California Water Service
Earpod Tree Appraisal Report

Prepared for California Water Service
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Background

I was contacted by Jennifer Kelsey, attorney with California Water Service on March 12, 2018. She provided background information concerning the conflict between plans for a new water line and an Earpod tree growing at the southern boundary of the South Coast Botanical Garden. I submitted a proposal to perform an appraisal of the tree, but I was not selected at the time.

Jennifer later forwarded my information to Jay Levitus, Engineer with California Water Service who contacted me on March 29th to retain my services as a consulting arborist. Jay provided me copies of the plans for the water line and coordinated a conference call with representatives of California Water Service and the County of Los Angeles.

I attended a conference call at 1pm on Monday April 2, 2018 with representatives of both California Water Service and County of Los Angeles including Jay Levitus and Kathine King, the Chief of Planning with the Los Angeles County Department of Parks & Recreation. Kathline requested I prepare an arborist report as a neutral third party that addresses several topics:

1) Provide my opinion on the health, status, and condition of the Earpod Tree
2) Provide guidelines for minimizing construction damage to the tree
3) Provide recommendations for monitoring the tree both during and after construction
4) Provide my opinion on six line items contained in section 3 of a Counter-Offer from Kathline King to California Water Service dated March 20, 2018.
5) Provide a Trunk Formula Method Appraisal of the depreciated reproduction cost of the subject Earpod tree.

I arranged to visit the South Coast Botanic Gardens later that day at 4pm. I met with garden superintendent Tanya Finney who showed me the location of the tree and answered basic questions about the site. I collected my data from the north side of the southern property line of the gardens and then I drove around to Lariat Lane and collected additional data from the southern side of the property line.

On April 3, 2018, Jay contacted me and requested that I prepare the report by Thursday, April 5, 2018. No changes were made in the scope of work.

Subject Tree

Subject tree is an Earpod tree (*Enterolobium contortisiliquum*). It consists of four co-dominant stems, casting an 84-foot crown spread over a nursery garden area to the north and a horse trail and private road to the south. The tree is approximately 50 feet tall and has a generally symmetric crown, slightly biased to the northwest. At the time of my observation, the tree was just coming out of dormancy and pushing out a new canopy of foliage.

The canopy is generally healthy. There are 6 dead branches to a maximum diameter of 6" in the canopy that could be pruned out or allowed to remain until they self-prune. The smallest of the four trunks divides into two stems at a height of about 9 feet. One of these stems has been dead for at least one year, as indicated by the loss of bark.

The soil appears to have been undisturbed for at least the past five years. It is covered in a beneficial accumulation of leaf litter. I was told that the tree is growing near the edge of the region where fill soil was added over a decommissioned landfill, and soil settling has been an ongoing management challenge at the gardens. This tree's extensive root system is functioning as a means of reducing soil movement within the tree's critical root zone.

The center of the trunk is located approximately 5'4" to the north of a chain link fence along the southern property line and approximately 18' to the north of a white rail fence along the horse trail.

Scope of Construction

A new 24" water line and 30" suction pipeline are intended to be constructed in proximity to the Earpod tree. The planned location of the new lines would be between the white rail fence and the chain link fence, approximately 10' to the south of the Earpod tree. To install the pipes, a trench must be dug to a depth of approximately 7 feet with a width of 7.5 feet. Working in such proximity to the tree will likely result in some amount of damage to the root system of the subject Earpod tree.

I was told that four project alternatives were considered and were found infeasible:

1) *Adjusting the alignment further to the south*: If the water line were adjusted any further to the south, it would be too close to the existing sewer line. Since the new line is intended for potable water, proximity with a sewer is unacceptable.

2) *Adjusting the alignment to the north of the tree*: The South Coast Botanic Gardens was built upon a former landfill. If the water line were installed to the north of the tree, it would be in close proximity to landfill soil, which again is unacceptable for a potable water line.

3) *Tunneling under the tree*: I was told by a project engineer that tunneling under the tree would require excavating a large pit nearby for the machinery that would perform the excavation. I was told that an adequate space for such a pit is not possible to achieve on this site, so tunneling is impossible. If the lines are installed underground, they must be installed in a trench dug from the surface.

4) *Installing the line above ground*: I was told by Tanya that installing a potable water line aboveground requires a greater degree of protection from disturbance and vandalism. If it were installed above grade, it would have to run around the north side of the tree, effectively blocking the tree off from the public and management of the gardens. I was also told that the expense of installing the line aboveground was infeasible.

In the Counter-Offer, the County has asked California Water Service to use a combination of hand-digging and Air Spading. Such excavation techniques will be considerably less-damaging to the Earpod tree than using heavy machinery excavators. I discuss my recommendations in more detail in the Impact and Monitoring Recommendations section and also in the County Counter Offer Review section.

Construction activity within the dripline of the subject tree is planned for fall through winter, the best time of year in which the work could be performed. The tree will be in dormancy, so sap flow will be minimized, reducing the stress of construction on the tree.

Impact and Monitoring Recommendations

Pre-Construction

Pre-construction treatment is intended to set the Earpod tree into a "holding pattern" to last through the stresses from construction activity. These recommendations should be implemented prior to the start of construction.

1. Erect tree protection fencing along the existing chain link fence. Fencing should be a flexible, brightly colored material that draws visual attention to the protection zone. It should extend for the entire length of the fence within the dripline plus five additional feet to the east and to the west. Since excavation will not extend beyond the existing chain link fence, no new fencing support posts need to be erected.

   The purpose of the tree protection fencing in this case is not to create a physical barrier – one such barrier already exists. Rather, it is intended as a visual cue to remind construction personnel of the boundary of the tree protection zone.

2. Prune the dead branches off the tree. Pruning should be performed by a crew directly supervised by a Certified Arborist. Branches should be dismantled back to just outside the branch bark ridge, minimizing the cross sectional area of the exposed wood.

3. Do not perform a 25% crown reduction or any additional pruning unless directed by the project arborist (see Counter Offer Review section). Avoid pruning any live branches unless they come into conflict with infrastructure or minimum street clearance. And then, only remove the minimum amount of living foliage to achieve a given clearance objective.

4. Do not apply fertilization, pesticide, or fungicide treatment unless directed by the project arborist. At this time, I do not recommend any treatment.

During Construction

This is the stage where mechanical injury is the most likely to occur. By following these recommendations, the likelihood of accidental damage will be reduced:

1. General Guidelines
    a. Inform all construction personnel of the intention to preserve the Earpod tree. Many times damage occurs because workers are not aware of the importance of preserving the trees on site. This includes contractors and their respective subcontractors as well.

    b. If any changes are made to the plans resulting in any new excavation or equipment access within the Tree Protection Zone of the Earpod tree, the project arborist should be informed. Additional protection measures may need to be discussed.

    c. Throughout the construction period, a certified arborist should make periodic site visits:
        i. Project arborist should meet with the construction crew supervisor to discuss tree protection measures prior to commencing excavation within the tree protection zone.
        ii. Project arborist should directly supervise all excavation within the tree protection zone.
        iii. After the excavation phase, project arborist should make bimonthly site visits to ensure the tree protection plan is being followed.

    d. If any injury should occur to the Earpod tree during construction, the project arborist should be informed within 24 hours so it may be evaluated and treated as soon as possible.

    e. No construction materials should cross the tree protection fencing and lean against The Earpod tree or be affixed to it.

f. Vehicles may pass within the tree protection zone as long as they remain on the existing paved private road.
    i. Vehicles and heavy machinery should not pass over any portion of exposed soil within the tree protection zone unless the project arborist and construction supervisor agree there is a valid reason to do so.
    ii. If vehicles must pass within the tree protection zone over exposed soil and there is no feasible alternative, then the project arborist should be informed prior to allowing vehicular access. Six inches of wood chip mulch should be laid over the soil to cover the access path for any vehicles or heavy machinery over exposed soil. Plywood should be laid atop the mulch. The combination of mulch and plywood will distribute the weight of the machinery and vehicles to reduce the amount of soil compaction and injury to roots beneath.

g. Do not apply fungicide, pesticide, or fertilizer unless directed by the project arborist. If symptoms of an adverse condition are identified, the priority treatment method should be an adjustment of cultural conditions (irrigation, soil level, mulch, etc…) before applying any chemical control.

2. Excavation Phase
    a. Excavation phase should take place between October 15, 2018 and February 15, 2019. This is the time of the year when sap flow is at a minimum. If excavation were to take place in the spring and summer months, then the tree would not have time to respond to root cutting with new root development. When root cutting takes place during the fall and winter, there is a window of time during the early spring when conditions are favorable for growth, and new tissue has an opportunity to grow before the stressful summer months.

    b. Project arborist should directly supervise all excavation within the tree protection zone (TPZ) of the Earpod tree. It is not possible to know exactly where the roots are located prior to excavation, so direct supervision is imperative. The arborist will be able to identify key roots that are uncovered in the excavation process and can recommend appropriate management actions accordingly.

c. Excavation should be performed using a combination of hand tools and pneumatic excavation tools (Air Spade is a brand name of a pneumatic tool).
    i. The operator of the pneumatic excavation tool should have at least three years of experience with the tool and should be directly supervised by a Certified Arborist.
    ii. Workers using hand tools should be given the explicit instructions to preserve all roots larger than one inch in diameter until the project arborist makes a determination.

d. If roots are encountered, the arborist should make the determination of whether to preserve or sever them. The decision to remove or retain roots should be based on a determination of the impact to the health of the tree and also on the practical limitations of installing the pipes. Typically, most roots are found in the upper 24-36 inches of soil, so although there may be a significant mat of roots at the surface, it may be possible to excavate below them to clear adequate space for the pipe sections to be slid underneath.

e. If roots are determined to be necessary for removal, appropriate severing cuts should be made to root junctions with a sharp cutting tool. The exposed cross sectional area of the root cut should be minimized to reduce the area exposed to root rot pathogens. If a root junction is not within the trench area, then the root should be severed to the edge of the trench.

f. Over the period of time that the trench is open, roots will be exposed to air and will have the potential to lose water and desiccate. When active excavation is finished on each given workday, the exposed roots should be covered with damp towels:
    i. Cloth towels may be used on thick roots or clusters of roots capable of holding the additional weight without deforming. Cloth towels may be replaced at the end of each day, but should be rinsed daily to reduce the buildup of mildew.
    ii. Damp heavy duty paper towels should be used for smaller roots that deform under the weight of the cloth towels. Paper towels should be replaced with fresh ones daily.
    iii. The project arborist will make the final determination of the material used, but both cloth and paper towels should be kept in adequate supply.
    iv. If the trench will be covered with plywood overnight, the towels should be laid over the roots before to the plywood covering is secured in place.
g. In the morning of each workday, the protective towels may be removed prior to resuming construction and excavation work.

Post-Construction Care

The following management practices and monitoring are recommended:

1. Retain the leaf drop around the root zone of the Earpod tree where practical. The best ground cover for a tree is its own leaf mulch. Leaf mulch will continue to reduce soil evaporation and mitigate soil temperature changes.

2. Prune the Earpod tree for clearance as branches descend into the minimum clearance zone over the street and over the nursery. If pruning is performed once every 1-3 years, the cut sizes should all be smaller than 1 inch in diameter. Again, pruning should be performed by a crew directly supervised by a Certified Arborist.

3. Apply a deep-soak irrigation to the soil within the dripline of The Earpod tree once per month from March through September for the first year after construction. Irrigation should take approximately two to four hours at a low application rate. The goal of the irrigation is to moisten the soil to a depth of 6-12 inches while minimizing runoff. Do not apply irrigation within 5 feet of the trunk.

4. Do not apply fertilization, pesticide, or fungicide treatments unless directed by the project arborist at one of the post-construction monitoring inspections.

Post-Construction Monitoring

The post-construction monitoring plan should follow these guidelines:

1. Project arborist should inspect the tree for any changes in its condition immediately after construction activity is complete and again at quarterly intervals for two years following completion of construction activity, for a total of 9 quarterly inspections.

2. Inspections should be a Level 2 Basic all-visual ground-based inspection from both sides of the southern property line of the gardens. The health and structure of the crown, branches, trunk, and root crown should be evaluated. If symptoms of stress are observed, the project arborist should make appropriate mitigation recommendations.

3. A short 1-2 page report summarizing the findings should be submitted by the project arborist to a designated representative of California Water Service after each site inspection.

4. The first post-construction inspection report should include a risk assessment. Subsequent reports would only include a risk assessment section if the inspecting arborist determines the level of risk posed by the tree has changed from the initial post-construction report.

5. If after two years of monitoring the tree does not show any signs of stress related to construction, the monitoring frequency may be decreased to an annual inspection for years 3-7. Typically symptoms of root injury appear in the crown within 7 years of the injury. If new symptoms of stress or decline occur more than 7 years after construction, they are likely related to a subsequent causal agent.

County Counter Offer Review

On March 20, 2018, Chief of Planning Kathline King sent a letter with a Counter Offer to California Water Service concerning the planned pipeline construction along the southern property line of South Coast Botanic Gardens. Among the topics discussed was a list of six provisions requested by the County of Los Angeles. I was asked by Kathline to provide my opinion on each of them. These provisions can be found as line items A through F in section 3 of the Counter Offer letter. I have abbreviated them here for reference:

A. "Prior to construction, Cal Water…will perform an up-to-25% crown reduction of the Earpod tree…"

   During the phone conference on April 2, 2018 at 1:00pm, this line item was clarified for me by a representative from the county. I was told that the "crown reduction" included both height reduction and also a thinning of the branch density.

   I believe this provision is not only unnecessary, but it would actually be damaging to both the health and structure of the tree. The crown of the tree is currently in the natural rounded umbrella form for the species. The shoots within the crown are not excessively dense for the species. All of the existing living branches are currently accustomed to the wind loads to which they are exposed.

   Assuming the water pipe installation project proceeds, the tree will undergo significant stress from construction, even if the amount of root cutting is minimized. The way trees cope with stress is by creating new response growth tissue. Carbohydrates are produced in the leaves through the process of photosynthesis, and a higher rate of photosynthesis in the tree will increase the rate at which it can deposit new tissue. Performing a crown reduction would reduce the amount of foliage and therefore the photosynthetic capacity of the tree.

   In addition to the reduced ability to produce new response growth tissue, the crown-reduced tree would have a lower sap-pressure, and may become predisposed to insect infestation. Healthy trees with a high sap pressure can push wood-boring pests out of their boreholes, but trees with lower sap-pressure lose this line of defense. From a tree health perspective, performing a crown reduction is not recommended.

   From a structural perspective, crown reduction is also not advised in this case. There is a common misconception in the tree industry that trees must be thinned or reduced to keep them safe in the wind. This has been largely disproven through research in the energy damping systems of tree branch structures. Trees exist in their natural morphology with branch lengths and spacing that optimize energy dissipation. Oscillating branches dissipate energy at their respective unions with their parent stems.

Each branch oscillates at a slightly different frequency, creating an effect known as mass damping. Mass damping is the opposite of resonance frequency where branches oscillate at the same frequency as the wind and progressively whip back and forth more violently until they snap. Mass damping distributes the force of the wind evenly over the set of all branch unions. When there are fewer branch unions in the tree, more stress is concentrated at each individual union. When there is more stress concentrated at a branch union at a given instant in time, there is a greater likelihood of branch failure.

The reason many arborists recommend thinning trees is they want to reduce the amount of surface area exposed to the wind, thereby reducing the total force applied to the tree. However, the effect of mass damping is greater than the effect of the increased surface area exposed to the wind. Even though a tree may be exposed to greater total wind force, the force is spread over more branch unions so the force on any given branch union is less than if the tree were thinned. Trees that are more dense and complex have a better ability to handle wind loads than do thinned trees.

Therefore, thinning and reducing the canopy of the Earpod tree is at best an unnecessary waste of resources and at worst is damaging to the tree's ability to withstand wind loads.

Rather than performing a crown reduction, I recommend prescribed target pruning as needed. If there are dead or defective branches, they can be removed. If there are branches that extend over the roadway or conflict with infrastructure, they can be individually reduced or removed until conflict is mitigated.

B. "The Earpod will remain in place during construction."

I agree with this provision. Any attempt to transplant the tree would likely result in its eventual death.

C. "Cal Water will provide measures to increase the chance of the Earpod survival. The measures will include but are not limited to: …"

I agree that measures should be taken to increase the chance of the Earpod tree's survival. I will address each of these requested measures individually. I have also added some measures to the Impact and Monitoring Recommendations section of this report.

a. "…providing a certified arborist onsite during construction…"

I agree that a Certified Arborist should be present on site during construction. As detailed in my recommendations section, I recommend a Certified Arborist be present initially to meet with the construction supervisor, directly supervise all excavation within the Tree Protection Zone, and provide bi-monthly site visits to ensure the tree protection plan is being followed.

It is uncommon for construction projects to require the arborist be present onsite for the entire duration of the project. What many construction projects will do is keep the project arborist "on-call" during certain phases of construction and then send images via email or text message or have phone conversations regarding recommendations.

b. "…and adhering to the International Society of Arboriculture's publication Managing Trees During Construction…"

   There are two publications that ISA has available. I recommend both be referenced:

   i. ANSI A 300 Construction Management Standard – Part 5
   ii. Best Management Practices (BMP) – Managing Trees During Construction

   As far as strict adherence, I would recommend inserting some clarification into this provision. There is flexibility written into both the standard and the BMP guide. In the standard, the word "should" denotes an advisory recommendation and the word "shall" denotes a mandatory requirement. In this provision, I recommend strict adherence to the "shall" requirements in the A300 standard. It would be inappropriate to require strict adherence to "should" recommendations because there are often valid reasons to deviate from them in practice. Rather, construction management may procure a valid reason in consultation with the project arborist for deviating from the "should" advisory recommendations in the A300 standard.

   With regards to the second publication, the BMP is intended to provide elaboration on the concepts raised in the A300 Standards. It provides a baseline for practice, but construction managers may deviate from them if there is a valid reason. As with the "should" advisory recommendations in the standard, construction managers may procure a valid reason in consultation with the project arborist for deviating from an item published in the BMP.

c. "…including but not limited to employing only hand-digging and air spading within five feet of the [Earpod's] dripline (Tree Protection Zone or TPZ) and prohibiting vehicles within the TPZ."

   I strongly agree that heavy machinery should not be used within the Tree Protection Zone. Heavy machinery such as excavators and skip loaders have the potential to significantly damage roots by physically tearing through them and also by compacting the soil over which the equipment drives.

I have one minor change I recommend to this provision: Air Spade is a brand name. I recommend changing it to be "pneumatic excavation tool," (a tool using pressurized air) allowing the use of other brands of the tool that still perform the same function. I have included more detailed recommendations concerning operation of the tool in the Construction Impact and Monitoring Recommendations section of this report.

D. "Prior to line encasement and backfill, Cal Water will apply a broad spectrum fungicide (such as Captan) with the oversight of a certified arborist."

Application of a broad-spectrum fungicide is unnecessary. Fungicides can suppress the growth of fungi, but they are meant to be applied when a specific pathogen has been identified. Fungi grow when environmental conditions are favorable for their growth: excessive soil moisture is the most common reason for pathogenic fungal infections. Simply because a root has been cut does not necessarily mean that the tree is any more likely to contract a pathogenic fungus.

If a fungal infection is identified and treated, the fungicide treatment does not eradicate the pathogen. It only slows down the fungal growth, allowing time to correct the cultural conditions that favored its growth in the first place. For example, if there is excessive soil moisture that favors root decay, then treatment may be applied until site drainage can be improved.

If a fungal infection is identified at some point in the construction process, and the project arborist recommends treatment, then an individual licensed as a California Pest Control Advisor would be legally required to select and apply the treatment. As a preventative measure, I recommend against retaining the provision requiring fungicide treatment.

E. "Cal Water will indemnify the county in perpetuity for any damages resulting from the Earpod tree failing or dying."

Typically if damage is done to a tree's root system, symptoms will appear in the canopy within 7 years. If no symptoms appear after 7 years, then future problems are likely due to a subsequent causal agent occurring after the root damage. Consider providing an expiration date to this clause. Rather than indemnification in perpetuity, consider indemnifying for 7 years with an option to renew for an additional period of time if the final construction monitoring report shows stress or other structural problems resulting from construction damage.

The Earpod tree is a living organism and has the potential to die or fail from causes unrelated to the construction work. Therefore, consider appending a qualifying clause to the end of the indemnification provision: "…resulting from the Earpod tree failing or dying *as a result of the construction damage as determined by an independent consulting arborist*."

These suggestions do not constitute legal advice. I recommend seeking the advice of qualified legal counsel before making decisions concerning matters of liability.

F. "In the event that the tree fails or dies, Cal Water will compensate the County for the acquisition and installation of four 36" box Earpod trees and the construction of a cantilevered shade structure…"

One of the functions of the Earpod tree is the shade it provides to the nursery plants below its canopy. A new cantilevered shade structure would be an equivalent replacement of this function of the tree in the landscape.

Another function of the tree is contribution to the botanic garden's collection as a rare species. Four new 36" box trees could be considered an equivalent to most tree removals because the new trees would restore the species to the garden's inventory. A 4:1 ratio is commonly employed as mitigation trees when direct replacement is not possible because of anticipated mortality rates between the time of planting and the time the tree finally grows to parity.

However, for this specific case, four 36" box replacement Earpod trees are not likely obtainable because of the aforementioned rare status of the species. The cost of obtaining such replacement trees would likely be excessive in comparison to the cost of planting and growing smaller replacement trees. If replacement trees are required as a functional replacement, I recommend addressing this provision as follows:

1. If replacement of the Earpod tree becomes necessary, cost quotes would be obtained for procuring the 36" box size. If they are not available in the lower 48 US States, then proceed to step 2.

2. Next, cost estimates would be procured for propagating ten replacement trees from the largest locally available size to the size of a 36" box tree. Ten trees would be used instead of four because it accounts for anticipated mortality between growing from the smaller size up to the 36" box size. If no nursery stock is locally available in any size, then the cost estimate would be for the cost to ship and propagate seeds.

3. Of the two methods, the one with the lesser cost would be selected.

If the Earpod tree were to die or fail as a result of construction damage, then requiring payment of a Trunk Formula Method appraisal and procurement of a cantilevered structure and replacement of new trees would not be equivalent to the loss incurred. The Trunk Formula Method appraisal represents the extrapolated cost to reproduce the tree, less depreciation. In theory, TFM accounts for the entire amount of the loss.

It would be equivalent to either pay the TFM appraisal or to provide a functional replacement (shade structure and replacement trees), but not both. Provision of both would replace the lost value twice. Consider adjusting this provision to be one of three possibilities:

1. The compensation would be Functional Replacement (shade structure and replacement trees)
2. The compensation would be the Trunk Formula Method appraisal
3. The compensation would be the lesser of the two

As before, consider appending a clarifying clause that limits the liability to California Water Service to only tree failure or death resulting from construction damage because there exists a possibility that the Earpod could die or fail from a cause unrelated to construction damage.

Trunk Formula Method Appraisal

The approach I took for appraising the subject Earpod tree was the cost approach. Because the subject tree is larger than the largest commonly available transplantable tree, I deemed it appropriate to use an extrapolation formula to appraise the cost of procuring it, even if no comparable tree is available for sale. The Guide to Plant Appraisal 9th Edition outlines the Trunk Formula Method of appraisal, abbreviated here:

The theory of the Trunk Formula Method is to scale up the cost of the largest commonly available transplantable tree relative to the total cross sectional area of the tree trunk. The unit cost per square inch of nursery stock is calculated for the largest commonly available transplantable tree, and it is multiplied by the cross sectional area of the subject plant being appraised. This is the basic cost of the tree.

After calculating the basic cost of the tree, depreciating factors are introduced. Since hand-selected nursery stock is in theory the best quality, the basic cost must be adjusted downward by a condition factor to reflect any defects in form, health, or vigor. This is a subjective rating between 0% and 100% as determined by the appraising arborist. The same is true for the location of the tree: the optimal location can be selected for transplantable nursery stock, but not for an established tree. Therefore, the basic cost is multiplied by a location factor between 0% and 100% as well. Lastly, the species of the tree may be more or less valuable than other trees of the same size, location, and condition. So there is a third factor introduced: the species rating, also between 0% and 100%.

The final appraised Trunk Formula Method cost solution of the tree is the product of the total cross sectional area, the unit cost of trunk area, and the three depreciating factors: species, location, and condition. See the appraisal table at the end of this report for a detailed calculation.

The Trunk Formula Method is the most commonly used method of tree appraisal because of the robust set of data available. There are other methods of tree appraisal that were not used for this assignment (see Other Appraisal Methods).

Trunk Area

First, the diameter of the subject trunk is measured. The height of the measurement is conventionally made at 4.5 feet above natural grade. If the subject tree has multiple trunks, the diameter of each individual trunk is measured. The cross sectional area (A) is calculated by the formula $A = \pi/4\ d^2$. Then the cross sectional area of each trunk is added together to arrive at the total trunk cross sectional area.

The subject Earpod tree had four trunks, so I measured the diameter of each, calculated the cross sectional area of each, and then added the cross sectional areas together to arrive at a total cross sectional area for the tree.

Trunks 3 and 4 were pleached together at 4.5 feet above grade, so I was unable to wrap a tape measure around them at that height. I obtained diameter measurements by measuring the distance between parallel tangents to each respective trunk. Trunks 1 and 2 did not preclude direct measurement, so I obtained a circumference measurement by wrapping a tape measure around them and then calculating the diameter by dividing by π.

Unit Cost

The unit cost of nursery stock is published in the Western Chapter ISA Regional Species Classification Guide, and it varies based on the growth rate of the tree and its trunk size in various box sizes. This unit cost is expressed in dollars per square inch of trunk cross sectional area.

Enterolobium contortisiliquum is not listed in the regional guide, but a different species of the same genus is listed: *Enterolobium cyclocarpum*. I used this alternate species as a means of obtaining unit cost data for purposes of this appraisal. The assumption I made for this substitution is the reproduction cost of *E. contortisiliquum* is the same as *E. cyclocarpum*.

E. cyclocarpum is from Nursery Group 3 in Southern California, having a unit cost of $62 per square inch of trunk area. The WCISA Regional Guide was most recently published in 2004. One of its weaknesses is it has not been adjusted for inflation and current market pricing. As an alternative to using the published values in the guide, a more detailed analysis of the unit cost could be performed at a much greater expense: wholesale nursery pricing catalogs from many growers can be obtained and analyzed for size and price information to determine a more accurate unit cost. Due to budget and time limitations, that additional level of research was not undertaken for this appraisal report.

Species Rating

The species ratings of many trees grown in the western United States are also published in the Western Chapter ISA Species Classification Guide. The ratings are designed to reflect the suitability of the tree for the region. The appraising arborist has the discretion to adjust the species rating up or down by up to 10% to reflect localized benefits or problems related to the species of the subject tree.

As discussed in the Unit Cost section, *E. contortisiliquum* is not listed in the regional guide. I used the species rating for *E. cyclocarpum* based on the assumption that the value of the species and its appropriateness for Southern California Coastal Influence subregion is the same as *E. contortisiliquum. E. cyclocarpum* is listed as a 50% species in Southern California Coastal Influence subregion. I modified the published rating by +10% for its rarity in Southern California.

The total species rating I assigned to the Earpod tree was 60%.

Location Rating

The location rating has three components that are averaged together: site, contribution, and placement. The site is the relative market value of the property on which the tree is growing. The contribution is the degree of benefits the tree adds to the landscape. The placement rating reflects how effective the tree is at providing its functional and aesthetic attributes. The average of these three values is the location rating.

I rated the site for The Earpod tree 100% because it is growing at a botanic garden which may be thought of as a "tree museum." A botanic garden or arboretum is the highest value site on which a tree can grow.

In rating the contribution subcomponent, I considered the following benefits provided by the tree:

- It shades the nursery plants below with the northern half of its canopy. These shade-loving plants would either not survive or perform poorly if the Earpod tree were absent.
- It provides an attractive aesthetic appearance.
- It is a rare specimen for the Los Angeles County collection.
- Since it is growing on the edge of a landfill area, its roots are helping to reduce movement of fill soil.

The tree provides the maximum quantity of these benefits that it could for a tree of the same species and age. Therefore, I rated the contribution of the tree as 100%.

In rating the placement subcomponent of the Earpod tree, I considered the following:

- It is placed in an optimal location for shading the nursery plants below its canopy. It provides southern shade for nearly the entire day, protecting the sensitive leaves from sun.

- It is growing in a part of the gardens that is not available for public viewing. On the map, the Nursery & Greenhouse region is greyed out and the map states "No Public Access." Along the road up to the nursery area, there is a sign that states, "Authorized Personnel Only. Nursery closed to the public."

  If members of the public are not permitted access to the nursery, then their best access for enjoyment of the benefits of the Earpod tree is from the horse trail to the south of the property line. From the horse trail, there is no signage indicating that a tree of significant value or rarity is present on the opposite side of the chain link fence along the property boundary.

  Although the tree contributes aesthetic appearance and significant rarity to the gardens, it is not easily accessible or enjoyed by general members of the public. It is not readily obvious from the map or from the horse trail that there is a rare species behind the nursery. For that reason, I significantly reduced the placement rating of the tree.

- It is growing near the boundary between landfill soil and original soil, so it is able to partially help mitigate soil movement. However, it would have been more effective at retaining fill soil if it were growing entirely over the fill soil or closer to the edge of a topographic feature.

Although the tree is well-placed for its function of shading the nursery plants, its primary contribution is its rarity and aesthetic appearance. Another less-rare species could perform a similar amount of shading for the nursery plants. The ability of the tree to contribute its primary function is significantly reduced as a result of its growing location. Therefore, I assigned a placement rating of 40%.

The total location rating I assigned to The Earpod tree was 80%.

Condition Rating

The Guide to Plant Appraisal divides the condition rating into 8 subcategories, each rated on a scale of 1-4. A rating of 4 is assigned to *No Apparent Problems*, and 1 is assigned to *Extreme Problems*. These subcategories are summed and divided by the maximum score of 32 to arrive at a final percentage condition rating. The subcategories are: Root Structure (RS), Root Health (RH), Trunk Structure (TS), Trunk Health (TH), Scaffold Branch Structure (SS), Scaffold Branch Health (SH), Branches and Twigs Health (BH), and Foliage and Buds Health (FH).

I did not observe any defects in Root Structure (RS) or Root Health (RH), so I rated them both as 4 for No Apparent Problems.

I rated the Trunk Structure (TS) as 2 for Major Problems because there are four co-dominant stems growing tightly together at narrow angles of attachment. The narrow angles of attachment and correspondingly high aspect ratios between adjoining trunks create weak attachment unions that are known for their elevated likelihood of failure when loads are applied. I would have rated the defect as a minor problem if there were a large central stem with significantly smaller co-dominant stems. Here, three of the stems are all approximately the same size. I would have rated the defect as an extreme problem if there were active cracking along their unions. I did not observe active cracking. Therefore, I assigned a rating of Major Problems.

I rated the Trunk Health (TH) as 4 for No Apparent Problems. I observed striations on two of the trunks, but the striations were growth cracks, not stress cracks. They indicate the tree is healthy and growing rapidly.

I rated the Scaffold Structure (SS) as 4 for No Apparent Problems. The tree was growing in a normal decurrent form for the species. There was a slight bias of the canopy to the northeast, but the amount of asymmetry was not significant enough to justify a rating of a minor defect.

I rated the Scaffold Health (SH) as 3 for Minor Problems. There were dead branches present in the canopy to 6” in diameter. The overall health of the other scaffold branches was excellent.

I rated the Branch Health (BH) as 3 for Minor Problems. I observed bark loss on several living branches. These branches may die in the near future from reduced conductivity. Overall, most of the branches in the canopy were healthy and functioning normally.

I rated the Foliage Health (FH) as 4 for No Apparent Problems. The tree was just beginning to come out of its dormant stage. From my ground-based all-visual inspection, I did not observe any defects in the foliage or buds. An aerial inspection may yield additional information that could change the result of this rating. Additional information would only reduce the condition rating for this tree.

The total condition rating I assigned to The Earpod tree was 87.5%.

Appraised Cost Solution

The basic cost is then multiplied by the species, condition, and location ratings. The calculated amount is then rounded to reflect the level of precision in the appraisal. If the amount is less than $5000, then it is rounded to the nearest $10. If the amount is greater than $5000, then it is rounded to the nearest $100. The rounded amount is the final appraised cost solution by using the trunk formula method.

I appraised The Earpod tree to have a Trunk Formula Method cost solution of $26,900.

Other Appraisal Methods

I did not use any other methods of tree appraisal. I did not research the cost to procure a direct replacement of the subject tree. I did not calculate the present value of the income generated by the benefits provided by the tree. I did not calculate the difference in market value of the subject property before and after the loss.

Because I only used one method of appraisal, I did not include a reconciliation section in this report.

Limits of Assignment

My investigation was limited to above-ground observations of the subject tree and the surrounding site. My investigation was based solely upon my site inspection on April 2, 2018 at 4:00pm. No excavation was performed. All of the information provided to me regarding the history of the site and the subject tree was assumed to be true. If any information is found to be false, the conclusions in this report may be invalidated.

This report is not a risk assessment, nor does it provide any estimates for the cost of remedies. My expertise in this matter is limited to arboriculture, and this report is not intended to be legal advice. I do not guarantee the safety, health, or condition of the subject tree. There is no warranty or guarantee, expressed or implied, that problems or deficiencies in the subject tree may not arise in the future.

Arborists are tree specialists who use their knowledge, education, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living trees. Clients may choose to accept or disregard the recommendations of the arborist, or to seek additional advice.

Arborists cannot detect every condition that could possibly lead to 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 specified period of time. Likewise, remedial treatments, like any medicine, cannot be guaranteed.

Trees can be managed, but they cannot be controlled. To live near trees is to accept some degree of risk. The only way to eliminate all risk associated with trees is to eliminate all trees.

Works Cited

Council of Tree and Landscape Appraisers. A Guide for Plant Appraisal, 9th Edition. ©2000 CTLA.

Western Chapter of the International Society of Arboriculture. A Regional Supplement to the CTLA Guide for Plant Appraisal, 9th Edition. ©2004 by WC-ISA

Appraisal Calculations

California Water Service - Earpod Tree Appraisal				
Appraising Arborist: James Komen				
4/4/2018				
Tree 1				
Measurement	**Source**		**Condition Rating**	
DBH	See Trunk Measurements			
Trunk Area of Subject Tree	See Trunk Measurements	1031 in²	Root Structure	4
Unit Cost	WCISA Species Guide	$ 62.00	Root Health	4
Replacement Tree Cost	WCISA Species Guide	$ 1,482.00	Trunk Structure	2
Replacement Tree Size	WCISA Species Guide	23.75 in²	Trunk Health	4
Trunk Area Increase	B-E	1007 in²	Scaffold Branch Structure	4
Basic Tree Cost	C*F+D	$63,930.71	Scaffold Branch Health	3
Species Rating	WCISA Species Guide + 10%	60%	Branches Health	3
Location Rating	Arborist Opinion	80%	Foliage Health	4
Condition Rating	Arborist Opinion	87.5%	Total Score	87.5%
Depreciated Cost	G*H*I*J	$ 26,850.90	**Location Rating**	
Final Appraised Cost Solution	Round to nearest $100	$ 26,900.00		
			Site	100%
			Contribution	100%
			Placement	40%
			Total Score	80%

Tree 1 Trunk Measurements			
Trunk #	Circ	DBH	Trunk Area
1	5'6"	21.0 in	346.6 sq in
2	2'9"	10.5 in	86.7 sq in
3		19.0 in	283.5 sq in
4		20.0 in	314.2 sq in
		Total Area	1031.0 sq in

Figure 1: Trunk Formula Method appraisal calculations for the Earpod Tree. Insets are shown for the Trunk Measurements and the subcomponents used in calculating the Condition Rating and Location Rating.

Photos and Figures

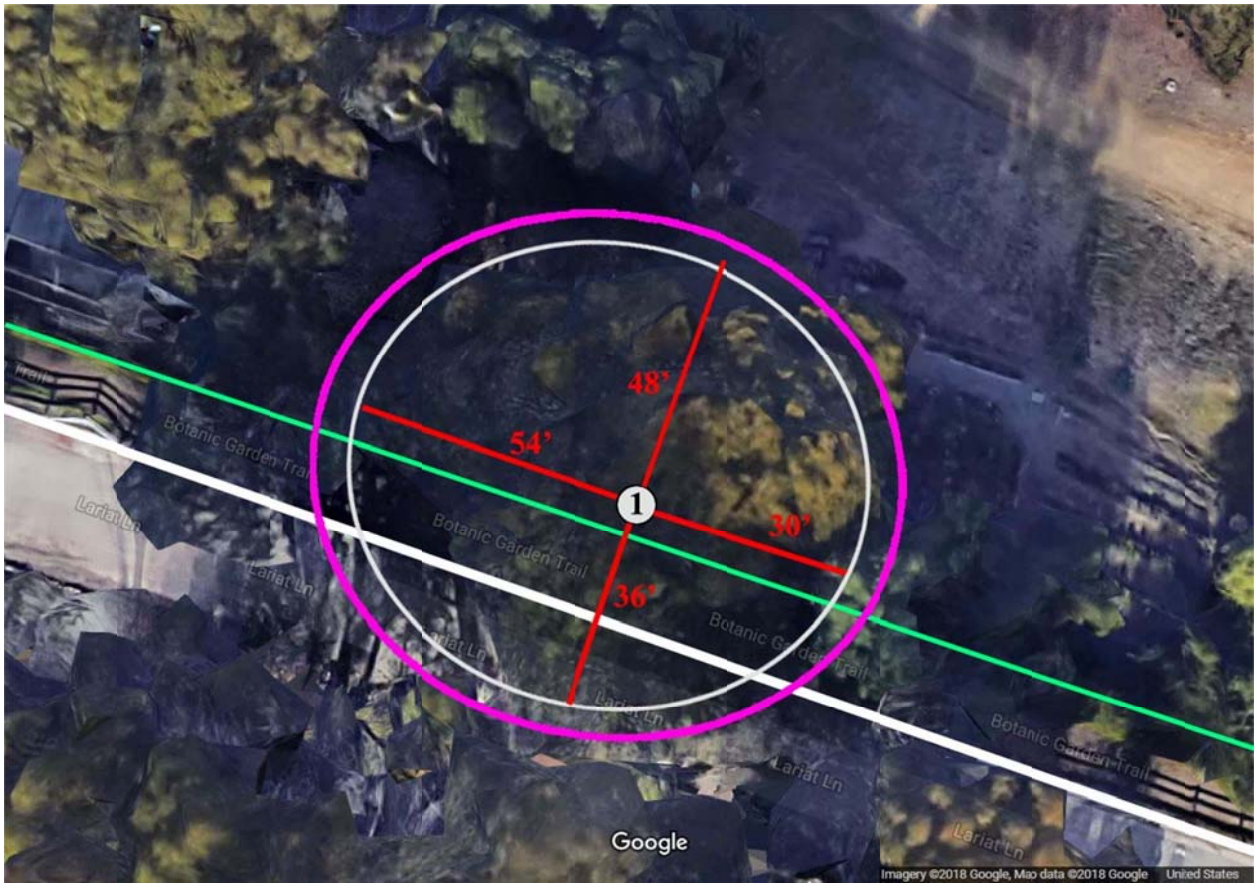

Figure 2: Site map of the subject Earpod tree showing the approximate trunk location and dripline in grey. The Tree Protection Zone is delineated by the purple ellipse, 5 feet beyond the dripline of the tree. The chain link fence along the southern property line is shown in green, and the white rail fence is shown in white. Canopy measurements are shown in red.

Figure 3: Looking southeast at the Earpod Tree. It has a large canopy that extends to the north over the botanic garden nursery (lower left) and a horse trail (right, behind chain link fence).

Figure 4: Looking southwest at the Earpod tree. It has a normal form for the species.

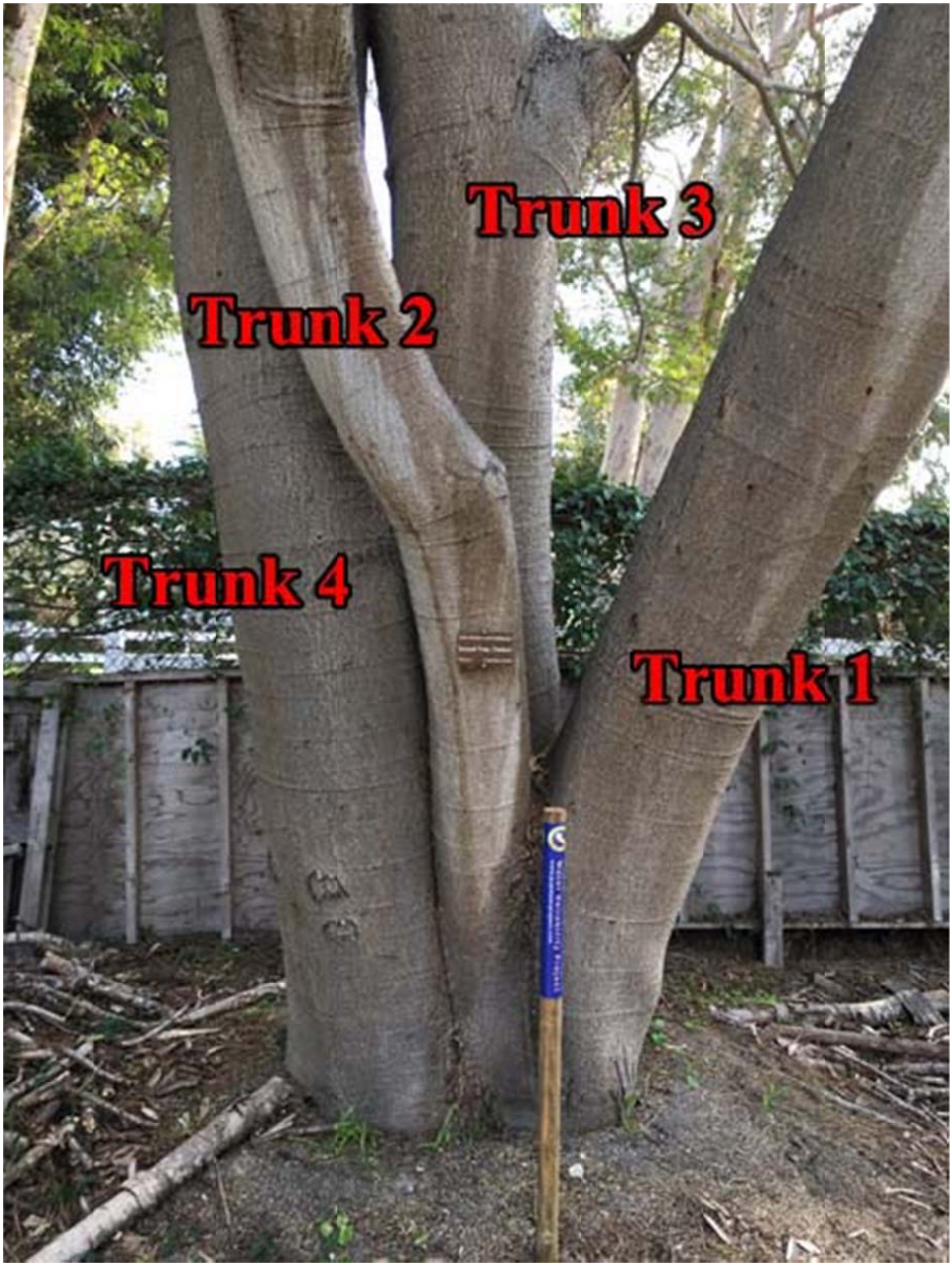

Figure 5: Looking southwest at the labeled trunks of the Earpod tree. There are four trunks with narrow angles of attachment and high aspect ratios.

Figure 6: Looking east at Trunk 1 (left) and Trunk 3 (center). These trunks have growth striations, indicating the tree is healthy and rapidly depositing tissue.

Figure 7: Looking up into the canopy of the tree: there are several dead branches and living branches with bark loss, contributing to the reduced condition rating.

Figure 8: Looking southeast along the horse trail. The subject Earpod tree is seen at left. The proposed trench will be located between the chain link fence (left) and the white rail fence (right).

Figure 9: Annotated map of the South Coast Botanic Gardens showing the location of the Earpod tree. It is growing within an area marked as "No Public Access."

Figure 10: Looking south up the access road to the gardens nursery and the subject Earpod tree. A sign to the left of the driveway restricts access to the general public.

Figure 11: Close up of the sign to the left of the access driveway to the nursery. This sign restricts access to the general public.