Feb 17, 2020

Tree Ecological Benefit Analysis and Risk Assessment
Location: 1810 University Avenue, Honolulu HI
TMK: 28016001, size (~1 acre)
No. of trees: 17 (see figure 1 for species and location)
Inventoried by: Smart Tree Pacific
Performed on: January 22, 2020
Analysis Objective: How to minimize loss of ecosystem services of the trees being disrupted from redevelopment
Prepared: Wai Lee and Jolie Dollar, Smart Trees Pacific

Executive Summary:
The total annual ecological benefits for all 17 trees on the property were assessed at $1,587 by the Tree Plotter software. The three larger trees selected for the study, the Tamarind, the Kiawe and the Monkeypod, if selected to keep, would offer an annual benefit of $836 (see figures 2 and 3). While these three trees represent 17% of the population, they contribute 53% of the monetary benefits. This is because of their species and size. Large trees provide more benefits than smaller ones. Their ecological benefits account for more than 60% of all the trees on the property (see figure 4). The size of these three trees are also above average for their species in our public tree inventory, in other words, these trees are above average ecological contributors when compared to trees in adjacent parks and street right-of-ways. Replacing their contributions would take a lot of trees and time to grow the replacements to the current size.

Here is an aerial map of all the trees that were inventoried at the site:

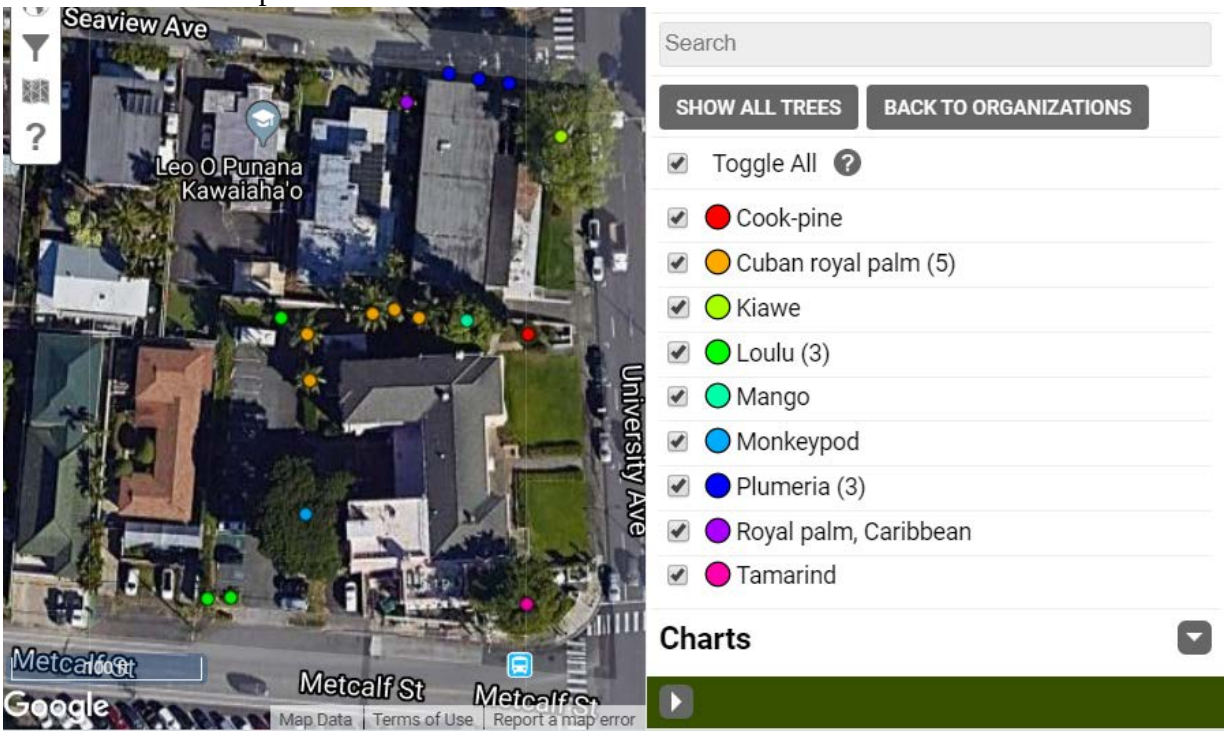

Figure 1. The location and species of all the tree on the property

Recommendation

Since the 3 large specimens on site contribute the most to the ecological benefits, and the Tamarind, which also is rather unique in the Honolulu area, and the Kiawe are on the boundaries of the parcel, we strongly urge the developer to retain them as part of the development. We understand that the Monkeypod is in the middle of the proposed new building. This tree could potentially be relocated to the median in front of the Atherton House or to an off site location as Monkeypod tends to do well in such type of removal/replanting. We will be happy to help to find a buyer and contact a master arborist who moves Monkeypod professionally. We also recommend a Certified Arborist be consulted in both retaining the trees so construction does not adversely impact the trees and the job site, in any relocation.

Ecological Benefits Assessment Methodology

The Tree Plotter software calculates the ecological benefits into two steps. It first determines the trees' abilities based on the species and physical measurements, such as the tree volume. Then it applies the financial value using national averages. The electricity saving is undervalued in this report.

Figure 2. Ecological benefits of the 17 trees on the property Figure 3. Ecological benefits of the selected three trees

Atherton House Trees				
Eco-benefits comparative breakdown	All 17 Trees	Selected 3 trees	Percentage	eco-benefit to make up
Total monetary	$1,587.00	$836.00	53%	
Storm Water monetary	$565.00	$369.00	65%	
Storm Water (in gallons)	56,331	36,874	65%	19,457
Property value	$540.00	$166.00	31%	

Energy savings	$338.00	$221.00	65%	
Electricity KWH saved	2,852	1,809	63%	1,043
Air quality monetary	$95.00	$64.00	67%	
Pollutants removed(in lb)	66	45	68%	21
Carbon monetary benefit	$29.00	$16.00	55%	
Carbon Stored (in lb)	7,719	4,823	62%	2,896
Carbon Sequester (in lb)	2,855	1,800	63%	1,055
Carbon Avoided (in lb)	5,324	3,337	63%	1,987

Figure 4. Ecological benefits comparative breakdown

Then, we compared the size to other trees of the same species in our public tree inventory to understand their relative significance within the local population. Of the more than 17,000 trees in our inventory, we have found these trees are all above average within their own species. The Tamarind is the largest in the inventory. In other words, they are significant within our public tree population.

Diameter at Standard Height (DSH in inches)	Trees at Atherton	Average DSH in inventory	Population size
Tamarind	44	29	9
Monkeypod	36	32	926
Kiawe	46	38	81

Figure 5. Diameter at Standard (4.5”) height comparison

Eco-benefit Replacement Recommendation

We looked for the right tree for this location with the following criteria:

With the limited planting space and canopy volume next to the building, it will be very difficult to replace the 14 mature trees on the property in year one. Our strategy is to use medium sized trees to gradually replace the ecological benefits of these trees over time. We recommend 10 medium sized trees for the front of the new building. The replacement trees will be set back at least 6 feet from the sidewalk to allow root growth. These trees will be pruned to an 8 foot clearance for pedestrian access and view planes for vehicles traffic. We recommend an alternated mix of two species, Kukui and Kou, to provide biodiversity and aesthetics. In figure 6, we outlined the placement of these trees to compliment the proposed building facade. Ideally these trees could provide better cooling benefits if they are placed on the makai side of the building as suggested in the diagram. The yellow and green color rings denote how the cooling benefits can be improved. Having them on the east side, will still provide some cooling benefits from the mid morning sun, especially during the summer months.

This benefit analysis is based on planting 2 inches diameter young trees for the duration of 50 years, the duration of the contract. We have chosen a younger tree at 2-inch versus a 4-inch diameter because their adaptation ability is higher. The choices of trees from the nursery are better. Over time, these trees will join the Kiawe and Tamarind to acquire woody mass and intercept storm water run off for the entire eastern side of the property. Together they will intercept more than 1.6 million gallons of stormwater. The detailed ecological benefit report for the proposed trees is attached in Appendix A.

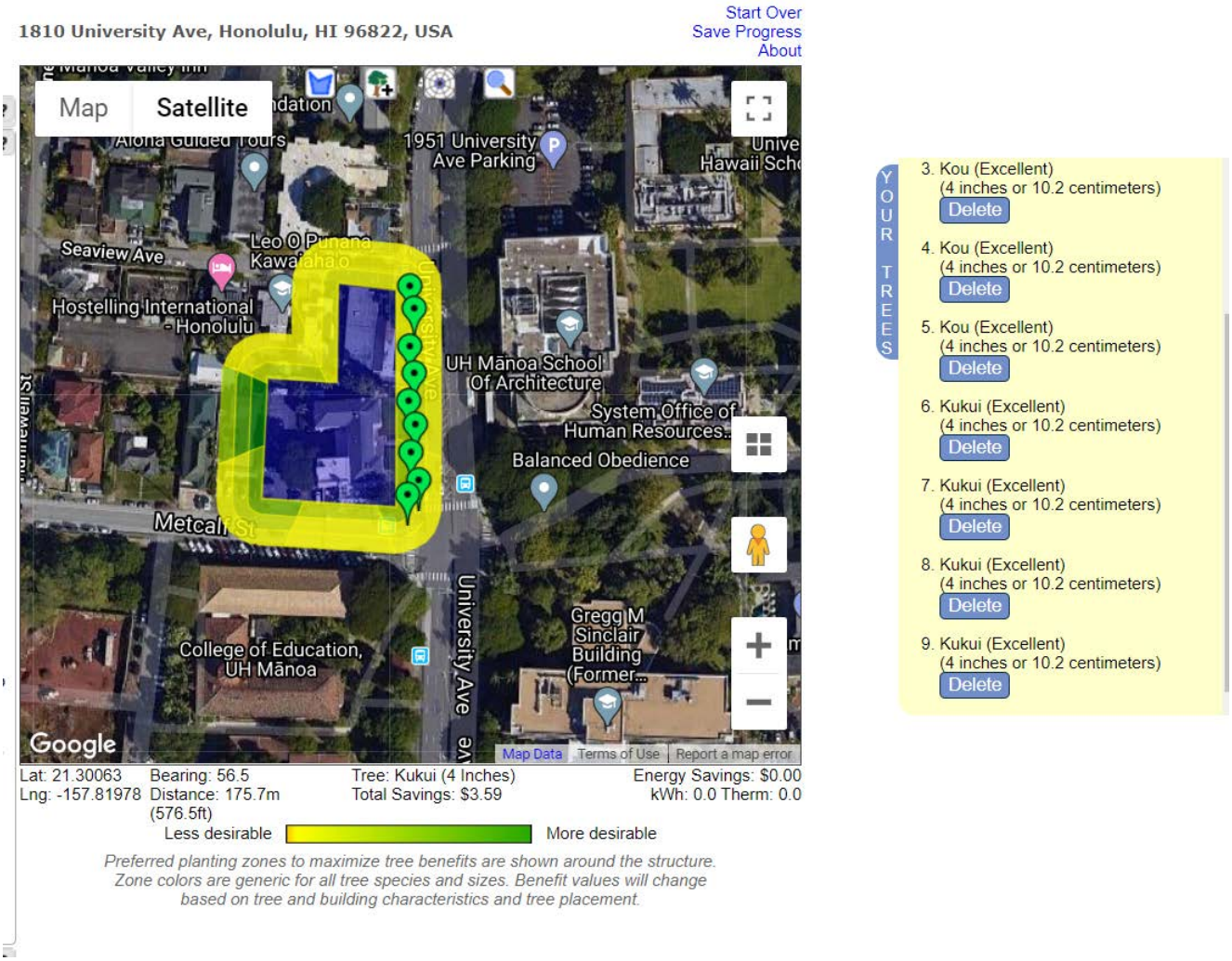

Figure 6, Propose tree planting sites around the redeveloped building. The yellow and green ring denote the ideal effect of placement of trees to reduce energy saving. Only the proposed new trees are shown. The Kukui and Kou are planted in alternated fashion.

Report of: Jolie Dollar, ISA Certified Arborist, WE-4963A

Project Site: Charles H. Atherton Branch YMCA
1810 University Avenue
Honolulu, HI 96822

RE: Tree Risk Assessment

1.0 Introduction

Michael Lam, Senior Vice President, Development, Hawai'i Region of Hunt Companies, Inc, has contracted Smart Trees Pacific (STP) to review the ecological service of all seventeen trees at 1810 University Avenue and a tree risk assessment for three of the trees on the property. This site currently houses the Charles H. Atherton House and the Atherton Branch YMCA.

This tree risk assessment has been prompted by concerns for the health of three trees on the site.

Approximate Location of Subject Trees

On January 22, 2020, Jolie Dollar, International Society of Arboriculture (ISA) Certified Arborist WE-4963A and ISA Tree Risk Assessment Qualified Arborist conducted a field review and assessment of the subject trees.

2.0 Assessment Procedure

This assessment is based upon the standards and practices described within the American National Standard Institute (ANSI) A300 (Part 9) Tree Risk Assessment; a. Tree Structure Assessment -

Standard Practices. The Level 2 assessment is a 360-degree visual evaluation of a tree where the crown, trunk, trunk flare, above-ground roots, and site conditions are evaluated in regard to targets. Level 2 assessments include the use of a rubber mallet for "sounding" the tree and probes that can be used to evaluate open cavities.

The Level 2 inspection and assessment was conducted from various vantage points on the ground at a distance from the subject trees. Tree and site conditions that were inspected and assessed included:

- Tree Characteristics: Tree species was visually identified based on STP's expertise. Tree height was measured with a TruPulse hypsometer. Tree health was measured through observations of foliage coloration, form, and density. Other tree characteristics were visually inspected and assessed using visual signs and symptoms identified according to STP's expertise.
- Root Condition: Obvious signs of significant decay or restrictions within the root system that is evident through observations of visible surface roots and tree crown condition.
- Trunk Defects: Obvious signs of significant decay, cavities, large cracks, or any other major defects that are readily visible from the side of the tree visible and that may affect or represent a sign of the structural integrity of the tree.
- Scaffold Branch/Tree Crown Defects: Large dead branches, multiple and/or weak attachments, excessive end weight, and large broken branches hanging over targets.
- Site Factors: Obvious signs of recent construction activity and other action or conditions that may damage or restrict roots, or otherwise compromise tree structural stability. Soil types or conditions were not researched. Distances of the tree from significant targets was measured as practical on-site using the TruPulse Hypsometer and confirmed using Google Earth measures.
- Targets: Observations and signs of the presence of people and property within the fall zone of the tree and tree parts.

The time frame applied to estimate the likelihood of failure of the subject tree and tree parts is 36 months.

3.1 Findings and Conclusions for T1

Findings and conclusions are restricted to the subject trees and site conditions, and factors that STP observed and believes would significantly influence the likelihood of failure of trees or tree parts, likelihood of impact to a significant target identified on the site, and consequences of impact to those primary targets.

T1 Tree Characteristics:

- Species: The subject tree is identified as monkeypod (*Albizia saman*).
- Height: The height of T1 is approximately 35 feet.
- Diameter at Breast Height (DBH): 35 inches
- Crown Class: T1 is dominant on this site and moderately exposed to winds.
- Crown Spread: The crown spread of T1 is approximately 70 feet by 65 feet.
- Crown Density: The crown density is approximately 50%, with 0% dieback.
- Live Crown Ratio: The live crown ratio of T1 is 50%.
- Form: T1 possesses the symmetrical, spreading form typical of the species, with a single stem. It has a low type of dense and dome-shaped crown, with a short trunk.
- Tree Health: T1 appears to be vigorous with no significant signs or symptoms of poor health

Subject Tree (T1)

Monkeypod trees can grow up to 75 feet in height with trunk diameters over 4 feet. It is native to Central and South America and was introduced in 1847 in Honolulu and Kaua'i. It is a common species planted in parks, home landscapes, and road sides. This species of tree is known to possess a strong structure with an exceptionally strong defense system that resists decay.

Trunk Defects: No significant trunk defects are observed. There is a light attached to the trunk with a metal conduit running up from the ground.

Scaffold Branch/Tree Crown Defects: No significant scaffold branch or tree crown defects are observed.

Site Factors: The site is a planting strip within a parking lot. T1 is approximately 25 feet from a building and overhangs multiple vehicle parking spots.

Targets: The primary targets identified within the fall zone of T1 are the building, vehicles, and people.

The occupancy (exposure) rate of the building is constant since it is a permanent structure that cannot be moved. The occupancy rate for vehicles and people is frequent.

Risk Categorization for T1: The risk rating for whole tree failure or a tree part failing, striking a target, and causing significant injury or damage within the next 36 months is **Low**.

There are no concerns for T1 within the 36-month time frame and normal weather conditions.

It is rated as improbable that T1 will experience a whole tree failure or drop a branch within the 36-month time frame during normal weather conditions because of the good health of the tree and site conditions.

There is a low likelihood that a whole tree or branch will strike the building because of the distance between the tree and the building and probable fall distance of the tree, and there is a medium likelihood that a whole tree or branch will strike vehicles or people because of probable fall distance of the branch or tree and frequent occupancy rates of the two targets.

The consequences of an impact from a whole tree or branch striking the targets is minor for the building, significant for vehicles, and severe for people; however, it is unlikely that a branch or the tree will strike any of these targets within the 36-month time frame during normal weather conditions.

3.2 Findings and Conclusions for T2

T2 Tree Characteristics:

- Species: The subject tree is identified as tamarind (*Tamarindus indica*).
- Height: The height of T2 is approximately 50 feet.
- Diameter at Breast Height (DBH): 44 inches
- Crown Class: T2 is dominant on this site and moderately exposed to winds.
- Crown Spread: The crown spread of T2 is approximately 60 feet by 50 feet.
- Crown Density: The crown density is approximately 75%, with 0% dieback.
- Live Crown Ratio: The live crown ratio of T2 is 75%.
- Form: T2 possesses an oval-shaped, open, and slightly asymmetrical form.
- Tree Health: T2 appears to be vigorous with no significant signs or symptoms of poor health

Subject Tree (T2)

Tamarinds are slow-growing, long-lived, evergreen trees that under optimum conditions can grow 80 feet high with a spread of 20 to 35 feet, in its native eastern Africa and Asia.

Trunk Defects: No significant trunk defects are observed. There is a power line and light fixture mounted on the trunk and a sign nailed to the trunk.

Scaffold Branch/Tree Crown Defects: No significant scaffold branch or tree crown defects are observed.

Site Factors: The site is a planting circle within a public sitting area. The trunk of T2 is approximately 25 feet from a building and overhangs a public sitting area.

Targets: The primary targets identified within the fall zone of T2 are the building and people.

> The occupancy (exposure) rate of the building is constant since it is a permanent structure that cannot be moved. The occupancy rate for people is frequent.

Risk Categorization for T2: The risk rating for whole tree failure or a tree part failing, striking a target, and causing significant injury or damage within the next 36 months is **Low**.

There are no concerns for T2 within the 36-month time frame and normal weather conditions.

It is rated as improbable that T2 will experience a whole tree failure or drop a branch within the 36-month time frame during normal weather conditions because of the good health of the tree and site conditions.

There is a very low likelihood that a whole tree or branch will strike the building and a medium likelihood a whole tree or branch will strike people because of probable fall distance of the branch or tree and occupancy rates of people.

The consequences of an impact from a whole tree or branch striking one of the targets is minor for the building and significant for people; however, it is unlikely that a branch or the tree will strike either of these targets within the 36-month time frame during normal weather conditions.

3.3 Findings and Conclusions for T3

T3 Tree Characteristics:

- Species: The subject tree is identified as kiawe (*Prosopis pallida*).
- Height: The height of T3 is approximately 50 feet.
- Diameter at Breast Height (DBH): 46 inches
- Crown Class: T3 is dominant on this site and moderately exposed to winds.
- Crown Spread: The crown spread of T3 is approximately 85 feet by 70 feet.
- Crown Density: The crown density is approximately 50%, with 10% dieback.
- Live Crown Ratio: The live crown ratio of T3 is 50%.
- Form: T3 possesses an oval-shaped form.
- Tree Health: T3 appears to be in fair condition with some signs of decaying wood and dieback.

Subject Tree (T3)

The history of kiawe on Hawai'i starts in 1828 when a kiawe seed was brought over from Europe and planted at the corner of a church in Honolulu. By 1840, progeny of the tree had become the principal shade trees of Honolulu and were already spreading to dry, leeward plains on all of the islands. Many old kiawe trees have been saved as garden and park trees during land development and have grown to large sizes with irrigation. Although it is a coastal species, kiawe is defoliated by windblown salt spray of winter storms.

Trunk Defects: Dead and rotting wood are present in portions of the trunk, determined by sounding with a mallet and excavation of the cavities. However, there is good wound wood growth (healing) around the cavities.

Dead and Rotting Wood in Trunk and Scaffold Branch; Confined Planting Space

Scaffold Branch/Tree Crown Defects: Dead and rotting wood are present in portions of the scaffold branches, determined by sounding with a mallet and excavation of the cavities. However, there is good wound wood growth around the cavities.

Site Factors: The site is a small, confined planting space along a public sidewalk and adjacent to stairs accessing the courtyard and entrance to the building. The trunk of T3 is approximately 20 feet from a building and overhangs sidewalks and building entryway. A rain gutter from the adjacent building flows out and over the top of the trunk where the scaffold branches are attached, probably contributing to the deterioration of the wood at this junction.

Rain Gutter Flow over the Junction of the Trunk and Scaffold Branches

Targets: The primary targets identified within the fall zone of T3 are the building, parked vehicles, moving vehicles, and people.

The occupancy (exposure) rate of the building is constant since it is a permanent structure that cannot be moved. The occupancy rate for parked vehicles, moving vehicles, and people is frequent.

Risk Categorization of T3: The risk rating for whole tree failure or a tree part failing, striking a target, and causing significant injury or damage within the next 36 months is **Low**.

The main concern for T3 within the 36-month time frame and normal weather conditions is scaffold branch failure due to the presence of rotting and dead wood.

It is rated as possible that T3 will experience a whole tree failure or drop a branch within the 36-month time frame during normal weather conditions.

There is a low likelihood that a whole tree or branch will strike the building and a medium likelihood that a whole tree or branch will strike parked vehicles, moving vehicles, or people because of distance to the targets and probable fall direction of the tree and branches.

The consequences of an impact from a whole tree or branch striking the targets is minor for the building and significant for parked vehicles, moving vehicles, and people; however, it is unlikely that a branch or the tree will strike any of these targets within the 36-month time frame during normal weather conditions.

4.0 Recommendations

Based on the findings and conclusions of this assessment, STP does not find that risk reduction work is required at this time.

If the trees are retained, it is recommended that the tree owner retain a qualified arborist to conduct an inspection and assessment of the subject trees 12 months after the date of this inspection to re-evaluate condition, unless changes in tree or site condition occur first. It is further recommended that inspections be conducted according to a regular frequency recommended by the qualified arborist to re-evaluate tree condition, unless changes in the tree or site condition occur between each interval. In the instance of changes in tree or site condition that may affect tree structural integrity, an inspection and assessment should be conducted as soon as possible. Regular assessments will also permit the qualified arborist and owner to develop a better understanding of the risk character of the subject trees and develop a cost-effective management plan to best manage future failure risk.

5.0 Assessment Limitations and Further Information

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

- Arborists are specialists in tree management and care who use their education, knowledge, training and experience to inspect and assess tree health and condition, and identify measures that reduce risk of personal injury or property damage from trees exhibiting defects.
- This assessment is based upon the information provided by the Client, and Smart Trees Pacific's education, knowledge, training, experience and diligent field investigation. Arborists cannot detect every condition that could possibly lead to the structural failure or decline in the health of a tree. Trees are living organisms that fail in ways we do not fully understand and cannot always predict. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time. Likewise, remedial treatments, like any medicine, cannot be guaranteed.
- This assessment is based on predictions of tree behavior during normal weather conditions and the condition of the tree at the time of the field inspection. Normal weather conditions are defined as wind less than 47 mph (40kts) in speed and rainfall that does not saturate the soil and destabilize the tree root system. Changes to tree or site conditions after completion of the field inspection that are caused by severe weather, construction, accidents, insects, disease or other agents may change the structural integrity of a tree or tree part and increase risk. These types of future changes in condition and their impact on the tree cannot be reasonably predicted during a risk assessment.
- This assessment is restricted to the designated tree(s) and did not assess any other nearby trees that may present potential hazards to people or property.
- Recommendations for risk reduction treatments may involve considerations beyond the scope of the arborist’s services such as cost, public sensitivity, property management considerations, and other issues. This assessment did not consider these factors, but focused on the structural integrity of this tree and its relative risk to the public at the time of this inspection and during normal weather conditions.
- Trees can be managed, but they cannot be controlled. To live, work and play near trees is to accept some degree of risk. The only way to eliminate risk from trees is to remove trees, but removal is generally only preferred if recommended by a Qualified Arborist because it also eliminates the multitude of benefits provided by trees.
- Clients may choose to accept or disregard the recommendation of the arborist, or to seek additional advice.

Please contact Jolie Dollar, by telephone 951-965-0391 or email jdollar@smarttreespacific.org, for any questions or to obtain further information regarding this assessment or report.

i-Tree Design v6.0
Tree Benefit Report - 02/19/2020
1810 University Ave, Honolulu, HI 96822, USA
Trees Evaluated: 10

Total Projected Benefits (2020-2070) - Over the next 50 years, based on forecasted tree growth, i-Tree Design projects total benefits worth $34,821:

- $16,531 of stormwater runoff savings by intercepting 1,653,009 gallons of rainfall
- $3,068 of air quality improvement savings by absorbing and intercepting pollutants such as ozone, sulfur dioxide, nitrogen dioxide, and particulate matter; reducing energy production needs; and lowering air temperature
- $4,299 of savings by reducing 184,822 lbs. of atmospheric carbon dioxide through CO_2 sequestration and decreased energy production needs and emissions
- $10,923 of summer energy savings by direct shading and air cooling effect through evapotranspiration
- $0 of winter energy savings by slowing down winds and reducing home heat loss

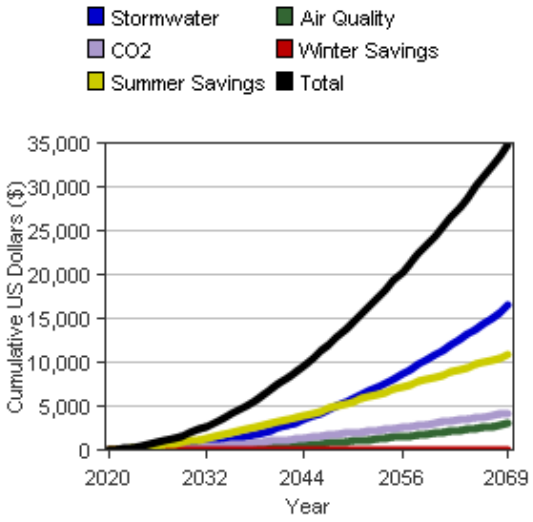

Figure 1. Tree benefit forecast for 50 years

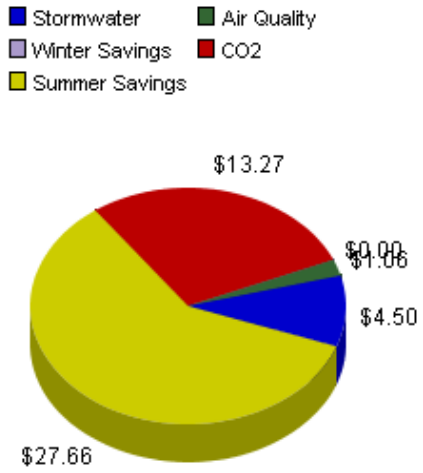

Figure 2. Annual tree benefits for 2020

Current Year - For 2020, i-Tree Design estimates annual tree benefits of $46.49:

- $4.50 of stormwater runoff savings by intercepting 450 gallons of rainfall
- $1.06 of air quality improvement savings
- $13.27 of carbon dioxide reduction savings
- $27.66 of summer energy savings
- $0.00 of winter energy savings

Future Year - In the year 2070, based on forecasted tree growth, i-Tree Design projects annual benefits of $1,232.82:

- $685.85 of stormwater runoff savings by intercepting 68,584 gallons of rainfall
- $129.11 of air quality improvement savings
- $137.94 of carbon dioxide reduction savings
- $279.92 of summer energy savings
- $0.00 of winter energy savings

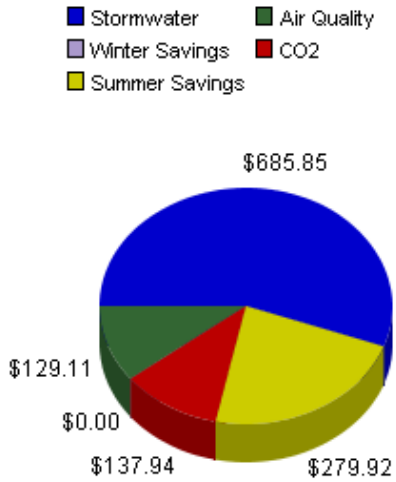

Figure 3. Annual tree benefits for the year 2070

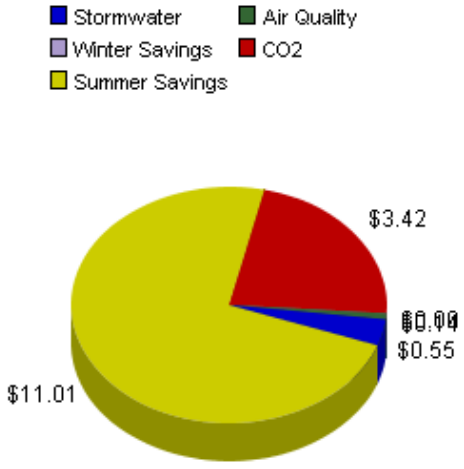

Figure 4. Total benefits to date

Total Benefits to Date - Over the life of the tree(s) so far, i-Tree Design calculates total benefits worth $15:

- $1 of stormwater runoff savings by intercepting 56 gallons of rainfall
- $0 of air quality improvement savings
- $3 of carbon dioxide reduction savings
- $11 of summer energy savings
- $0 of winter energy savings

Individual Tree Benefits							
Tree	DBH (in)	Condition	Location to Structure	Benefits			
				Current Year (2020)	Future Year (2070)	Projected Total (2020-2070)	Total to Date
1. Kou	2	Excellent	Northeast (26 ft)	$1.93	$7.25	$354	$0
2. Kou	2	Excellent	Northeast (28 ft)	$1.93	$7.25	$354	$0
3. Kou	2	Excellent	East (28 ft)	$5.24	$22.95	$1,092	$0
4. Kou	2	Excellent	Southeast (28 ft)	$2.68	$10.57	$511	$0
5. Kou	2	Excellent	Southeast (28 ft)	$2.68	$10.57	$511	$0
6. Kukui	2	Excellent	Northeast (12 ft)	$1.99	$231.46	$6,145	$1
7. Kukui	2	Excellent	East (10 ft)	$9.35	$260.31	$7,493	$4
8. Kukui	2	Excellent	Southeast (10 ft)	$9.19	$234.05	$6,422	$4
9. Kukui	2	Excellent	Southeast (10 ft)	$9.19	$234.05	$6,422	$4
10. Kukui	2	Excellent	Southeast (31 ft)	$2.31	$214.36	$5,516	$1
Total				**$46.49**	**$1,232.82**	**$34,821**	**$15**

DBH: "diameter at breast height" is the standard measurement of tree trunk width at 4.5 feet (1.5 meters) above the ground.