Health and Condition Report

for

Brimbank City Council

Report on five significant *Quercus canariensis* (Algerian Oak) trees throughout H.V. McKay Gardens, Sunshine

Prepared by

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1. Introduction

Homewood Consulting Pty Ltd has been engaged to provide a report on five mature *Quercus canariensis* at H.V. McKay Gardens Assessment.

This report details the species, canopy size, Diameter at Breast Height (DBH), health, structure, Useful Life Expectancy (ULE), contribution to the landscape and recommendations for long term management of the trees.

2. Key Objectives

- Identify and record the dimensions of the specified trees located on the site.
- Provide an assessment of the health and structure of the specified tree specimens.
- Provide recommendations for management of trees to ensure that their health and structure is maintained for the short to long-term.

3. Methodology

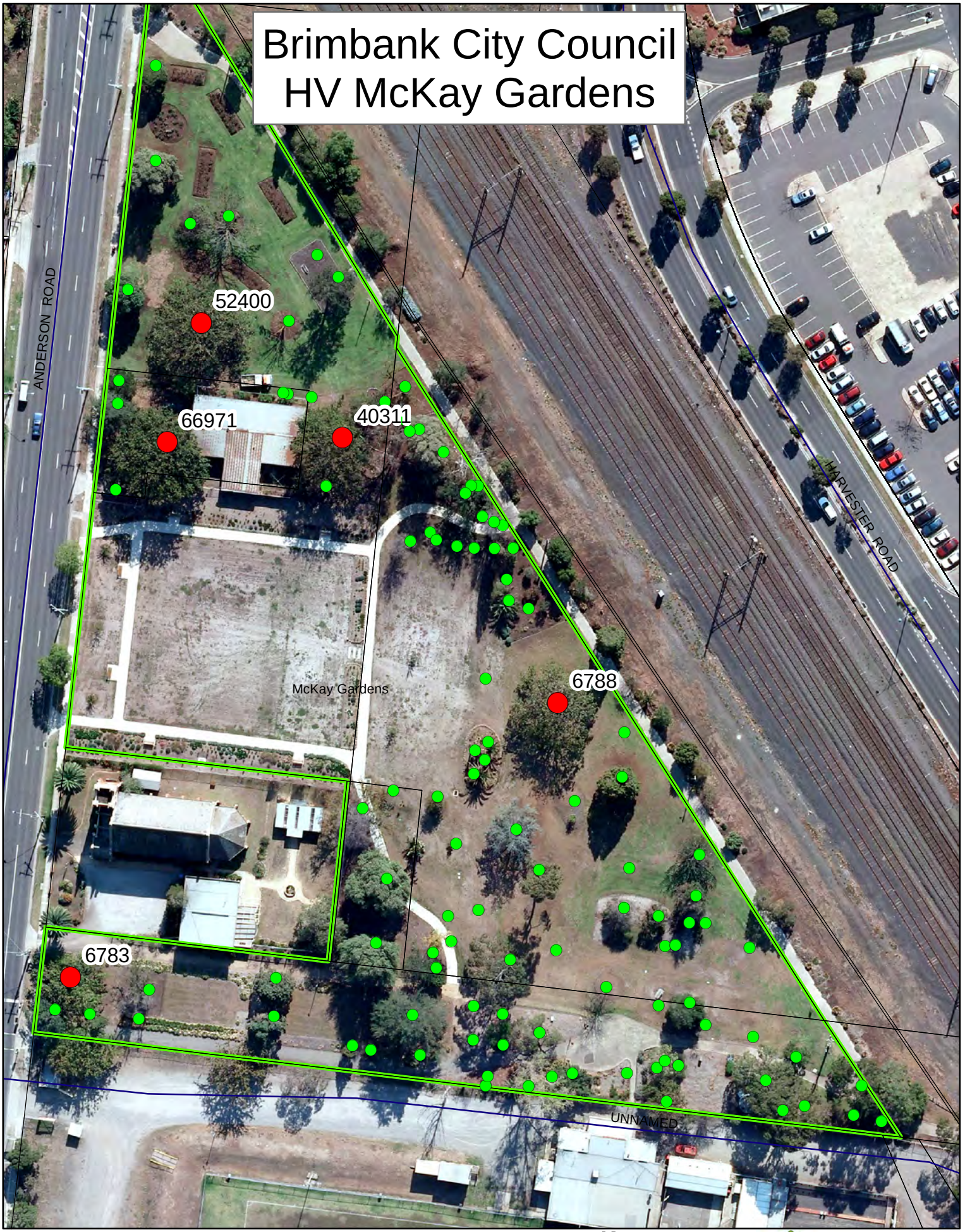
3.1 Site Inspection

On Friday 6 August 2010 Ben Kenyon conducted a site inspection.

Data collected for the trees included:

- Botanical Name
- Height and Width
- Diameter at Breast Height (DBH)
- Health
- Structure
- Maturity
- Useful Life Expectancy (ULE)
- Landscape Contribution
- Individual Significance
- Risk Assessment

For full details of the information collected see Appendix 1



BRIMBANK CITY COUNCIL

Legend

- Trees Assessed
- Other Trees

N

Projection: GDA 94 Zone 55
Map Prepared By: Ben Kenyon
Date: October 2010

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4. Tree Assessment

4.1 Tree 6783

Tree Number	**6783**
Botanical Name	***Quercus canariensis***
Common Name	**Algerian Oak**
Origin	**Exotic**
Canopy Dimensions (H×W)	**10 m x 14 m**
Diameter at Breast Height	**76cm**
Health	**Very Poor**
Structure	**Good**
Useful Life Expectancy	**5-10 years**
Landscape Contribution	**High**
Individual Significance	**Valuable**

Figure 1: Tree 6783, is showing signs of severe stress

4.2 Tree 6788

Tree Number	**6788**
Botanical Name	***Quercus canariensis***
Common Name	**Algerian Oak**
Origin	**Exotic**
Canopy Dimensions (H×W)	**11 m x 16 m**
Diameter at Breast Height	**87cm**
Health	**Very Poor**
Structure	**Good**
Useful Life Expectancy	**20-40 years**
Landscape Contribution	**High**
Individual Significance	**Valuable**

Figure 2: Tree 6788, is showing signs possum predation

4.3 Tree 40311

Tree Number	**40311**
Botanical Name	***Quercus canariensis***
Common Name	**Algerian Oak**
Origin	**Exotic**
Canopy Dimensions (H×W)	**14 m x 15 m**
Diameter at Breast Height	**106cm**
Health	**Very Poor**
Structure	**Good**
Useful Life Expectancy	**20-40 years**
Landscape Contribution	**High**
Individual Significance	**Valuable**

Figure 3: Tree 40311

4.4 Tree 66971

Tree Number	**66971**
Botanical Name	***Quercus canariensis***
Common Name	**Algerian Oak**
Origin	**Exotic**
Canopy Dimensions (H×W)	**15 m x 20 m**
Diameter at Breast Height	**120cm**
Health	**Very Poor**
Structure	**Good**
Useful Life Expectancy	**20-40 years**
Landscape Contribution	**High**
Individual Significance	**Valuable**

Figure 4: Tree 66971

4.5 Tree 52400

Tree Number	**52400**
Botanical Name	***Quercus canariensis***
Common Name	**Algerian Oak**
Origin	**Exotic**
Canopy Dimensions (H×W)	**10 m x 18 m**
Diameter at Breast Height	**87cm**
Health	**Very Poor**
Structure	**Good**
Useful Life Expectancy	**20-40 years**
Landscape Contribution	**High**
Individual Significance	**Valuable**

Figure 5: Tree 52400

5. Observations

5.1 Overview and Discussion

McKay Gardens is a triangular shaped reserve that is bordered to the west and north by the Melbourne Bendigo Train Line, to the east and north by Anderson Road and to the south by Chaplin Reserve.

Historically, the gardens have been one of the main centrepieces for the City of Brimbank and a point of reference and pride for the local community (Pearson, B, Pers comm., Oct 2010).

5.2 Tree Health

The gardens have numerous small to large sized trees, however five of the larger *Quercus canariensis* (Algerian Oak) (Tree No. 6783, 6788, 40311, 66971 and 52400) are showing signs of severe stress and dieback.

All of the *Quercus canariensis* have reduced foliage size, foliage density, reduction in vigour (extension growth over the last 5 years has dramatically reduced), there is also a highly visible and large volume of small deadwood throughout the canopy. See Figure 6.

Possum predation within the canopy of the trees' and particularly within Tree 6788, have further exacerbated the current stress most likely caused by the current drought conditions.

Figure 6: Highly visible and large volume of small deadwood in the canopy is an indicator of substantial stress.

5.2.1 Possum Predation

All of the mature *Quercus canariensis* show signs of possum predation and Tree 6788 is under severe stress due to the degree of predation.

Possums can cause significant damage to trees when their numbers rise to unsustainable levels. Sustained defoliation over successive seasons can result in a significant decline in heath and eventual tree death.

It is evident that possums often concentrate grazing on trees with poor health, accelerating the process of decline. The attraction of stressed trees to possums may be due to the greater habitat potential of hollows and decayed wood thought the canopy. Other theories suggest the increased sugar or carbohydrate level produced in the leaves of stressed trees make them a more palatable food source for the possums.

When possums are excluded however, trees can recover. Figure 7 documents the exceptional recovery of a completely defoliated *Eucalyptus camaldulensis* known historically as the 'Hovell Tree' in Albury, New South Wales.

Figure 7: A) Pre-banding, B) Post-treatment (August 2007), C) Six weeks later

Brush tailed possums are agile climbers and are able to leap significant distances as they traverse the urban forest. The distance they can jump is dependent on their take-off platform, whether they can get a run-up to it and also how far vertically they need to jump. The more vertical the distance they have to cover, the shorter the distance they can leap (Cavanagh, 2007).

An agile (young) possum can leap from a fixed, solid base, up to 2.5m horizontally or downwards, around 1.2m at an angle of nearly 50º to the horizontal (close to optimum of 45º) and with a run-up, 1.7 m upwards at an angle of around 18º. Vertical jumping appears to be less than 1m (Cavanagh, 2007).

To reduce the impact that possum predation is having on the mature *Quercus canariensis*, a possum exclusion program should be implemented. This will require 'banding' the trees with a polycarbonate band around the trunk/s which is too smooth for the possums to climb and may require pruning from surrounding trees to reduce possible access points.

5.2.2 Drought

In large areas of southern and eastern Australia, dry conditions have persisted since 1996, with record low rainfall levels across many parts of the Murray Darling Basin. See Figure 8. This is in conjunction with higher than average temperatures. Since 1975, the six year temperature average compared to the long-term average has been steadily increasing (BOM 2007).

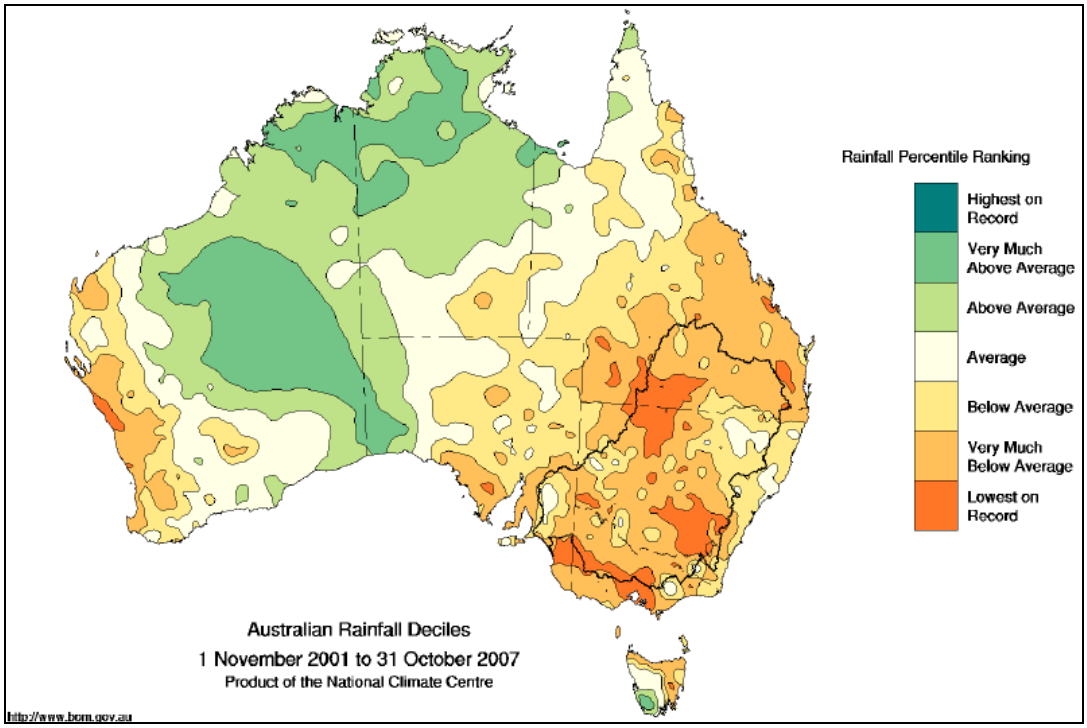

Figure 8: Rainfall deficit since 2001, (BOM,2007)

Historically gardens of this type were highly maintained with a plentiful and frequent watering regime. It is likely that when these *Quercus canariensis* were planted and establishing they would have been watered often, and as such have developed relatively shallow fibrous root systems.

Since water restrictions came into force, and have steadily become stricter, these trees would have had to grow with significantly less water. In fact for the last few years have had to rely primarily on the very infrequent and low amount of rainfall.

To adequately reduce the affect that the drought is having on the trees the entire soil profile needs to be rehydrated. Once this has happened then regular irrigation and rainfall should adequately maintain the level of soil moisture.

5.3 Irrigation Requirements

To calculate the volume of water that is required for each tree it is necessary to calculate the soil volume that requires hydration. Due to its size and location, calculating the volume of water required for Tree 6788 should provide an order of magnitude required for each of the trees.

To irrigate the soil profile to a depth of 600mm beneath Tree 6788 calculate the soil volume.

The canopy is 16.0m in diameter and in this situation the optimum depth to irrigate is 600mm (to get below the 'hard pan').

Volume = Area of base x depth

Volume to irrigate m^3 = πr^2 x depth

= $(3.142 \times (8)^2) \times (0.6)$

= $3.142 \times 64 \times 0.6$

= $120.64m^3$

Allow for 15% porosity (thick reactive clay soil, Handreck and Black, 2002)

= $120.64m^3 \times 15\%$

= $18.1m^3$

= $18m^3$

1 m^3 = 1000 litres

Volume to apply = 18 000L

5.4 Soil Examinations

5.4.1 Soil Conditions under *Quercus canariensis*

To identify any further causes of stress upon the trees, a simple soil examination and excavation was undertaken.

Within and surrounding the canopy within the root zone a grid pattern of holes were bored. The holes were drilled using a using 50mm x 700mm drill bit.

Figure 9: Holes were drilled

Figure 10: Example of finished hole

The results of the soil examination under each tree were almost identical;

- Top 10-200mm consisted of very loose large wood chips,
- The next 100mm a loose very dry topsoil with minimal root growth
- At 300mm was a very solid hard layer (Hard Pan)
- Beyond the ‘Hard Pan’, the soil held no moisture and was hydrophobic or ‘bone’ dry, this layer contained absolutely no root growth. See Figure 11.

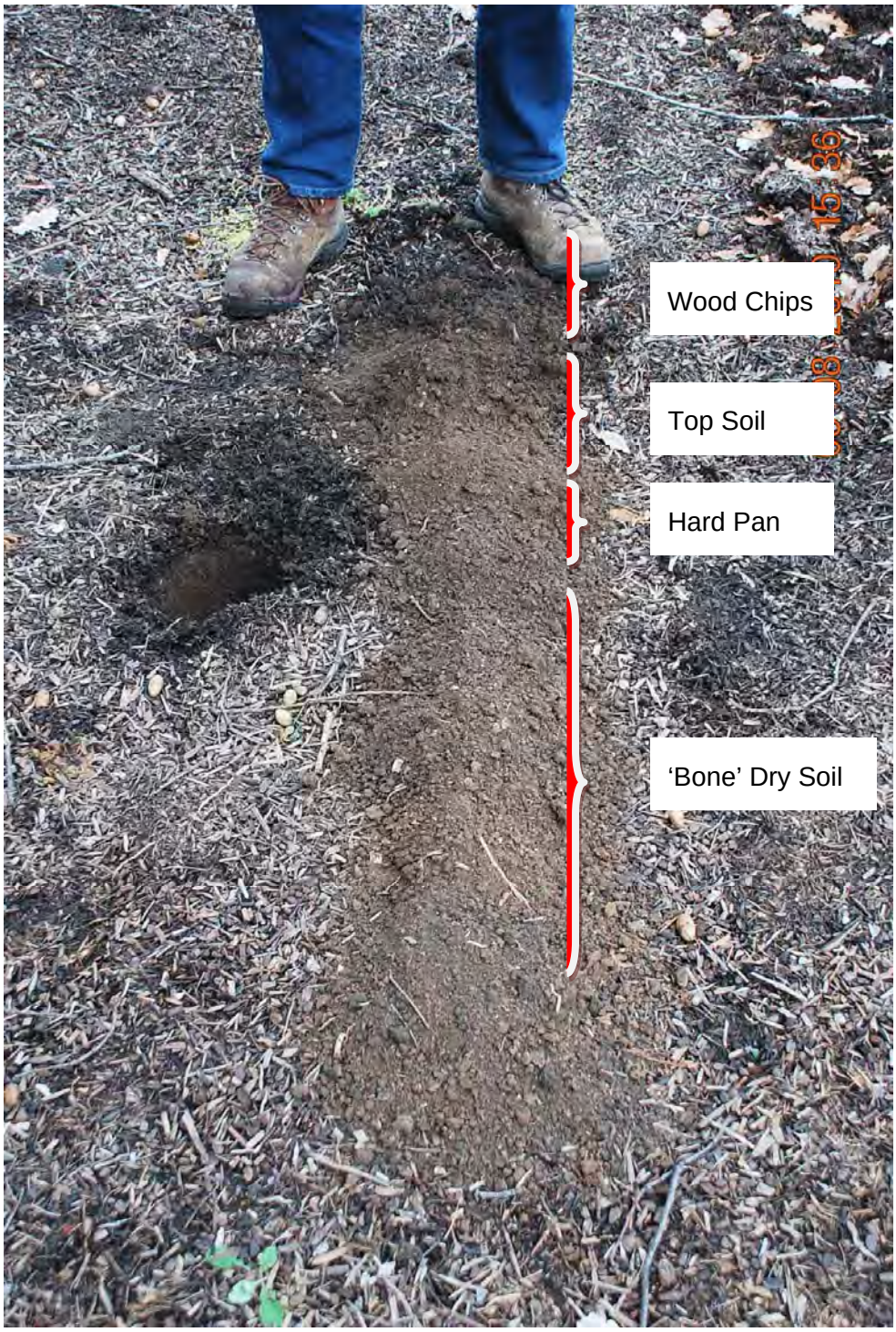

Figure 11: Examination of soil profile within McKay Gardens

The results of the excavations indicate that most of the finer feeder roots (water and nutrient absorbing roots) are located above the hard pan that is within the top 300mm of the soil profile.

Figure 12: Feeder root growth appears to be only within the top 300mm of the soil profile

5.4.2 Additional Soil Excavations

Additional excavations were undertaken in two other locations, under another tree within the park that appeared to be in very good health and out of the park boundary to compare soil conditions.

Figure 13: *Brachychiton acerfolia*, Kurrajong

Figure 14: Results from soil drill outside Gardens

Soil was excavated from underneath a *Brachychiton acerifolia*, near the north west corner of McKay Gardens. The soil conditions beneath the *Brachychiton acerifolia* were the same as those observed underneath the *Quercus canariensis* trees however, the health of the tree is vastly different.

The difference in the performance of the tree is likely to be attributed to the species of the tree, an Australian Native that is used to a minimal water/rain regime in comparison to the *Quercus canariensis*. It is also a younger specimen and may not have experienced the same watering regime as the *Quercus canariensis* during its establishment.

The soil excavations undertaken outside the park were completed from within the Railway Reserve. The soil was taken from the upper edge, not within the drainage line yet the soil was completely saturated and looked like 'slurry'.

It appears that there is water available in the soil profile immediately surrounding the gardens but the soil within the park has become compacted and organic matter has been reduced to such an extent that any available water is not absorbed into the soil profile. Most of the water runs off before it can be absorbed.

5.4.3 Other Factors Affecting the Trees

In addition to the reduced watering regime, severe drought and possum predation the trees are also coping with stresses such as compaction of the soil profile (Hard Pan) and loss of organic matter.

Soil compaction causes direct damage to trees, through physical root damage and also reduces/elimination organic matter and prevents moisture penetration into the soil profile.

Compacting the soil level is detrimental because:

- it changes soil conditions dramatically
- the tree's root system does not have enough time to adapt to the changed conditions.
- It can lead to a decline in tree health and even death.

Water infiltration into the soil horizon takes a lot longer. It also inhibits or prevents gas exchange between the roots and the atmosphere. See Figure 15 and Figure 16.

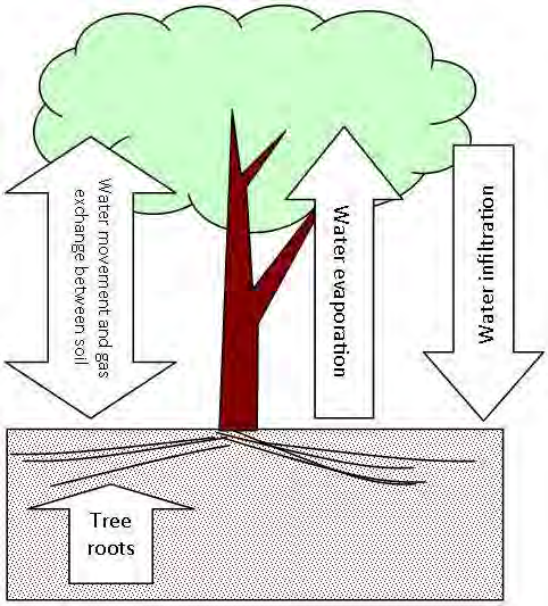

Figure 15: Soil under normal conditions

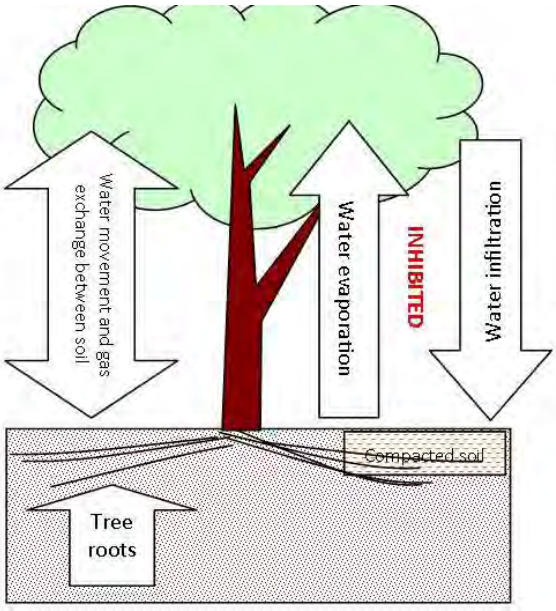

Figure 16: Compacted soil

In particular Trees 40311 and 6783 have had one or more pathways constructed within close proximity, or have a driveway or building within close proximity. See Figure 17 and Figure 18. The 'Hard Pan' surrounding all the trees, uncovered during soil excavations is evidence of compaction of the soil profile over a long period.

Figure 17: Tree 6783 has a highly modified soil environment

Figure 18: Tree 40311 has a heavily compacted access route directly over its root system

Tree 52400, has a very thick layer of mulch around its base. Mulch has many benefits including weed suppression, moisture retention, reduction of compaction and increasing soil organics. However, if the mulch is too thick and of not the right composition, it can have the opposite effect and become detrimental to the tree.

The layer of mulch around this tree in most places exceeds 200mm and it is composed of very large chunks of wood. The soil profile beneath the mulch is extremely dry. The mulch appears to be absorbing any available water preventing the soil from receiving any moisture. See Figure 19.

Figure 19: The mulch under Tree 67888 has a very high wood composition

The composition of a good quality mulch generally consists of a mixture of leaves, bark and wood. This range of materials ensures that the organic matter is broken down by soil fauna and then used rapidly by plants (Harris, Clark and Mattheny 1991, Hitchmough, 1991). The

composition of the mulch on site is mainly large chips of wood. The time taken and energy required to break the mulch down into usable material is longer than for well-structured or composted mulch.

Due to the composition of the mulch (mainly wood) it is lacking in smaller organic matter, this is preventing it from being broken down to enrich the nutrients in the soil and in fact may be causing what is termed 'Nitrogen Draw Down' where any bacteria or organisms in the soil, battling to break it down take nitrogen out of the soil (Handreck & Black, 2002 and Hitchmough, 1994), causing the tree to further suffer from nutrient deficiencies.

6. Conclusions

Five *Quercus canariensis*, (Algerian Oaks) located within H.V. MacKay Gardens, Sunshine are showing severe signs of stress.

All of the *Quercus canariensis* have reduced foliage size, foliage density, reduction in vigour (extension growth over the last 5 years has dramatically reduced), there is also a highly visible and large volume of small deadwood throughout the canopy.

- Possum predation and drought are having a significant impact on the health of all of the trees.

Soil excavations found that the soil profile is extremely dry, has little organic matter and compacted with a 'Hard Pan' at around 300mm deep within the soil profile.

- The compacted soil profile, 'Hard Pan' surrounding all the trees is preventing any available water or rainfall from penetrating deep into the soil profile.
- The compaction of the soil is also stopping organic matter and beneficial soil fauna such as worms from colonising the space and improving the growing conditions of the trees.

The poor performance of the trees is a combination of historic watering regimes, current drought conditions, species type, compaction and soil organics/nutrient conditions and possum predation.

- To improve the health of all these trees, the present stresses need to be either removed or reduced to a level that the individual trees are able to cope with.

An integrated approach should be taken to ensure that the health of the trees improves before Brimbank City Council loses a valuable asset and historical link to the past.

7. Recommendations

Immediately (Before Summer –December 2010)

1. Break up the hard pan under each tree by using a 50mm diameter core drill in 200mm grid pattern to 3.0m beyond the dripline of each tree
2. Irrigate each of the trees with a minimum of 18 000L of water using a soil injection probe
   - 2.1 The soil injection probe will deliver water beneath the 300mm depth hard pan and help break it up
   - 2.2 Include a liquid fertiliser (Nitrogen rich) and seaweed extract to assist with root growth and soil conditioning at manufacturers rates

After the first watering and soil amelioration

3. Apply slow release, nitrogen rich fertiliser to soil surface
4. Control possums through a tree banding and integrated pruning program
5. Remove excess mulch under Tree 6788
6. Apply mulch under each of the trees using 'arboricultural mulch' not woodchips
   - 6.1 The mulch needs to be a mixture of wood, bark and foliage to encourage formation of humus (organic matter)
7. Introduce worms to the mulched areas
   - 7.1 Worm eggs and juveniles are available at most larger nursery's such as Bunning's Warehouse for approximately $50.00 per 1000 (250gm) worms)

Follow Up

8. Monitor extension growth for the next two seasons

8. References

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Appendix 1. Data Collection Definitions

The information collected on each specimen was based on the assessor's experience and opinion of each of the trees. Included are the descriptions for each of the listed categories. The following information was collected on each tree.

1.1 Botanical name:

The genus, species and common name.

1.2 Canopy dimensions

Height (approximate) and width (measured) of the canopy in metres.

1.3 DBH

Diameter at breast height (measured at 1.3m above ground level).

1.4 Health

Table 1. Health Definition

Term	Definition
Excellent	The tree is demonstrating excellent or exceptional growth. The tree should exhibit a full canopy of foliage and be free of pest and disease problems.
Good	The tree is demonstrating good or exceptional growth. The tree should exhibit a full canopy of foliage, and have only minor pest or diseases problems.
Fair	The tree is in reasonable condition and growing well. The tree should exhibit an adequate canopy of foliage. There may be some deadwood present in the crown. Some grazing by insects or possums may be evident.
Poor	The tree is not growing to its full capacity; extension growth of the laterals is minimal. The canopy may be thinning or sparse. Large amounts of deadwood may be evident throughout the crown. Significant pest and disease problems may be evident or symptoms of stress indicating tree decline.
Very Poor	The tree appears to be in a state of decline. The tree is not growing to its full capacity. The canopy may be very thin and sparse. A significant volume of deadwood may be present in the canopy or pest and disease problems may be causing a severe decline in tree health.
Dead	The tree is dead.

1.5 Structure

Table 2. Structure Definition

Term	Definition
Good	The tree has a well-defined and balanced crown. Branch unions appear to be strong, with no defects evident in the trunk or the branches. Major limbs are well defined. The tree is considered a good example of the species.
Fair	The tree has some minor problems in the structure of the crown. The crown may be slightly out of balance, and some branch unions may be exhibiting minor structural faults. If the tree has a single trunk, it may be on a slight lean or exhibiting minor defects.
Poor	The tree may have a poorly structured crown. The crown may be unbalanced or exhibit large gaps. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. The tree may have suffered root damage.
Very Poor	The tree has a poorly structured crown. The crown is unbalanced or exhibit large gaps with possibly large sections of deadwood. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. Branches may exhibit large cracks that are likely to fail in the future. The tree may have suffered major root damage.
Failed	The tree has a very poorly structured crown. A section of the tree has failed or is in imminent danger of failure.

1.6 Useful Life Expectancy (ULE) Rating

Useful Life Expectancy is approximately how long a tree can be retained safely and usefully in the landscape.

Table 3. ULE Definition

Term	Definition
Unsafe	The tree is considered dangerous in the location and has no significant amenity value.
Less than 5 years	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and have value for up to five years, but will need to be replaced. During this period, normal inspections and maintenance will be required. If possible, replacement trees should be planted.
5 – 10yrs	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for up to ten years. During this period, normal inspections and maintenance will be required.
11 – 20yrs	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for up to twenty years. During this period, normal inspections and maintenance will be required.
20 – 40 years	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for up to forty years. During this period, normal inspections and maintenance will be required.
Greater than 40 years	The tree, under normal circumstances and without extra stresses being imposed on it, should be safe and of value for greater than forty years. During this period, normal inspections and maintenance will be required.

1.7 Tree Origin

Table 4. Tree Origin Definition

Term	Definition
Exotic	The species originates in a country other than Australia.
Native	The species originates within Australia.
Indigenous	The species originates within the local environs.

1.8 Contribution to the Landscape Rating

Table 5. Contribution to the Landscape Rating Definition

Term	Definition
High	The tree may be significant in the landscape, offer shade and other amenities such as screening. The tree may assist with erosion control, offer a windbreak or perform a vital function in the location (E.g.: Habitat, shade, flowers or fruit).
Medium	The tree may offer some screening in the landscape or serve a particular function in the location.
Low	The tree offers very little in the way of screening or amenity.

1.9 Tree Significance Rating

This rating system is used to rate the significance of trees in a local area. Some trees identified in local areas may be suitable for National or State registration. Trees that have State or National significance would normally be registered by The National Trust and identified as such. This system of rating and any values expressed represents the opinion of the consultant.

Trees may be considered significant in a local area if they fit into one or more of the following categories.

- Exceptional size
- Rare
- Very old
- Unusual shape or form
- Aboriginal cultural value
- Historic value
- Exceptional example of a species
- Economic, genetic
- Outstanding feature in the landscape
- Habitat value
- Erosion control

Table 6. Tree Significance Rating Definition

Term	Definition
Exceptional .	A tree is considered exceptional because several of the preceding categories apply to the specimen. This tree is normally one that creates a profound effect on the local area and has an exceptional impact on the tree surveyor
Outstanding	A tree is considered outstanding because one or several of the preceding categories apply to the specimen. This tree is normally one that attracts attention and has a noticeable impact on the area and the tree surveyor.
Valuable	A tree is considered valuable because at least one of the preceding categories may be applicable or partially to the specimen. This tree is normally one that is a reasonable specimen without any particular outstanding features. It normally has a diameter at breast height over 1000mm and has good to average health and structure.
Moderate value	A tree is considered to have moderate value because it may be in reasonable condition but may only partially fulfil any one factor. It generally has a diameter at breast height of less than 1000mm and an average or poor health and structure.
Low value	As an individual specimen, the tree is not considered significant. This may be a small specimen, with poor health or structure and be common in occurrence or possibly a weed species. This tree has no impact on the tree surveyor.
Negligible	As an individual specimen, the tree is not considered significant. This may be a very small specimen with very poor health and structure and may be common in occurrence or a weed species. This tree has no impact on the tree surveyor.