certified arborist with the goal of reducing weight in the canopy and lessening transferred stress to scaffold limbs and the main stem caused by dynamic wind loads.

Several large pruning cuts were observed through the canopy from previous maintenance efforts. Many of these cuts exhibit signs of decay and are absent of callus wood. It is assumed that areas of decay within scaffold and secondary branching is extensive due to poor wound closure or hollow. Although no specific dates are available for when this work was conducted pruning likely occurred simultaneously with installation of static cabling systems. These cabling systems were likely installed to help support scaffold branching and reduce likelihood of failure during high wind events.

Risk Assessment:

An ISA level -2 (Basic Tree Risk Assessment) was completed on the tree at the time of inspection using the ISA Basic Tree Risk Assessment Form, attached hereto as 'Appendix A'. The tree risk assessment was conducted following the process developed by ISA's Tree Risk Assessment Qualification (TRAQ) which has a arborist follow a step-by-by step visual evaluation of the tree to identify defects of concern and potential targets at risk. The failure potential onto a target is then loaded into a series of matrices which help the arborist determine a likelihood of impact to a target. The likelihood of failure and likelihood of impact is then compared to an assumed consequence of failure which provides an overall risk rating.

Tree risk ratings should be used as a management tool for decision making involving trees or tree defects to help the owner make informed decisions on tree risk reduction based on their aversion or acceptance of risk (risk tolerance). If an individual tree's risk rating exceeds the decisionmakers risk tolerance than risk migration actions are necessary. Mitigation actions may include pruning, installation of cabling and bracing systems, moving observed targets, restricting access, or removal. Removal, however, should be considered a last resort and reserved for situations where residual risk cannot be mitigated to a level below the tree owners risk tolerance.

Results:

Risk assessment of the evaluated coast live oak identified three primary targets, a multi-use trail located within the dripline carrying constant occupancy, PG&E electrical distribution lines carrying constant occupancy within 1x canopy height, and park users (identified as picnickers) whose occupancy rate is currently rare due to an ongoing public health crisis, COVID-19.

The only defect of concern evaluated as part of this risk assessment included a cavity at the root crown with fruiting bodies of a significant wood decay fungi, *Laetiporus gilbertsonni var. pallidus*. Although stress cracks on scaffold limbs and decay in the canopy are present, they were not evaluated as major risk factors due to observation of prior maintenance including pruning and installation of static load cables, both considered adequate protection factors.

Evaluation of risk related to failure of the coast live oak at the point of primary defect onto known targets within striking distance returned an overall tree risk rating of LOW. In this case the tree's LOW risk rating has been identified due to the consequences of failure for each target carrying a constant occupancy rate having low monetary value. Although the consequences of tree failure onto Park users would likely result in severe injury, occupancy rate of park users within the dripline of the evaluated oak is currently rare. Therefore, likelihood of a visitor being present and injured by the failing tree is also determined to be low.

Discussion:

The coast live oak is a mature tree exhibiting a history of prior maintenance, limb failure, evidence of extensive internal decay, and has entered a state of retrenchment. The tree overhangs a highly used trail, popular lawn picnicking area, and is adjacent Pacific Gas and Electric electrical distribution lines. These targets are well within striking distance of the tree in the event of limb or full tree failure. Prior efforts to mitigate risk include: reduction pruning, removal of dead limbs, and cabling, all of which have helped to previously reduce risk, and extend the trees presence as visible landmark in Flood Park. Evaluation of the tree following an ISA Level 2 Tree Risk Assessment, using the Basic Tree Risk Evaluation form returned an overall tree risk rating of LOW. However, external signs of fungi associated with cubical brown rot located at the base of the tree is a significant concern which cannot be ignored. Additional assessment of this potentially significant defect through means of a Level 3 "Advanced" Tree Risk Assessment using a resistance drill is recommended to determine the percentage of sound wood versus internal decay.

ISA Tree Risk Level 3, Advanced Assessment

Flood County Park: 59" Coast Live Oak

January 6, 2021

Advanced Assessment:

An advanced assessment evaluates a specific defect or defects of concern to more accurately identify risk associated with a tree or tree part. The advanced assessment process selected for this tree involved evaluating soundness of wood and calculating the level of internal decay using a Resistance drill.

Resistance drills use a small diameter, 1/16" bit to core into the tree. Resistance of the wood will increase as the bit drives deeper unless hollow, decay, or structural anomalies are encountered. Tests are run until reaching the maximum operational capacity for the drill, or resistance falls significantly due to presence of decay or hollow. Tests are stopped in these scenarios to reduce risk of damage to the mechanical components of the recording device, drill, and long semi-flexible bit.

The resistance drill used for this test was an IML RESI 400-s, which has a maximum operational capacity of 15". This drill has the ability to record resistance tests using a stylist and wax-paper strips which are retained by the arborist and copies provided to the landowner and included with any necessary reports.

Advanced Assessment Methods:

The method of resistance drilling was chosen based on evidence obtained during a level two tree risk assessment which suggested extensive internal decay and possible root damage. The advanced assessment was implemented on the same date, January 6, 2021, and utilized an IML RESI F400-s Resistance Drill. Results from each test were recorded on wax-paper strips to provide accurate record of the test results at the time of inspection. See 'Appendix B' for scans with analysis notes of test graphs and images of test locations.

Note that resistance drill data is specific to the point of testing and may not accurately reflect internal structure for untested locations. To collect more representative data on the trees internal structure several dill sites were selected at varying heights and bearing.

Nine test points were drilled at varying locations around the trees circumference and at heights varying between 18" – 54" above ground level.

Advanced Assessment Observations:

Depth of solid wood for seven of the 9 tests range from 5.5” to 11.25” while two tests returned negative results. One test encountered no decay to the maximum capacity of the drill while the other experienced no resistance to the maximum capacity of the drill. Average results indicated significant internal decay at starting at a depth of 7.55”.

Tests 1 and 6 returned 3/4” wide anomalies which is consistent with a minor cavity, callus gap, or ring shake. These anomalies were considered significant structural issues as lateral extent of the anomaly is unknown and potentially significant to structural capacity of the tree.

Tests 4 and 5 returned steep increases in resistance around 8” into solid wood signifying either development of an internal callus or presence of a hard substance possibly concrete or mason brick. Tests 6 and 7 were stopped at depths of 9.25 and 12.25 inches respectively, further triggering suspicions of prior use of concrete.

Filling of cavities or covering superficial wounds with concrete or mason block was very common maintenance practice between the 1920’s through 1970’s. Unfortunately filing cavities provides no additional support for trees and only creates future management problems when they need to be managed.

The table below provides the test number, height of test, aspect of tree being tested, depth of solid wood subtracting internal decay and bark, and the solid wood percent to tree diameter.

Test Number	Height of test (inches)	Direct of Test	Depth of solid wood	Solid wood tested (Percent to diameter)
1	18	West	5.5*	9.3
2	24	North	8	13.5
3	22	East	11.5	19.5
4	22	South	6.25	10.6
5	24	Southeast	8	13.6
6	54	West	5.5	9.3
7	54	Southeast	8.25	13.9
8	54	East	>15	>25
9	22	Southwest	Null**	0
Average			7.55"	12.74%
* .75" wide cavity identified at 2.75" depth into solid wood. Depth of solid wood beyond cavity 5.5".				
**No resistance drilling directly into basal cavity.				

According the International Society of Arboriculture cross-sectional area formulas may not accurately predict strength-loss of wood due to variable factors, including location and extent of decay, rate of active growth, individual species wood density profile, exposures to dynamic influence by weather and other external factors. It is generally accepted that when decay exceeds 80% of solid wood the risk of unpredictable failure increases exponentially. While some tree species may withstand up to 90% internal wood loss due to decay, exposure by dynamic forces play a significant role in increasing likelihood of failure.

Conclusions:

Advanced assessment of the coast live oak using a resistance drill verified an extensive level of internal decay. Assessment of resistance drill returns verify the average percent of sound wood is only 12.74%, which is 43% lower than the recommended 20% threshold to identify a high-risk tree. Although the level 2 risk assessment identify the tree has having a low risk rating the extent of internal decay cannot be ignored. Level of internal decay elevates the likelihood of failure to probable which in turn elevates the trees overall risk level to HIGH.

Recommendations:

Due to severe decay within the basal heartwood of the tree caused by the fungal pathogen, *Laetiporus gilbertsonni var. pallidus* removal of the 59” coast live oak is recommended.

Two constant targets including the multi-use trail and Pacific Gas and Electric electrical distribution lines are located within the dripline or striking distance if the tree were to fail. While the Department could restrict access beneath the tree decommissioning or reroute of the multi-use trail is not practical. Similarly, it would be unreasonable to ask the utility to relocate their electrical distribution lines to preserve a tree which exhibits a significant structural defect. Recalculation of the tree’s risk level after advanced assessment identifies a significant change in risk from Low to High. Due to the advanced state of internal decay and no reasonable alternatives to removal would significantly reduce the trees risk rating.

Dan Krug

Arborist- San Mateo County Parks

ISA Certified Arborist IL-4996A

Tree Risk Assessment Qualified

Phone: 650-599-1371

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References:

Tree Risk Assessment Manual second Edition, Dunster et al. 2017

Decay Fungi of Oaks and Associated Hardwoods for Western Arborists, Glasser and Smith

Tree Risk Assessment Limitations, Restrictions and Further Information:

This report, its findings and recommendations are submitted with the following understanding:

- Arborists are specialists in tree management and care who use their education, knowledge, training and experience to inspect and assess tree health and condition, and identify measures that reduce risk of personal injury or property damage from trees exhibiting reasonably detectable defects.

- This assessment is based upon the information provided by the Client, and the reporting Arborist's education, knowledge, training, experience and diligent field investigation. Arborists cannot detect every condition that could possibly lead to the structural failure or decline in health of a tree. Trees are living organisms that fail in ways we do not fully understand and cannot always predict. 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 specified period of time. Likewise, remedial treatments and mitigation measures cannot be guaranteed.

- Although risk ratings may be found to be low, it is important to recognize and understand that a risk does exist that the whole or a part of the subject tree may fail, impact a significant target and cause significant injury or damage during normal weather conditions within the defined time frame.

- This assessment is based upon predictions of tree behavior during normal weather conditions and the condition of the tree at the time of the field inspection. Normal weather conditions are defined as wind less than 47 mph (76kph/41kts) in speed and rainfall that does not saturate the soil and destabilize the tree root system. Changes to tree or site conditions after completion of the field inspection that are caused by severe weather, excavation, construction, accidents, insects, disease or other agents may change the structural integrity of the site, a tree or tree part and increase risk. These types of future changes in condition and their impact on the tree cannot be reasonably predicted during a risk assessment.

- This assessment is restricted to the designated tree(s) and did not assess any other nearby trees that may present potential hazards to people or property.

- Recommendations for risk reduction treatments may involve considerations beyond the scope of the arborist's services such as cost, public sensitivity, property management and/or other issues. This assessment did not consider these factors, but focused on the reasonably detectable structural integrity of this tree and site conditions relative to the risk to people, significant property and activities at the time of this inspection and during normal weather conditions.

- Recommendations for frequency of re-inspection and time frame for application of mitigation measures are not guarantees of tree safety within the recommended time interval. Trees or tree parts may fail within those time frames. These are only recommendations based on tree assessment at the time of this inspection.

- Trees can be managed, but they cannot be controlled. To live, work and play near trees is to accept some degree of risk.

Clients may choose to accept or disregard the recommendation of the arborist, or to seek additional advice.

APPENDIX A

Appendix B