DUDEK
MAIN OFFICE
605 THIRD STREET
ENCINITAS, CALIFORNIA 92024
T 800.450.1818 F 760.632.0164

October 7, 2022 12067

John Ugrob
Public Works Superintendent
City of Encinitas
Encinitas, California 92024

Subject: Blue Gum Tree Risk Evaluations, North Vulcan Avenue, City of Encinitas, California

Dear Mr. Ugrob:

This letter report provides results of an evaluation of ten blue gum eucalyptus trees (*Eucalyptus globulus*) located within the right-of-way along North Vulcan Avenue in the City of Encinitas (City), California. The evaluation included an inspection of the tree crowns for trimming recommendations, trunks and scaffold branches for overall structural soundness, and trunk bases for the presence of observable signs of cavities and/or decay.

Specifically, Dudek's International Society of Arboriculture (ISA)-certified and Tree Risk Assessment Qualified (TRAQ) arborists examined the trees by performing Level 2 Basic Tree Risk Assessments and Level 3 Advanced Assessments with sonic tomography. The evaluations were completed in September 2022. The tree assessments focused on collecting information that could be used to determine the trees' current condition and overall tree risk rating to help formulate recommendations for short- and long-term tree management.

This letter report summarizes the results of Dudek's assessment and provides recommendations for tree management.

1 Overview

Dudek's assignment consisted of the following:

1. Perform Level 2 Basic Tree Risk Assessments of ten eucalyptus trees located in the right-of-way on North Vulcan Avenue between La Costa Avenue to the north and Leucadia Boulevard to the south.
2. Perform Level 3 Advanced Assessments of ten eucalyptus trees located within the focus area using a PiCUS 3 Sonic Tomograph to map any potential internal decay and/or degradation.
3. Develop a letter report and associated matrices that present the results of the Level 2 Basic Tree Risk Assessments and the Level 3 Advanced Assessments identifying locations, obvious defects, potentially hazardous conditions, and provides recommended mitigation for all ten trees.

2 Evaluation Methods

The following section provides a detailed description of the methods used in this assignment. Observations, results, conclusions, and recommendations are all addressed in the latter portions of this report.

2.1 Level 2 Basic Tree Risk Assessment

The Level 2 Basic Tree Risk Assessment is a 360° visual assessment that evaluates the tree's crown, trunk, and trunk flare; visible aboveground roots; and site conditions. The assessment involves inspection of the tree's crown, branches, trunk, and **root collar** for the presence of structural defects such as **included bark**, cavities, fungal fruiting bodies, and/or **decay**. The Level 2 Basic Tree Risk Assessment also evaluates the likelihood that an observed defect could fail, the likelihood of the defect impacting a specific target should failure occur, and the subsequent damage that may occur should failure and impact occur. Through this evaluation, the level of risk for a tree and/or a specific tree part is determined using ISA's Tree Risk Matrix and based on a defined time frame. The defined time frame establishes the period for which risk is being evaluated to determine the likelihood of failure during the given time frame. The defined time frame for this risk assessment is 12 months, with the assumption of normal weather conditions for the region. The Tree Risk Matrix, provided in Exhibit 1, consists of two matrices that are used to estimate the likelihood of a tree impacting a specific target (e.g., automobile, person, house) and to determine the level of risk as a combination of likelihood of tree or tree part failing and impacting a target and the severity of the consequences from that failure. Using the Tree Risk Matrix, the qualified arborist can determine if the observed defect and/or tree has a low, moderate, high, or extreme risk of failure.

Exhibit 1. Tree Risk Matrix 1

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impact			
	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

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	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

2.2 Level 3 Advanced Assessment

Level 3 Advanced Assessments are performed following a Level 2 Basic Tree Risk Assessment to provide detailed information about specific tree parts, defects, targets, or site conditions. Specialized equipment, data analysis, and expertise are usually required for advanced assessments. For this assessment, sonic tomography was used to perform a Level 3 Advanced Assessment of the lower trunk on ten blue gum eucalyptus trees, identified in Attachment 2 - Level 2 Basic Risk Assessment Matrix. The sonic tomograph provides a detailed analysis of the structural integrity within the lower trunks and is discussed in the following sections.

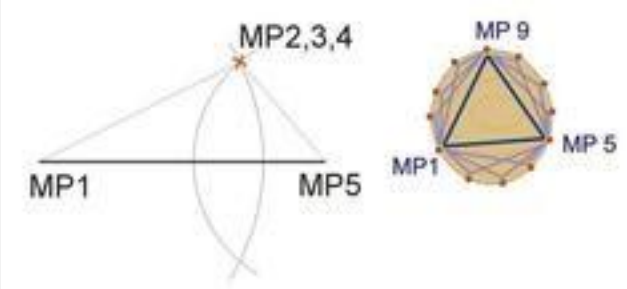
Sonic Tomography

Sonic tomography detects decay, cavities, and fractures in trees by measuring the velocity of sound waves as they pass through wood. Differences in velocity help determine areas of healthy wood and areas of damaged wood, as damaged wood has less elasticity and density than healthy wood. The reduction in elasticity results in the inability of sound waves to take a direct path through the wood, thereby indicating the presence of damaged wood. The speed of sound in wood correlates with wood quality and is, therefore, a measure of the breaking safety of the trunk (i.e., acceptable level of trunk damage/hollowness) and residual wall thickness (i.e., remaining undamaged wood).

To evaluate the presence and level of potential decay, cavities, and/or fractures within trees, a series of evenly spaced measuring points (MPs) are installed. MPs consist of pins that are tapped into the tree with a hammer until they make contact with the wood and are past the tree's bark layer. Contact with wood allows for accurate sound transmission. Upon completion of MP placement, the geometry of each tree was recorded using PiCUS calipers and a triangulation method (Exhibits 2 and 3). During the triangulation method, the MP positions are split into triangles, and the lengths of all sides are measured. The resulting measurements provide a detailed image of the tree's geometry, which is essential for calculating the sonic tomogram of a tree. A sonic tomograph reading was taken at one location on each individual tree. The readings were taken at approximately between 3-6 inches above grade.

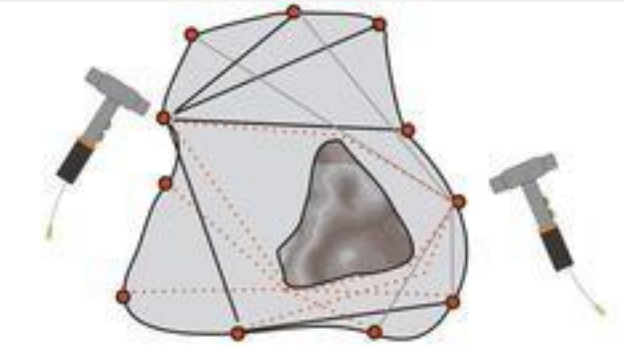
Exhibit 2. Calculating a Tree's Geometry

Exhibit 3. Triangulation Method



Once the tree's geometry has been calculated and recorded, sensors are attached to the MPs, and sonic measurements are taken. The sonic measurements are taken by tapping each MP with an electronic hammer that creates sonic waves (Exhibit 4).

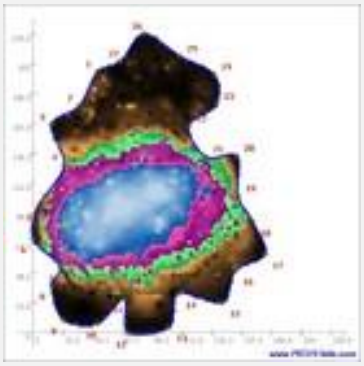
Exhibit 4. Graphic Representation of Sonic Measurement Method



These sonic waves reverberate through the tree, and the velocity of each wave is recorded at each of the MPs. This process is repeated until all MPs have been tapped and the corresponding velocities are recorded. The sonic tomograph's main unit (a computer) records and calculates the sonic tomogram when all readings have been taken. The tomogram then shows the relative and apparent ability of the wood to transmit acoustic waves. This representation displays different colors that represent the various properties of the wood (Exhibit 5). The colors displayed and their corresponding properties are as follows:

- Dark brown – Areas of healthy wood, where the fastest velocities occur
- Green – Varies, but describes the distance between healthy and damaged wood, and can be indicative of early fungus infection
- Violets and blues – Damaged wood

Exhibit 5. Graphic Representation of Sonic Tomogram Reading (not subject tree)



Following the sonic tomography sampling, data was electronically transferred into the PiCUS 3 software program (i.e., custom software created for the analysis and presentation of sonic tomograph data) for detailed analysis. The software calculates 2D tomograms that show the ability of wood to transmit sonic waves, which allows the user to measure residual wall thickness. During the analysis, the extent and level of decay within the tree was calculated, and the structural integrity of the tree was analyzed.

Following completion of the damaged/decayed wood analysis, Dudek calculated the overall level of damaged wood and categorized each tree into one of seven risk-of-failure categories. The seven risk-of-failure categories were based on the total level of observed damaged wood (% of overall wood). Damaged wood included detected damage/rot, incipient decay, and the presence of internal cracks that may compromise the structural integrity of the tree. The seven categories are comprised of very low risk (no decay detected), low risk (1%–9%

damaged wood), elevated risk (10%–19%), moderate risk (20%–29%), high risk (30%–39%), very high risk (40%–49%), and significant risk (50%+). For categorization purposes, the risk of failure is based upon the level of observed internal damage/decay, but also takes into consideration the following factors:

1. Location of observed damage
2. Tree health
3. Location of the tree in the landscape
4. Likelihood of previous root damage
5. Tree species
6. Tree susceptibility to Santa Ana wind conditions
7. Overall tree structure

Following completion of the evaluations and categorizations, management recommendations for each tree were made. The management recommendations are based upon the previously listed factors and the Level 2 findings. However, in general, a tree was recommended for removal if it was found to have a failure potential rating of high, very high, or significant. A tree was recommended for retention, pruning, and monitoring if it was found to have a failure potential rating of elevated, moderate, or low.

Note that the failure risk described in this study is based on failure at the point of inspection and does not include failure risk associated with other tree components, such as root crown, root, and branch failure.

3 Results

The following subsections provide a general overview of the results from the Level 2 and Level 3 tree assessments. Attachment 2 - Level 2 Basic Risk Assessment Matrix and Attachment 3 - Level 3 Sonic Tomography Matrix, provide a detailed summary on an individual tree basis.

3.1 Results – Level 2 Basic Tree Risk Assessment Summary

The Level 2 Basic Tree Risk Assessments evaluated site history, tree health and species profiles, load factors, and tree defects and conditions affecting the likelihood of failure in the crown and branches, trunk, and roots/root collar for ten trees. The following subsections provide a summary of those findings, and Attachment 2 - Basic Risk Assessment Matrix, provides a detailed summary on an individual tree basis. Attachment 5 - Photograph Log, provides detailed photographs of the ten evaluated trees.

Targets

Targets represent people and property that may be impacted should failure of the tree or tree part occur. Targets were first classified by their distance in relation to the tree. Anything that is a distance beyond 1.5 times the height of the tree is not considered a target, as impact would not likely occur in the event of whole tree failure. For the ten trees, the main targets identified were pedestrians, cyclists, moving cars, parked cars, SDG&E utilities, residents, apartments, homes, fences, and City assets, such as fire hydrants. The distance of targets from trees varied from being within the drip line, within 1 times tree height, and 1.5 times tree height.

Occupancy rate is another factor used to assess targets, specifically how often a target is within the fall distance from the tree. For these trees, frequency was associated as follows for each of the identified targets:

- **Rare:** Pedestrians, cyclists, residents and moving vehicles – This reflects that while people walk or bike on a sidewalk, or cars travel on a road adjacent to the trees, the actual time spent within the fall distance of an individual tree is brief.
- **Occasional:** No target was assessed with an occasional occupancy rate.
- **Frequent:** Parked cars – Parked cars were located on the street and in driveways adjacent to the trees. Parked cars are considered to have a frequent occupancy rate as they will eventually move but may remain in the same location for an extended period of time.
- **Constant:** Houses, apartments, fences, City utilities, and SDG&E utilities– These targets are fixed and do not move. As such, they are constantly within the fall distance of the assessed tree.

Growing Environment

All ten trees are large, mature blue gum eucalyptus trees located on flat to slightly sloping terrain. The trees are located within the public right-of-way and are noted as Tree IDs 8242ETree, 8247ETree, 8258ETree, 8259ETree, 1062PWTree, 8310ETree, 8304ETree, 8268ETree, 8266ETree, and 8265ETree in the City of Encinitas's tree database. All trees are located within the right-of-way along North Vulcan Avenue. The trees are in a residential area, with homes or apartments located on the east side of the trees. In general, the landscaping consists of compacted sandy soils that range from landscaped to bare.

Site history was evaluated and includes factors such as previous land uses; grade changes; and potentially cut/damaged roots from construction related activities (driveway/asphalt repair from root lifting), landscaping, and irrigation installation. All ten of the evaluated trees appeared to be subject to a mixture of direct and indirect impacts that may have resulted from the development process.

In general, the prevailing wind direction is from the west, with common occurrences of high wind events during Santa Ana wind conditions.

Load Factors

Load factors take into consideration a tree's level of exposure to wind and the ability of the tree to disperse the force of the wind throughout the crown. Trees with a dense crown have more canopy area to buffer the impact of wind, and therefore have a lower overall load placed on limbs and branches. A lower load factor reduces the potential for limbs and branches to break during a wind event. The wind exposure for the ten trees is varied from full exposure to partial exposure. Eight trees have a density described as normal, and two tree crowns were described as dense, which is consistent with blue gum trees in an urban environment.

Tree Health and Species Profile

The health and species profile of each tree was evaluated to determine vigor; percent of the crown that is normal, chlorotic (abnormal), or necrotic (dead); observable pests, abiotic disorders (human inflicted), and the known failure issues associated with the tree species. Overall, the vigor of the trees was classified as normal and showed little to no signs of decline. Tortoise beetle activity was observed on

two trees. These pests cause foliar damage, however, generally do not jeopardize the health of a thriving tree. The species failure profile is categorized by branches, trunk, and roots, and is specific to an individual tree species. Eucalyptus trees are commonly observed to have branch part failure that results in branches breaking and falling.

Tree Defects and Conditions Affecting the Likelihood of Failure

The assessment of tree defects and conditions affecting the likelihood of failure represents the observations of the arborists' visual assessment of the trees' crown and branches, trunk, roots and root collar. Each tree part was assessed on multiple factors that reflect poor structural conditions, dead wood, pests, diseases, previous maintenance work, and other factors that may result in a defect of the tree part. For each tree, the arborist identified the defect of main concern, rated the likelihood that failure would occur within the given 12-month time frame, and rated the total load (mass) of the defect. The following section provides a review of the observed defects and conditions affecting the likelihood of failure for the trees' crown and branches, trunk, and root/root collar.

Crown and Branches

The tree crowns and branches were assessed on conditions such as crown balance, live crown ratio, and other factors that reflect weak attachments like co-dominant stems, included bark, and response growth from previous pruning. The tree crowns reach approximately 55 to 80 feet in height and range from 25 to 50 feet across at their widest points. Below are the most common tree crown and branch conditions and defects observed with the ten trees:

- **Live crown ratio:** The percent of live crown ratio varied from 30% to 80%
- **Weak Attachments:** Five trees were observed to have weak attachments.
- **Main Concern:** The main concern was weak attachments, codominant branches with included bark, and overextended branches.
- **Likelihood of Failure:** 55% of main concerns were classified as probable to fail, 18% were classified as possible to fail, and 18% were classified as improbable to fail within the established 12-month time frame.

The scaffold branches for all ten trees vary with regard to their evaluated "weak" or "strong" attachment points. Many trees exhibit evidence of past pruning (wounds, both callused and those that became injuries). Examples of weak attachment points include co-dominant stems and epicormic sprouts that have grown to a large size and included bark from acute attachment angles. Conversely, stronger attachments consisted of accommodating attachment angles with no included bark and sound branch architecture.

Details for the individual crown and branch assessments can be found in Attachment 2 - Basic Risk Assessment Matrix. It should be noted that the crown and branch evaluations were limited at times by interior foliage, branches, and/or obstructions that limited viewing. Aerial crown evaluations of the trees were beyond the scope of this assessment.

Trunk

The trunk of each tree was assessed for defects that could lead to failure, including the presence of conks, co-dominant stems, signs of decay, damage to sapwood or heartwood, and a noticeable lean. The trees' trunks range from 36 to 64 -inches in diameter at standard height. Below are the most common tree trunk conditions and defects observed in the ten trees:

- **Lean:** The ten trees had various levels of observed lean from vertical, with lean degrees ranging from 0 to 16 degrees. While six of the trees have an observed lean, typically a tree's lean will result in a failure of the root system, and not a breaking of the trunk itself.
- **Cankers, Galls, and Burls:** Two trees had observable cankers, galls, or burls on the trunk
- **Included bark:** One tree has included bark with codominant stems
- **Main Concern**: The main concerns were old wounds, burls, and codominant stems.
- **Likelihood of Failure:** 64% of main concerns were classified as possible to fail and 27% were classified as improbable to fail within the established 12-month time frame.

Roots and Root Collar

The evaluation of the roots and root collar consisted of an assessment of the parts of the tree that were visible above the soil, with no root crown excavations performed. Below are the most common tree root and root collar conditions and defects observed in the ten trees:

- **Buried Collars**: The root collars of five of the trees were buried, and all ten of the trees have pavement over their existing root system.
- **Conks:** No trees had observable conks on its roots or root collar.
- **Main Concern:** The main concerns included damaged structural roots.
- **Likelihood of Failure:** 82% of main concerns were classified as improbable to fail and 9% were classified as possible to fail within the established 12-month time frame.

Risk Categorization

To evaluate potential risk, Dudek Tree Risk Assessment Qualified arborists evaluated the trees using the ISA Basic Tree Risk Assessment Form. As observed at the time of the tree inspection, potential targets should tree failure (whole tree, branch, trunk, or root) occur included were pedestrians, cyclists, moving cars, parked cars, SDG&E utilities, residents, apartments, homes, fences, and City assets, such as fire hydrants. Potential targets ranged from within the trees' canopies to within 1.5 times the height of the tree. It should be noted that any specific target may or may not be associated with all of the trees on site and may only be associated with one individual tree. The frequency of the targets ranges from **constant** (i.e., houses, apartments, SDG&E utilities, fences, and fire hydrants), **frequent** (i.e., parked cars) and **rare** (i.e., pedestrians, cyclists, and moving cars). Details are provided in the Level 2 Basic Risk Assessment Matrix in Attachment 2.

Risk rating is a factor of the potential for tree or tree part failure, the likelihood of impact with a target, and the **consequences of failure**. A low rating for the site is related to the reduced likelihood that any specific part would fail and the low to very low likelihood that a target would be present during the potential failure. A

moderate risk rating is related to a possible likelihood that any specific part would fail, a high likelihood that a target would be present during the potential failure, and at least significant level of consequence should failure and impact occur. A high-risk rating is related to a probable likelihood that any specific part would fail, a high likelihood that a target would be present during the potential failure, and a severe level of consequence should failure and impact occur. Based on the findings of the Level 2 assessments, the following risk ratings were identified:

- **Low:** 2 trees (20%)
- **Moderate:** 8 trees (80%)

3.2 Level 3 Advanced Assessment Summary

The following describes the findings of the Level 3 Advanced Assessment.

Sonic Tomography

In total, ten eucalyptus trees were evaluated along Vulcan Avenue. All ten trees were evaluated for the presence of internal decay, damaged wood, and/or cracks on September 20, 2022. As seen in Table 1, Dudek found that two trees have low levels of detectable internal damage, one tree has elevated levels of detectable internal damage, two trees have moderate levels of detectable internal damage, one tree has high levels of detectable internal damage, and four trees have significant levels of detectable internal damage. The total number of trees within each failure potential category is presented in Table 1. Attachment 3 - Level 3 Sonic Tomography Matrix presents the sonic tomography evaluations on an individual basis.

Table 1. Failure Potential Ratings

Rating Level	% Damaged Wood	Total Trees
1 – Very Low	No Damaged Wood Detected	0
2 – Low	1% to 9 %	2
3 – Elevated	10% to 19 %	1
4 – Moderate	20% to 29 %	2
5 – High	30% to 39 %	1
6 – Very High	40% to 49 %	0
7 – Significant	50% to 100%	4
	Total	**10**

Detected internal damage/decay/rot varied from tree to tree and the location of the tomograph on the individual tree. Levels of detected internal damage ranged from 6% to 75%, with all of the trees exhibiting detectable damage. Individual sonic tomograms for the ten evaluated trees are presented in Attachment 4 - Sonic Tomography Images.

4 Recommendations/Discussion

Blue gum trees are native to Tasmania and southeastern Australia. The blue gum tree is believed to have been introduced to California in 1856. The tree is an introduced tree species that can grow to heights exceeding 100 feet. In its native environment in Tasmania and southeastern Australia the blue gum tree has an average life expectance of 200- to 400- years. However, in the urban California environment, like many tree species, the average life expectancy of the blue gum is reduced. Based on observations of blue gum trees in Southern California, the average anticipated lifespan of a blue gum eucalyptus is estimated to be 150- to 200- years under optimal conditions. The reduction in average annual lifespan of the trees in the urban environment is primarily due to pollution, poor soils, root growth limitations, pressure from insects and disease, and a limitation on available water sources (i.e., drought conditions and/or the use of recycled water (which is higher in salt content)), and construction related impacts. Furthermore, as the drought in Southern California continues, the anticipated lifespan of these trees is anticipated to be further reduced as limitations on water availability increase.

Less-desirable characteristics of eucalyptus trees are that they are "messy," shedding bark, leaf, and seed litter; require substantial growing space above and belowground and tend to be brittle in high winds. Furthermore, many eucalyptus species exhibit a tendency toward sudden branch drop, which has been found to occur at higher frequency in warmer climates and during drought conditions. Many eucalyptus trees drop limbs to aid in moisture retention in the remainder of the tree.

In many cases, as is the case for the blue gum trees along Vulcan, the development process resulted in varying levels of root-related impacts, including those associated with grading, soil compaction, trenching for installation of underground utilities (sewer, electrical, and irrigation), and sidewalk/street replacement and installation. Root removal, structural root damage and/or removal, and soil compaction associated with the development and landscape improvement process have impacted roots. These root impacts have resulted in many of the trees being susceptible to secondary diseases—most commonly, those involving fungal pathogens.

As noted in this evaluation, all ten trees assessed using the PiCUS 3 sonic tomograph were found to have internal decay and/or damaged wood within the lower trunk of the tree. If grown in an open, natural setting, these trees would most likely not be considered a risk. However, due to their location in the urban landscape, the presence of multiple targets, and the frequency of the targets within the zone of potential failure (where the tree will impact should failure occur), two trees are considered low risk with reduced failure potential as a result of internal decay, two trees are considered to have a moderate risk of failure from internal decay, one tree is considered to have an elevated risk of failure from internal decay, and the remaining five trees are considered to have a high to significant failure potential due to internal decay. As such five trees present a high to significant risk to the City of Encinitas and its residents.

As stated in the methods section, a tree is recommended for removal if it was found to have a failure potential rating of high, very high, or significant. As such, the benchmark for pass/fail in this evaluation is greater than 30% damaged wood. However, it should be noted that the risk increases as the percentage of sound wood becomes smaller (i.e., the incremental advancement of decay at the root crown has a corresponding risk increase). Therefore, a tree that passes by only a few percentage points may be recommended for preservation, but the risk of failure still exists. Thus, proactive management strategies must be considered and implemented in proportion to the findings. Individual trees were assigned a work priority rating on a scale

of1–immediate attention required to 4–attention required within one year. Based on the tree risk evaluations, Dudek recommends the following management actions to mitigate potential tree risk, reduce the likelihood of tree and/or tree part failure, and maintain the urban forest's aging tree population:

- **Removal of trees found to have high, very high or significant failure potential:** Dudek found five trees (8242, 8247, 8258, 8304, and 8268) that exhibited levels of internal degradation of 32% or more. Therefore, to minimize the risk associated with these trees, Dudek recommends they be removed and replaced. Removal of these trees will remove the overall associated risk. Detailed sonic tomography information can be found in Attachments 3 and 4.
- **Monitoring:** Five trees were found to have low to elevated levels of internal decay. As such, it is recommended that these five trees be inspected on an annual basis for signs of potential failure. Additionally, it is recommended that each of the five trees be evaluated with sonic tomography on an annual basis to track the spread of internal decay. Should the levels of internal decay reach a threshold of greater than 30%, it is recommended that the trees be considered for removal and replacement. These trees are also recommended for pruning, detailed in the next section.
- **Crown Cleaning, Reduction:** In total, and as seen in Attachment 2, Dudek arborists identified five trees that are recommended for crown cleaning and/or reduction within 12 to 24 months. The trees identified as candidates for crown cleaning had minor dead branches. The crown cleaning and reduction should remove no more than 25% of the crown unless it is necessary to correct branching defects. Crown reduction and removal of structurally unsound limbs will reduce hazards, such as dense or irregular crowns, broken limbs, and defects.
- **Maintenance schedule:** To minimize the risk of branch, limb, and/or trunk failure, Dudek recommends that the remaining trees be maintained on an annual maintenance cycle. An annual maintenance cycle will include the following:
  - Reduce hazardous/dead branches on a more regular basis
  - Help reduce weight and mass in the upper tree crowns
  - Allow the tree-trimming contractor to visually inspect the tree crown on a routine basis for defects and potential failure points

5 Concluding Notes

This letter report provides conclusions and recommendations based on the assessment of ten eucalyptus trees located on Vulcan Avenue by ISA-certified arborist and ISA-qualified tree risk assessor. The conclusions and findings discussed in this report and the associated tree, or tree-part risk opinions are valid for no longer than six months and only under normal weather conditions. 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. No aerial or subterranean evaluations were conducted as part of this assessment.

Arborists cannot detect every condition that could possibly lead to the failure of a tree. Trees are living organisms that fail in ways not fully understood. 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. There are no guarantees that a tree's condition will not change over a short or long period due to climatic, cultural, or environmental conditions. Trees provide many benefits to those who live near them. They also include inherent risk that can be minimized, but not eliminated.

Sincerely,

Christopher Kallstrand
Certified Arborist No. WE-8208A
ISA Tree Risk Assessment Qualified

Att. 1: Glossary of Terms
Att. 2: Level 2 Basic Risk Assessment Matrix
Att. 3: Level 3 Sonic Tomography Matrix
Att. 4: Sonic Tomography Images
Att. 5: Photograph Log

Attachment 1

Glossary of Terms

Term	Definition
basal diameter	The diameter of the tree taken at the base of the tree.
best management practices	The International Society of Arboriculture has developed a series of best management practices for the purpose of interpreting tree care standards and providing guidelines of practice for arborists, tree workers, and the people who employ their services.
cavity	An open wound in a tree, characterized by the presence of decay and resulting in a hollow.
co-dominant stems	Tree stems of equal size and relative importance, usually associated with either the trunk/stems or scaffold limbs/branches in the crown.
consequence of failure	personal injury, property damage, or disruption of activity due whole tree failure or the failure of a tree part.
constant occupancy	A target (see below) that is present at all times or nearly all times.
decay	Process of degradation of woody tissue by fungi or bacteria through the decomposition of cellulose and lignin.
defect	injuries, decay, or other abnormalities that directly affects the structural strength.
diameter at standard height (DSH)	The standard for measuring tree size. DSH refers to the tree diameter measured at 4.5 feet above the ground.
epicormic sprout	A shoot growing from an epicormic bud, which lies underneath the bark of a trunk, stem, or branch of a plant.
fracture	The cracking or breaking of a tree.
frequent occupancy	the target is in the strike zone for majority of the day.
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.
Level 1 Limited Visual Inspection	a walk-by/ground-level visual assessment of a tree that includes an assessment of one or more sides of an individual tree. Obvious and significant defects such as excessive lean, soil heaving or lifting, severe cracks, hangers, wounds/cankers, large dead or broken branches, and obvious fungal fruiting bodies are noted during the inspection.
Level 2 Basic Tree Risk Assessment	A Level 2, or basic, assessment is a detailed visual inspection of a tree and its surrounding site, and a synthesis of the information collected. It requires that a tree risk assessor walk completely around a tree looking at the site, buttress roots, trunk, and branches. A basic assessment may include the use of simple tools to gain additional information about the tree or its defects.
Level 2 Tree Risk Assessment	A Level 2, or basic, assessment is a detailed visual inspection of a tree and its surrounding site, and a synthesis of the information collected. It requires that a tree risk assessor walk completely around a tree looking at the site, buttress roots, trunk, and branches. A basic assessment may include the use of simple tools to gain additional information about the tree or defects.
Level 3 Advanced Assessment	Advanced assessments (generally more time intensive) are performed in conjunction with or after a Level 2 assessment to provide detailed information about specific tree parts, defects, targets, or site conditions. Specialized equipment, data collection and analysis, and/or expertise are usually required for advanced assessments. Procedures and methodologies should be selected and applied as appropriate, with consideration for what is reasonable to specific conditions and situations. All technologies involve some uncertainty and have their limitations; any evaluation of an individual tree will not be an accurate measure, but a qualified estimation.
likelihood of failure	the chance of a tree or tree part failure occurring within the specified time frame.

Term	Definition
load	the weight on a given defect that may increase the chances of failure.
low risk rating	derived from the risk rating matrix and includes a tree or tree part that has an unlikely likelihood of impacting the target combined with a negligible to severe consequence of failure.
measuring points	A series of evenly spaced points set on a tree to evaluate the presence and level of decay, cavities, and/or fractures.
occasional occupancy	the target is in the strike zone infrequently or irregularly.
overextended branch	a branch that reaches beyond the tree crown.
rare occupancy	A target that is very uncommon in the target zone.
residual wall thickness	Amount of un-damaged wood remaining in a tree that is structurally supportive.
root collar	the area on the tree where the roots join the trunk.
scaffold branches	Primary limbs that form a tree's canopy.
target	People, property, or activities that could be injured, damaged, or disrupted by a tree.
tree risk assessment	The overall process of tree risk analysis and evaluation.
triangulation method	During the triangulation method, the measuring point positions are split into triangles, and the lengths of all sides are measured to accurately measure tree dimensions.

Attachment 2

Level 2 Basic Risk Assessment Matrix

Site No.	Species	D.S.H (in.)	Height (ft.)	Crown Spread (ft.)	Potential Targets	Crown & Branches						Trunk					Roots & Root Collar				LV2 Tree Risk	LV3 Failure Potential	Mitigation	Residual Risk
						Live Crown Ratio	Co-dominant branches	Dead Twigs/ Branches	Weak Attachments	Main Concern	Likelihood of failure	Included Bark	Cankers/ Galls/Burls	Degree of Lean	Main Concern	Likelihood of failure	Collar Buried	Conks	Main Concern	Likelihood of failure				
8242ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	40	60	43	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, apartments, fence	40	Yes	No	Yes	None	Improbable	No	No	2	Codominant stems with included bark	Possible	Yes	No	None	Improbable	Low	High	Removal	None
8247ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	48	68	50	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, apartments, fence	45	Yes	No	Yes	None	Improbable	No	No	10	Codominant stems with included bark	Possible	No	No	Damaged structural roots	Possible	Moderate	Significant	Removal	None
8258ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	46	60	50	Pedestrians/bikers, moving cars, parked cars, fire hydrant, residents, apartments	60	Yes	No	Yes	Codominant scaffold branches	Possible	Yes	No	16	Codominant stems with included bark	Possible	Yes	No	None	Improbable	Moderate	Significant	Removal	None
8259ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	42	60	45	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, house, fence	40	Yes	Yes	Yes	Overextended branches	Possible	No	No	2	Codominant stems	Possible	Yes	No	None	Improbable	Moderate	Elevated	Monitor	None
1062PWTree	Blue gum eucalyptus (*Eucalyptus globulus)*	36	70	35	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, house, fence	50	Yes	Yes	Yes	Codominant branches with included bark	Probable	No	No	0	None	Improbable	Yes	No	None	Improbable	Low	Low	Monitor	Low

Site No.	Species	D.S.H (in.)	Height (ft.)	Crown Spread (ft.)	Potential Targets	Crown & Branches						Trunk					Roots & Root Collar				LV2 Tree Risk	LV3 Failure Potential	Mitigation	Residual Risk
						Live Crown Ratio	Co-dominant branches	Dead Twigs/ Branches	Weak Attachments	Main Concern	Likelihood of failure	Included Bark	Cankers/ Galls/Burls	Degree of Lean	Main Concern	Likelihood of failure	Collar Buried	Conks	Main Concern	Likelihood of failure				
8310ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	44	65	35	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, house, fence	50	Yes	Yes	Yes	Codominant branches with included bark	Probable	No	Yes	5	Burls	Possible	No	No	None	Improbable	Moderate	Low	Monitor	Low
8304ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	64	70	40	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, house, fence	30	Yes	No	Yes	Codominant branches with included bark	Probable	No	Yes	0	Codominant stems	Possible	Yes	No	None	Improbable	Moderate	Significant	Removal	None
8281ETree	Blue gum eucalyptus (Eucalyptus globulus)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Tree has been removed prior to evaluation	N/A
8268ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	44	80	40	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, house, fence	50	Yes	No	Yes	Codominant branches with included bark	Probable	No	Yes	0	Burl	Improbable	No	No	None	Improbable	Moderate	Significant	Removal	None
8266ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	36	60	30	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, house, fence	50	Yes	No	Yes	Codominant branches with included bark	Probable	No	Yes	10	Old wounds near base, lean	Possible	No	No	None	Improbable	Moderate	Moderate	Monitor	None
8265ETree	Blue gum eucalyptus (*Eucalyptus globulus)*	42	55	25	Pedestrians/bikers, moving cars, parked cars, SDG&E utilities, residents, house, fence	80	Yes	No	Yes	Codominant branches with included bark	Probable	No	Yes	0	Old wounds	Improbable	No	No	None	Improbable	Moderate	Moderate	Monitor	None

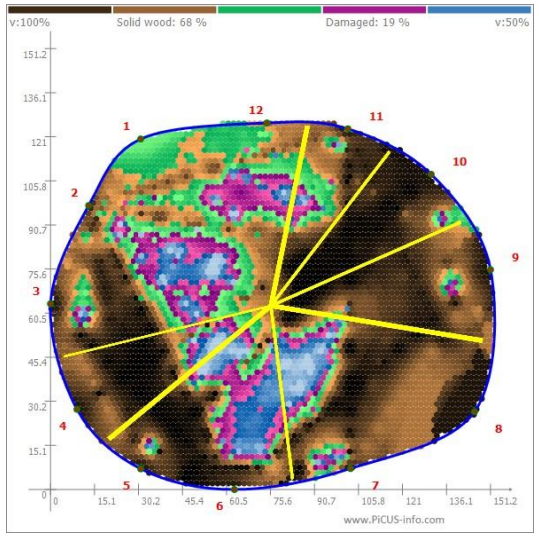
Attachment 3

Level 3 Sonic Tomography Matrix

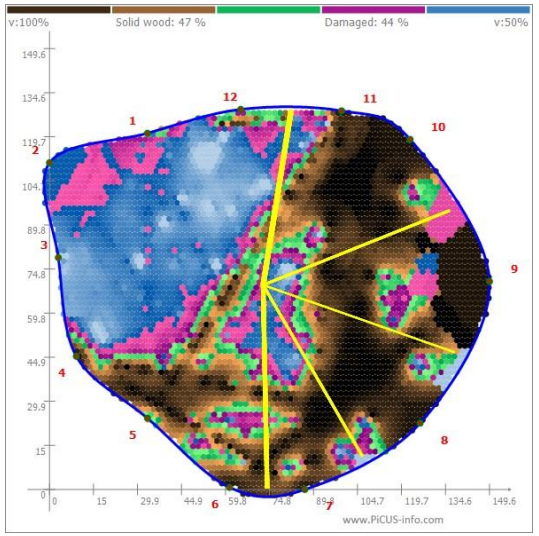
City of Encinitas Tree ID	PiCUS Data File ID	Tomograph Details								Failure Potential	Management Recommendation
		Approximate Location of Tomogram Reading	No Damage (%)	Damage / Decay / Rot (%)	Incipient Decay (%)	Overall Damaged Wood Detected (%)	Percent Damaged Wood (%)	Percent Undamaged Wood (%)	Crack Detected		
8242ETree	20220919_181415_LT_20220919_111415	3"	68	19	13	32	32	68	Yes, 7	High	Removal
8247ETree	20220919_183917_LT_20220919_113917	6"	47	44	9	53	53	47	Yes, 5	Significant	Removal
8258ETree	20220919_190415_LT_20220919_120415	3"	41	50	9	59	59	41	Yes, 6	Significant	Removal
8259ETree	20220919_192425_LT_20220919_122425	3"	83	8	9	17	17	83	Yes, 4	Elevated	Monitor
1062PWTree	20220919_194913_LT_20220919_124913	6"	93	0	7	7	7	93	Yes, 1	Low	Monitor
8310ETree	20220919_200733_LT_20220919_130733	3"	94	1	5	6	6	94	Yes, 7	Low	Monitor
8304ETree	20220919_203830_LT_20220919_133830	3"	25	64	11	75	75	25	Yes, 3	Significant	Removal
8281ETree	Tree has been removed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Plant vacant site
8268ETree	20220919_212610_LT_20220919_142610	6"	48	46	6	52	52	48	Yes, 2	Significant	Removal
8266ETree	20220919_214305_LT_20220919_144305	3"	72	20	8	28	28	72	Yes, 5	Moderate	Monitor
8265ETree	20220919_215519_LT_20220919_145519	6"	71	20	9	29	29	71	Yes, 2	Moderate	Monitor

Attachment 4

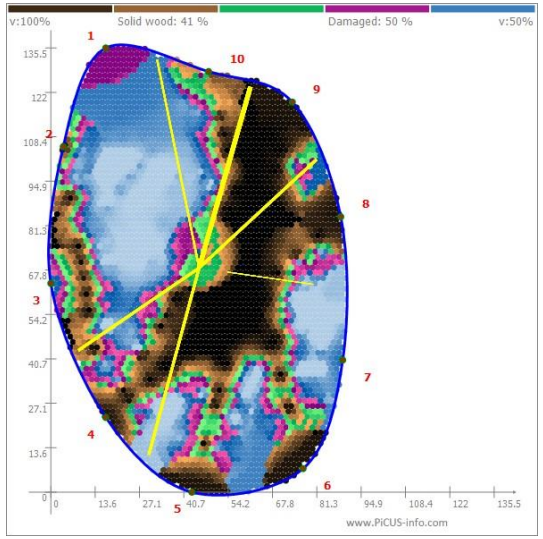
Sonic Tomography Images



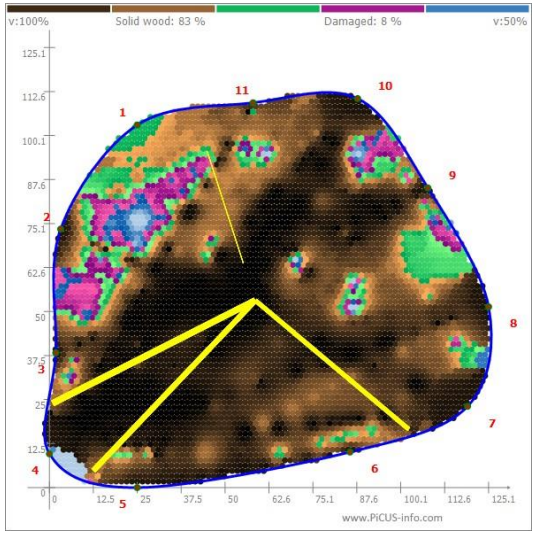
Tree No. 8242ETree – Remove



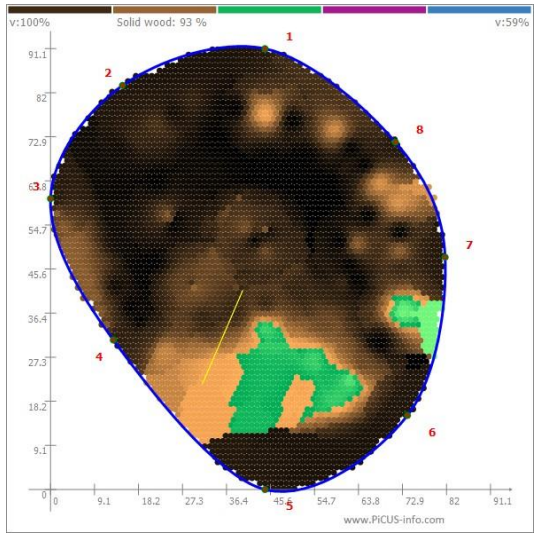
Tree No. 8247ETree – Remove



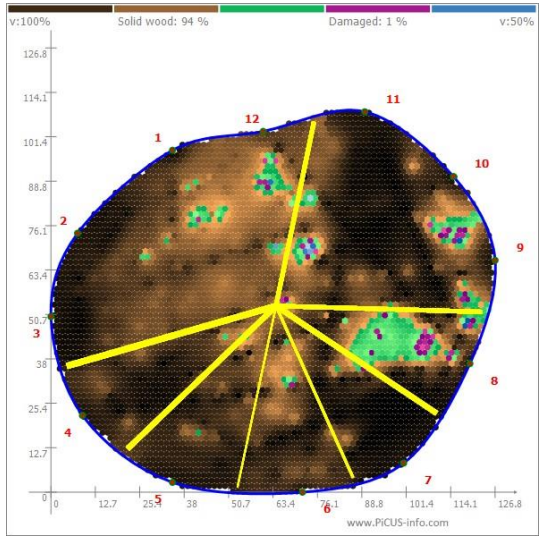
Tree No. 8258ETree – Remove



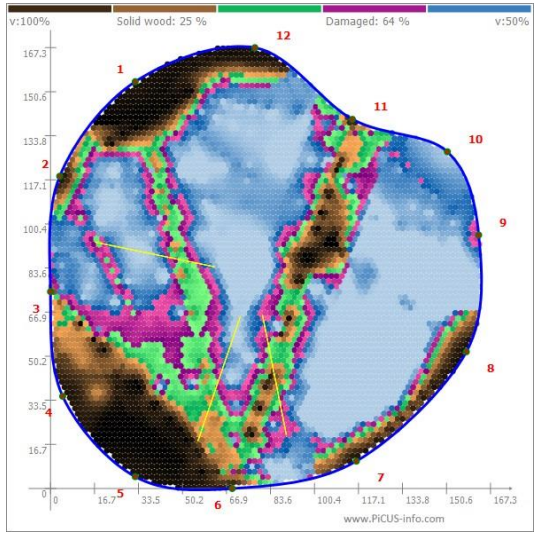
Tree No. 8259ETree – Monitor



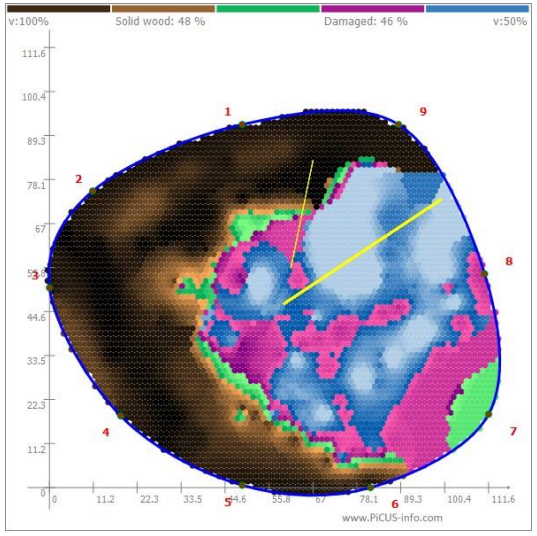
Tree No. 1062PWTree – Monitor



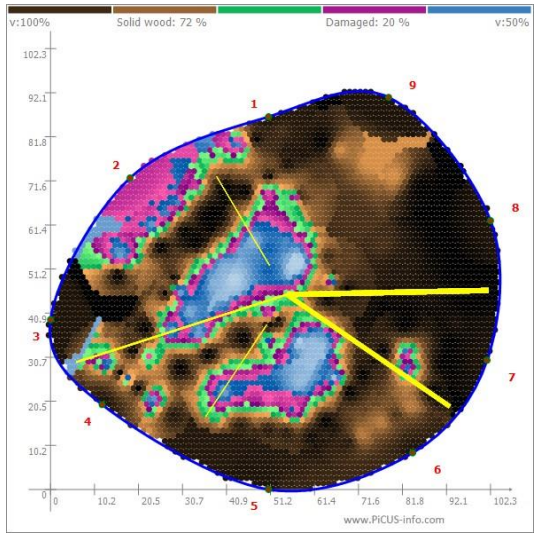
Tree No. 8310ETree – Monitor



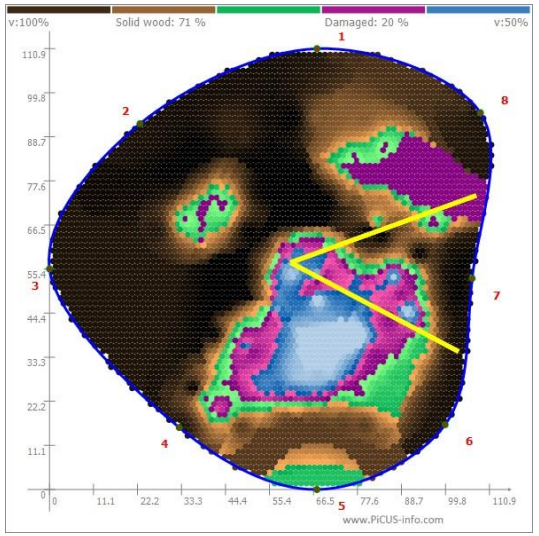
Tree No. 8304ETree – Remove



Tree No. 8268ETree – Remove



Tree No. 8266ETree – Monitor



Tree No. 8265ETree – Monitor

Attachment 5
Photograph Log

Photograph 1 – View of tree 8265ETree

Photograph 2 – View of tree 8266ETree

Photograph 3 – View of tree 8268ETree

Photograph 4 – View of tree 8304ETree

Photograph 5 – View of 8310ETree

Photograph 6 – View of 1062PW

Photograph 7 - View of tree 8259ETree

Photograph 8 – View of tree 8258ETree

Photograph 9 – View of tree 8247ETree

Photograph 10 – View of 8242ETree