
ASSESSMENT OF ENVIRONMENTAL EFFECTS – ARBORICULTURE

For Charcoalblue – Eric Lawrence
Site Waikato Regional Theatre
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Brief: Assessment and reporting on potential effects to Scheduled trees in relation to the proposed Waikato Regional Theatre
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1. Introduction

1.1. *Charcoalblue* has engaged *Arborlab Consultancy Services Limited* to provide an arboricultural assessment relating to the construction of the Waikato Regional Theatre (Theatre). Five trees, listed in the Hamilton City Council (HCC) district plan – Schedule 9D: Significant Trees (protected trees), are growing within the site of the proposed Theatre – 170 Victoria Street (the site), as shown in the below overhead photograph (Figure 1).

Figure 1 – Site location



1.2. For purposes of this report, the protected trees have been attributed the same numbers as listed in the HCC district plan 16.1 – 16.5. The five trees are listed in Table 1 below.

Table 1

ID# (as per planning maps)	Common Name	Botanical Name	Address/Legal Description	RNZIH Score	Category
T16 Map 45B	Hamilton Hotel Riverside Planting	Stand	Marlborough Place, Lot1 DPS 32477		
16.1	Norfolk pine	Araucaria heterophylla	Hamilton Hotel, 170 Victoria St	1728	1
16.2	Norfolk pine	Araucaria heterophylla	Hamilton Hotel, 170 Victoria St	1728	1
16.3	Bunya Pine	Araucaria bidwillii	Hamilton Hotel, 170 Victoria St	6912	1
16.4	Southern Magnolia	Magnolia grandiflora	Hamilton Hotel, 170 Victoria St	512	2
16.5	Southern Magnolia	Magnolia grandiflora	Hamilton Hotel, 170 Victoria St	864	2

1.3. The growing location of the protected trees is highlighted in the following overhead photograph (figure 2).

Figure 2 – Tree growing locations



1.4. This report provides an assessment of the likely effects that the proposed Theatre will have on the protected trees and provides measures that aim to mitigate any adverse effects that may arise with the proposed works.

1.5. The five protected trees in question were assessed as part of arboricultural survey undertaken in December 2017 for the purpose to establish their health, condition and to determine any risk posed by the trees. The assessments were undertaken in fair weather conditions and a memorandum outlining the findings supplied as part of the survey. No further tree assessments have been undertaken and the findings of the December 2017 assessments will be used as the base assessment in this report.

2. Limitations

- All assessments within this report have been taken from the tree survey assessments undertaken in December 2017.
- Assessments of the affects are in reference to the plans titled – Waikato Regional Theatre Resource Consent, date 17/07/2018, by Jasmx.
- Some of the assessments and corresponding work methodologies have been undertaken through technical discussion, for example the deck and screen pile locations.

3. Appendices

- Appendix A – Tree protection methods, mitigation and management plan
- Appendix B – Assessment Criteria

- Appendix C – Visual reference of rootzone areas.

4. The Site

4.1. The site is bordered by Victoria Street, Sapper Moore-Jones Place, the Embassy Plaza and the Waikato River. The site slopes down from Victoria Street to the River. There a number of terraces within the site. Trees 16.4 and 16.5 growing on the terrace associated with an existing driveway and carpark, which is west of the main buildings on the site. Tree 16.3, growing east of Trees 16.4 and 16.5, is within a northerly slope, slightly lower than the carpark terrace, which leads down to the lower terrace. Trees 16.2 and 16.1 growing to the north of Tree 16.3 within the lower terrace, a flat area below the carpark terrace, to the west. Tree No.16.4 to 16.1 are growing in an established garden area. Predominantly the area west of Tree No.16.4 is impervious.

5. Hamilton City Council Significant Tree Rules

5.1. Relevant Hamilton City Council rules regarding Significant Trees contained in Schedule 9 are outlined in Table 2 below.

Table 2

Volume 2, Appendix 9, Schedule 9D: Significant Trees	
h) Emergency works to, or removal of, a scheduled tree where: <ul style="list-style-type: none"> i. There is an imminent threat to life, property or a network utility ii. The scheduled tree carries a fatal disease 	P
i) Minor pruning and maintenance of a scheduled tree	P
j) The following activities located within the root protection zone of any scheduled tree <ul style="list-style-type: none"> i. Earthworks ii. The laying or forming of any impervious surface iii. Additions to, or the replacement of, any existing building or structure that is proposed to exceed the envelope or footprint of the existing building(s) or structure(s) iv. The placement and/or construction of any building or structure v. Directional drilling or boring vi. The storage of chemicals or other toxic substances 	RD
k) Non-emergency works to, removal of, or transplanting of a scheduled tree	D
Note 1. For activities and buildings in the Electricity National Grid Corridor see Chapter 25.7: City-wide – Network Utilities and the Electricity National Grid Corridor. 2. For any activity not identified above, see Section 1.1.8.1.	

5.2. The Theatre development proposes the removal of three protected trees and retention and protection of two protected trees. As such, the application should be assessed as a Discretionary Activity.

5.3. Hamilton City Council defines the Root Protection Zone as the minimum area required to ensure a tree’s health and stability is safeguarded, as calculated using the following table.

Tree age	Vigour	Metres
Young trees (where the age of the tree is less than 20% of life expectancy)	Good vigour	6 x DBH*
	Poor vigour	9 x DBH
Mature trees (where the age of the tree is between 20% and 80% of life expectancy)	Good vigour	9 x DBH
	Poor vigour	12 x DBH
Over mature trees (where the age of tree is greater than 80% of life expectancy)	Good vigour	12 x DBH
	Poor vigour	15 x DBH

*DBH means Diameter at Breast Height which in NZ is diameter at 1.4m high (the diameter of the stem 1.4m above ground level).

6. Proposed Works

- 6.1. The development of the Theatre is part of Hamilton City Council's transformation plan that aims to reshape the central city precinct, while maintaining valued green spaces and strengthening connections between the river, businesses, pedestrians and transport. This site has been chosen from a number of potential sites across the City as it meets a number of specific criteria.
- 6.2. In brief, it is proposed to retain western buildings that border Victoria Street including the Old Hamilton Hotel. The Theatre will be installed into the eastern portion of the site. The five trees in question are growing within the proposed footprint of the Theatre.
- 6.3. Due to health-related issues, one of the Norfolk Island Pines (Tree 16.2) is proposed to be removed. The two Southern Magnolia trees (Trees 16.4 and 16.5) are proposed to be removed as it is likely that they will be compromised by the proposed structure's foundations. The Bunya Pine (Tree 16.3) and the remaining Norfolk Island Pine (Tree 16.1) are proposed to be retained and incorporated into the Theatre design. The inclusion of the trees into the design will alter the rootzone area at ground level. The design also includes a first-floor deck structure to be built around the trunks of the trees and a screen structure that wraps around the eastern boundary of the Theatre. The trees will be located between the Theatre and the screen.
- 6.4. Excavations to construct the foundation will require a cut of approximately one metre below ground level. The location of the foundation is set within the terraced area associated with the carpark area, above the ground level of the trees being retained. All roots within the footprint of the foundation will need to be severed.
- 6.5. The closest edge of the foundations to the Bunya Pine is approximately 7.5 metres and approximately 9.3 metres to the Norfolk Island Pine. The edge of the foundation is outside the dripline of the trees, however, due to their size, there is potential that roots will be present within the footprint of the foundations. Further excavations will be required for piles associated with the deck and Theatre screen. The pile locations are flexible in respect that if any roots are found and to be retained, the pile location can be moved. Once the locations are finalised, the deck and screen structure will be made to suit.

7. Arboricultural Assessment

7.1. Trees 16.1 to 16.4 are growing within an existing rear garden that, at the time of assessment, has been unmanaged for a period of time. The rear garden links with the Hamilton river and the river edge vegetation, which includes a number of large, mature trees. The trees in question are considered to be part of this larger group and contribute to the amenity of this area. Tree 16.5 is growing at the western edge of a carpark area, adjacent the existing building. This tree is considered to be almost solitary in this position. All trees are at the rear of the existing buildings that adjoin Victoria Street. Sapper Moore-Jones Place links the rear carpark of the site to the main street and there are public paths that run along the embankment of the river, all of which provides limited viewership of the trees, in my opinion.

7.2. Norfolk Island Pine (16.1)

Table 3

TREE SPECIES:	Common Name: Norfolk Island Pine Botanical Name: <i>Araucaria heterophylla</i>					
DIMENSIONS:	Height: 17m Girth: 4220mm single stem Canopy Spread: 12m					
	Excellent	Good	Average*	Poor	Very Poor	Dead / Compromised
Form		✓				
Crown		✓				
Limb Structure			✓			
Trunk		✓				
Rootzone health		✓				
Structure		✓				
Amenity		✓				
Function		✓				
Rootzone impediments	✓					
Canopy impediments			✓			
*Start or default rating, using this Arboricultural Field Assessment, is average						

7.2.1. The Norfolk Island Pine (N. Pine) tree is growing within a relatively flat plain between two moderate slopes. There are two N. Pine trees approximately eight metres apart (trees 16.1 and 16.2). This tree is growing in proximity to a number of mature, large dimension trees, however, it is considered to be a codominant tree in association with the adjacent N. Pine, which somewhat combines to form a single canopy crown spread.

7.2.2. The tree displays good health and vitality indicated by the dense, well distributed foliage.

7.2.3. The amenity value of the tree is assessed to be good, however, as it is growing amongst other large dimension trees and is within the rear yard of a site its value is slightly reduced. Removal of the lower branches has raised the canopy of the tree, however this action hasn't adversely affected the tree's amenity value. The pruning cuts indicate correct arboricultural procedures.

7.2.4. The tree is fairly symmetrical with a single stem from ground level and a typical excurrent form of the Norfolk Island Pine species.

7.2.5. Norfolk Island Pines originate from Norfolk Island and are populated across the Pacific region. Typically, they form a single upright trunk with a pyramidal canopy shape. The trees produce cones that ripen on the tree, disintegrate and disperse while attached. Every so often the species produce an atypical number of cones which is referred to as a 'mast' year. During this time the cones can cause branch failures through the extra weight of the cones. Also, from time to time the cones can abscise before they disintegrate which can cause damage to objects below.

7.3. Norfolk Island Pine (16.2)

Table 4

TREE SPECIES:	Common Name: Norfolk Island Pine Botanical Name: <i>Araucaria heterophylla</i>					
DIMENSIONS:	Height: 18m Girth: 3630mm single stem Canopy Spread: 10m					
	Excellent	Good	Average*	Poor	Very Poor	Dead / Compromised
Form			✓			
Crown				✓		
Limb Structure			✓			
Trunk					✓	
Rootzone health		✓				
Structure				✓		
Amenity				✓		
Function				✓		
Rootzone impediments	✓					
Canopy impediments			✓			
*Start or default rating, using this Arboricultural Field Assessment, is average						

- 7.3.1. Similar to 16.1, this N. Pine tree is growing within the same general topography, that being a relatively flat plain between two moderate slopes.
- 7.3.2. The trunk of the tree has been damaged with a large area of bark removed. The removed bark area extends around approximately 90% of the tree's circumference, from ground level to approximately 500mm above ground level. The remaining 10% is a column of bark that hasn't been affected. It is unknown what has caused this damage to the trunk.
- 7.3.3. The tree is fairly symmetrical with a single stem from ground level and a typical excurrent form of the Norfolk Island Pine species. However, there are large areas of decline within the canopy that is adversely affecting the tree's crown shape.
- 7.3.4. The crown foliage density is visibly thinning with areas of open canopy due to foliage dieback. This indicates that the tree is in decline, which is a likely result of the cambium damage at the area of bark loss. It is unlikely, given the damage to the trunk, which has essentially ring-barked the tree, and the existing decline, the tree will recover from its current condition. In addition, there are little remediation measures that will improve the health and longevity of the tree. Overall, it has been assessed that the tree is arboriculturally compromised due to declining health.

Figure 2



The above photograph illustrates the bark loss at the base of the Norfolk Island Pine

7.4. Bunya Pine (Tree No.16.3)

Table 5

TREE SPECIES:	Common Name: Bunya Pine. Botanical Name: <i>Araucaria bidwillii</i>					
DIMENSIONS:	Height: 20m Girth: 5700mm single stem Canopy Spread: 18m					
	Excellent	Good	Average*	Poor	Very Poor	Dead / Compromised
Form			✓			
Crown		✓				
Limb Structure			✓			
Trunk			✓			
Rootzone health		✓				
Structure			✓			
Amenity	✓					
Function		✓				
Rootzone impediments		✓				
Canopy impediments		✓				
*Start or default rating, using this Arboricultural Field Assessment, is average						

7.4.1. The Bunya Pine displays a slight curve in the trunk from ground level which corrects towards the top of the tree. Typically, Bunya Pine trees have straight trunks from ground level, similar to N. Pines. The slight curve is likely to be a result of phototropism (growing towards light) or a poor growing angle when juvenile. This has self-corrected as the tree has matured – hence the straighten of the trunk towards to the top. Trees

are self-optimising specimens that produce response wood as a reaction to loading, therefore it is highly unlikely that the curve in the trunk has adversely affected the tree's stability.

- 7.4.2. The tree has been assessed to be of good health and vitality, indicated by the leaf colour, foliage shape, coverage and density. The tree is growing on a moderate slope between two relatively flat areas.
- 7.4.3. The Bunya Pine is growing as part of group of large mature trees on site and adjacent to the reserve area. It is the dominant tree on the site, which is suppressing tree 16.4 (Magnolia). The suppression has also, somewhat, suppressed lateral branch development of the Bunya Pine in this area.
- 7.4.4. This Bunya Pine is listed in The New Zealand Tree Register (notable tree register for New Zealand wide) in November 2000. The girth was recorded at 457cm, which provides an indication on the tree's growth in 17 years. The height recording is different by six metres showing that ground-based height assessments can be inconsistent.
- 7.4.5. Bunya Pine pines are a sub-tropical tree from Queensland, Australia, where they can achieve heights of 50m with a distinctive dome shape. The trees have a scale leaf shape which can be sharp to touch as they age. This species produces cones that can weigh in the vicinity of 10kg and can be the size of footballs. Usually the cone matures while still attached to the tree, disintegrate and the seed is dispersed by the wind, however, from time to time, similar to Norfolk Island Pines, the tree can abscise a full mature cone. During this period measures should be taken to eliminate targets (people) from within the dripline of the tree.

7.5. Magnolia Tree (16.4)

Table 6

TREE SPECIES:	Common Name: Southern Magnolia. Bull Bay Magnolia Botanical Name: <i>Magnolia grandiflora</i>					
DIMENSIONS:	Height: 13m Girth: 3700mm Canopy Spread: 15m					
	Excellent	Good	Average*	Poor	Very Poor	Dead / Compromised
Form				✓		
Crown			✓			
Limb Structure			✓			
Trunk			✓			
Rootzone health			✓			
Structure			✓			
Amenity			✓			
Function			✓			
Rootzone impediments			✓			
Canopy impediments				✓		
*Start or default rating, using this Arboricultural Field Assessment, is average						

- 7.5.1. The Magnolia is growing in close proximity to the Bunya Pine pine. The proximity has caused suppression of the Magnolia with little lateral growth to the east. Individually the tree would be assessed to be of poor form, however, the combination with the adjacent Bunya Pine pine contributes to the overall amenity value.

7.5.2. The tree divides into two stems at approximately three metres above ground. The eastern stem then divides into further stems. The main union of the two stems is poorly formed with some bark inclusion present. Bark inclusions indicate a poorly structured union, though this does not always associate with failure and there are no incantations that this union is unstable.

7.5.3. The tree is assessed to be of average or fair health and vitality, however, there is some foliage thinning within the upper canopy.

7.6. Magnolia Tree (16.5)

Table 6

TREE SPECIES:	Common Name: Southern Magnolia. Bull Bay Magnolia Botanical Name: <i>Magnolia grandiflora</i>					
DIMENSIONS:	Height: 14m Girth: 3900mm Canopy Spread: 10m					
	Excellent	Good	Average*	Poor	Very Poor	Dead / Compromised
Form			✓			
Crown				✓		
Limb Structure				✓		
Trunk			✓			
Rootzone health					✓	
Structure			✓			
Amenity			✓			
Function			✓			
Rootzone impediments				✓		
Canopy impediments			✓			
*Start or default rating, using this Arboricultural Field Assessment, is average						

7.6.1. This Magnolia is growing near the southern corner of the existing carpark area. The tree is growing between a garage structure and a building, with a roof that adjoins the two together. Walls associated with the boundary fence, the building and the garage are positioned within the tree's dripline, the tree is in contact with the building wall. A temporary plywood fence has been erected along the edge of an adjacent deck and has been affixed to the tree – though any damage through this attachment is likely to be negligible.

7.6.2. The tree divides into multiple stems above ground level. The attachment point of the main stem, on the underside, has an uncharacteristic formation, which appears to be similar to a 'socket', the attachment point on the opposite side of the stem is normal. This formation is a defect, however, the likelihood of failing, due to the formation on the upper side of the attachment point, is likely to be low.

7.6.3. There are a number of decay pockets on the eastern side of the tree's trunk. Two species of fungi were observed within these pockets. Further tests will need to be carried out to ascertain species of this fungi (one is likely to be *Agrocybe parasitica*). The presence of these fruiting bodies indicates decay/rot within the tree, although the identification of the fungi and its effects to the tree will need to be clarified. In regards to the likely advancement of decay, further tests would be required, such as a Picus test, to determine the extent of decay and whether the tree is compromised. A Picus

test uses sound waves through the tree, which can be used to visually interpret wood properties in a cross section of the tree.

- 7.6.4. The tree is assessed to be of low health and vitality, although generally, the foliage density of the tree is fair, there is a significant portion of dieback within the upper crown of the tree. This could be linked to the decay within the trunk and interruption of the vascular tissue conductivity.

8. Discussion

- 8.1. Significant trees included in the Hamilton City Council District Plan have been listed using the Royal New Zealand Institute of Horticulture (RNZIH) Stand Method of Evaluation – published 1988. This system provides 13 categories to which the tree is assessed against. The categories are given ratings of 1 to 4 and a description for each of the category parameters is provided to assist with the assessments. The rating figures from each category (1-4) are multiplied for the tree’s final score. Trees scored between 500 and 1000 points are afforded category 1 status while trees scored in excess of 1000 points are afforded category 2 status.
- 8.2. The five trees are listed in the HCC district plan as significant as they met the points threshold attributed to the RNZIH Standard Method of Evaluation. A review of the scoring has established some variances as outlined below.

Tree No.	HCC Score	Arborlab Score
- 16.1	1728	1536
- 16.2	1728	96
- 16.3	6912	10368
- 16.4	512	128
- 16.5	864	216

- 8.3. It has been assessed that tree 16.2 – Norfolk Island Pine is of poor condition, health and is declining. As the tree declines further, it is likely that it will start to disintegrate with the loss of branches, there is also a small likelihood that the tree could fail at the rootplate. It is unlikely that this tree will recover even if remedial measures are implemented. The removal of the tree can be mitigated with replacement planting. The attributed low RNZIH score provided by Arborlab is due to the decline of the tree.
- 8.4. Tree 16.5 – Southern Magnolia provides a ‘softening’ of the adjacent hard structures of the buildings and provides environmental and visually amenity benefits to the area. That said, the tree has been assessed to be of deteriorating health with branch dieback and likely decay issues within the trunk (which will need further testing to confirm). Arborlab’s RNZIH score for this tree is 216, which is less than the 500 points required to gain category 2 status within the Significant Tree Schedule. This is mainly attributed to the lower scores provided in the *useful life expectancy* and *form and shapeliness* categories, which can be correlated to the tree’s decline.
- 8.5. Tree 16.4 – Southern Magnolia is growing in proximity to the Bunya Pine to such extent that the canopy of the tree has been suppressed. This suppression has forced the tree to grow in a predominant westerly direction causing a significant asymmetrical crown shape. Notwithstanding, similar to Tree 16.4 the tree provides environmental benefits to the neighbourhood, and some limited amenity value, however this is lessened by the suppression of

the Bunya Pine. The tree is growing on the upper 'carparking' terrace level, within the footprint of the Theatre's foundations. Arborlab's RNZIH score for this tree is 128, which is also less than the 500 points required to gain category 2 status within the Significant Tree Schedule. This is attributed to the differences in the *form and shapeliness* category, which could be due to the fact that, as the tree has grown in size, the adverse effect of the suppression and its shape have become more significant.

- 8.6. The two Southern Magnolia trees have been provided protection under the HCC Significant Tree Schedule 9D. Due to their size and maturity, the trees will provide some benefits to the local environment, for example, climate modification, stormwater attenuation and amenity value to name a few, however, as they are a common exotic amenity tree, contribution to scientific or cultural values would be negligible. Given the scope and limited area of the proposed Theatre, the issues outlined above, amendments to the Theatre design to retain the trees is not considered by the project team to be reasonable.
- 8.7. The Bunya Pine and the healthy Norfolk Island Pine have been scored in excess of the HCC scores. This is likely due to the increased dimensions of the trees. The two trees are both healthy and in good condition and worthy of retention.
- 8.8. It has been determined that the most appropriate application of the HCC Root Protection Zone is 9 x DBH; 'Mature trees (which the age of the tree is between 20% and 80% of life expectancy)'. This also provides an area of potential rootzone disturbance, which has been calculated to be approximately ~15% in regards to the Bunya Pine and ~2.4% of the Norfolk Island Pine. For a visual reference of the rootzones please see Appendix C of this report. British and Australian Standards recommend avoidance of incursions into a rootzone of more than 20%. Using the British and Australian standards (both use 12 x DBH) the incursion into the Bunya Pine is in excess of 18%.
- 8.9. The Theatre has reduced its footprint to provide rootzone for the trees, however, due to the size of the trees' 'Root Protection Zones' the incursion within the Bunya Pine's rootzone is significant with potential for alterations to the root growing environment. Mitigation measures and a tree management plan will need to be adhered to mitigate any potential long-term adverse effects and to maintain the trees in a healthy condition.
- 8.10. The retention of the Norfolk Island Pines and the Bunya Pine will need to consider the risk associated with retaining these trees which produce and have the potential to abscise large, heavy cones. Further to this, both species can from time to time abscise mature branches. A number of protection measures can be designed and implemented to minimise potential harm from these occurrences, some of which are outlined in the tree management plan.
- 8.11. In addition, trees are naturally growing and shedding organisms. Debris and leaf fall from these species can cause problems, such as sharp/spikey leaves and slippery patches from debris. The decking and hard-standing areas should be designed with due consideration to the proximity of the trees, for example, the use of non-slip surfaces, leaf guards or grilles on gutters and a provision of access for maintenance.

9. Conclusions

9.1. The proposal, to build the Waikato Regional Theatre, requires the removal of three protected trees and works within the protected root zone of two protected trees. The removal of the three trees will be mitigated by replacement planting. A tree protection methodology and mitigation plan will be implemented and adhered to, to minimise adverse effects that may arise as a result of the Theatre instalment.

10. Recommendations

10.1. Trees 16.2, 16.4 and 16.5 are to be removed to ground level. The removal of the trees is to be undertaken by an experienced arboricultural contracting company in adherence to NZ Arb good practice guidelines. The tree removals will be undertaken in a manner that will avoid damage to the trees being retained on site. This will include avoiding any felling or dismantling where contact with the retained trees could occur and retaining machinery or vehicles on load bearing surfaces when within the tree's root protection zones.

10.2. Replacement trees should consist of at least three large grade specimen trees (80 – 160 litre trees) planted in a position that allows their full development. A planting and aftercare maintenance programme will ensure that the trees are maintained for at least 36 months. It should be considered that the trees are designed into the landscape plan of the theatre. The trees will be planted during the planting season June – August and maintained for 24 months.

10.3. The detailed design of decks, canopies and any other structures within the root zone of trees to be retained should be done in consultation with an arborist.

10.4. A specific tree protection management plan should be developed and adhered to for the proposed construction. See appendix A for an example.

10.5. An advice note should be placed on the resource consent acknowledging that cone abscission in the Bunya Pine and Norfolk Island Pine tree has been recognised and maintenance measures emplaced to minimise risk. The abscission of cones will not be a reasonable reason for the removal of these trees.

Appendix A – Tree Protection Methodology, Mitigation and Management

The following information relates to the Tree Protection Methodologies (TMP) that will be employed in the construction phase of the Theatre construction.

Tree Protection Summary of Requirements

- Site pre-commencement meeting held and documented.
- Tree Protection Zone (TPZ) to be delineated and physically marked on ground.
- Tree protection fencing to be installed.
- Works to be undertaken with adherence to control methods as specified in the TPM and conditions of resource consent.
- Works arborist on site to supervise any works in the vicinity of the TPZ of any of the trees.
- End of project arboricultural report compiled and submitted if required.

Tree Protection Methodology (TMP)

1. A suitably qualified and experienced arborist (Works Arborist), shall be engaged by the consent holder at the start of the project to supervise all works in the vicinity of the trees. The Works Arborist must be experienced in implementing tree protection methodologies during construction activities.
2. The consent holder and/or project manager shall arrange a precommencement meeting with the contractor and the appointed works arborist to outline the conditions of the resource consent, the TMP and timing of the works. An invitation shall be given to relevant Council Arborist with at least five working days' notice of the precommencement meeting.
3. It shall be the responsibility consent holder to ensure that all persons engaged or otherwise to work on the site are made aware of the conditions of consent and tree protection methodologies, and that those conditions are adhered to at all times.
4. No work shall take place within the TPZ without prior approval from the works arborist. Any amendments to the TMP or alterations to the work methodology, which could have more than negligible adverse effects that were not foreseen during the consent application process, shall require approval from the Works Arborist and written confirmation from the Council arborist.
5. Prior to works commencing, a suitable protective fence shall be erected at the edge of the TPZ or at the line of the Theatre's footprint. The location and structure type shall be at the discretion of the Works Arborist, however, it is expected that at a minimum the fence shall be robust and be at least 1.8m in height. No material is to be stored, emptied or disposed of within the TPZ, or vehicle or machinery may enter the TPZ unless otherwise agreed to do so by the Works Arborist.
6. Any cutting of existing concrete or asphalt shall be undertaken in a manner that avoids 'overcutting' – that being any more than the thickness of the medium being cut. This will mitigate inadvertent severance of roots that may be growing adjacent to this medium. Once cut, the removal of the medium shall be undertaken by hand where possible. If a machine excavator is to be used, then the bucket shall only remove the medium, which will expose the substrate.

7. Excavations for the Theatre.
 - a) The initial excavations of the substrate shall be undertaken along the delineated edge of Theatre's footprint. These excavations will be carried out using either with an airspade, Hydrovac or by hand held tools to one meter deep. The use of machine excavator can be utilised to remove and obstructions that cannot otherwise be removed by hand.
 - b) Roots uncovered, within the Theatre's footprint during any part of the process are to be documented and severed at the edge of the excavations.
8. Excavations for Piles
 - a) The initial excavations of the pile holes will be carried out using either with an airspade, Hydrovac or by hand held tools to 600mm below ground level. The use of machine excavator can be utilised to remove and obstructions that cannot otherwise be removed by hand.
 - b) Roots uncovered that measure 35mm in diameter or greater are to be retained and the pile hole backfilled. The pile hole will then be relocated. Roots measuring less than 35mm in diameter, where the Works Arborist is confident that the loss of the root won't adversely effect the tree, the root can be removed to the edge of the pile hole.
9. Roots that are to be severed shall be cut with a clean, sharp hand saw or loppers by, or under the supervision of, the Works Arborist.
10. All exposed roots that are being retained, shall be covered with a suitable protective material (such as Hessian, or a wool mulch) in order to protect them from drying and/or mechanical damage. The protective material shall be in place until such a time this area can be back filled with top soil or the final medium. The wrapping or covering of any roots shall be undertaken by the Works Arborist.
11. Large areas of exposed rootzones are to be protected with an overlay such as a layer of geotextile fabric laid over a 150mm thick layer of wood mulch, until such time that the ground can be reinstated with top soil or the final medium.
12. All exposed roots that can be exposed to concrete, shall be protected by a layer of polythene or similar to prevent chemical damage to the tree and contamination to the soil. If asphalt is to be installed directly over roots, a geotextile fabric shall be place over an approximate 50mm layer sand. The layer sand will allow the development of the roots that will minimise long-term damage to the asphalt.
13. If required, a completion memo will be compiled to outline the works undertaken, probable effects of the works and any ongoing remedial works that may be necessary. The report shall be made available to the Council stakeholders.

Mitigation Measures

14. Prior to any construction works, soil testing shall take place with the intention to analyse and amend any nutrient and/or microorganism deficiencies. Once analysed soil ameliorations will be carried out, with following soil tests taken annually for 24 months.

15. An 80-150mm layer of blended high fungal compost and aged mulch is to be installed within the TPZ.
16. A bespoke irrigation system will be designed installed within the root zone of the trees. The system will utilise rain fall, which will be distributed evenly to the trees' root zones. This system will also allow irrigation of reticulated mains water for use during extended dry periods.
17. Post works monitoring of the trees' health and condition will be undertaken. The first monitoring event will be six months following the completion of the works, with a second monitoring event eight months' after the initial monitoring event, this will allow for any potential seasonal variations. Further mitigation measures and monitoring requirements shall be outlined at each monitoring event. Other mitigation measure that may be implemented and will be outlined by the Works Arborist, such as compost tea application, pruning or soil amendments.
18. If required, a completion memo will be compiled to outline the works undertaken, probable effects of the works and any ongoing remedial works that may be necessary. The report shall be made available to the Council stakeholders.

Tree Management Plan

19. The two trees being retained are know for high leaf and debris drop. It is likely that this will need to be removed from the deck on a daily basis. All debris should be spread on top of the trees' root zones and left to break down. The decomposition of the debris will provide nutrient to the trees.
20. The trees are to be monitored on an annual basis for health and safety. The monitoring shall identify cone production. It is a generally accepted theory that Norfolk Island Pine trees produce 'mast years' where a large number of cones are developed. This can often lead to branch failure due to the extra weight. Cones produced on Bunya Pines can be as large as footballs and can weigh in excess of 10 kilograms. Cones from both trees can abscise intact. Cone observation will allow identification of cones that need to be removed prior to abscission. The removal of the cones will need to be undertaken in a careful manner that avoids damaged to structures. A suitable arboricultural contractor will need to be employed to undertake the works. If able, the deconning of the trees should be undertaken using an elevated platform.
21. Following the mitigation monitoring, the trees are to be inspected annually by a suitably experienced arborist. A memorandum shall be produced after each inspection event. This will provide a history of the trees.
22. The level of mulch and compost is to be inspected regularly. If the levels are below 80mm then a mix of aged mulch and compost is to be added. The compost is to be correctly sourced to have high fungal content suitable for large trees.
23. Soil moisture levels and soil tests are to be annually undertaken. This is to identify if there are any deficiencies and amelioration measures employed.

Appendix B – Tree Assessment Parameters

10.6. The following information outlines the parameters used to assess the trees in question. The parameters relate to the tree assessment tables below.

10.7. **Tree health** and vitality is categorised through a visual determination using;

- leaf or needle size
- leaf and twig shape and colour
- seasonal growth rates
- reaction wood development
- foliage density
- foliage coverage throughout the crown
- branch-tip dieback
- typical branch senescence.

For example, a tree assessed to have an average health rating would generally have irregular [minor] leaf or needle shape and/or colour and/or size; and/or irregular [minor] foliage density, distribution and/or average growth indicators and/or some tip dieback.

10.8. **Tree form** is an indication of crown shape. Crown shapes are influenced by their surroundings, light availability and branch loss, which can have varying impacts on their symmetry. The trees have generally been assessed on their individual crown shape, however, as the tree may be growing within a group environment, this could lead to the individual shape being assessed down. Although a poor rating may be attributed to the tree, the tree's contribution to the setting may be high through association within the group canopy. This can be generally recognised through the Crown Class rating.

10.9. **Crown class** rating provides an indication on the tree's relationship with the surrounding tree environment. The categories used include Dominant, Codominant, Intermediate, Suppressed and Open grown, as shown in the below diagram.

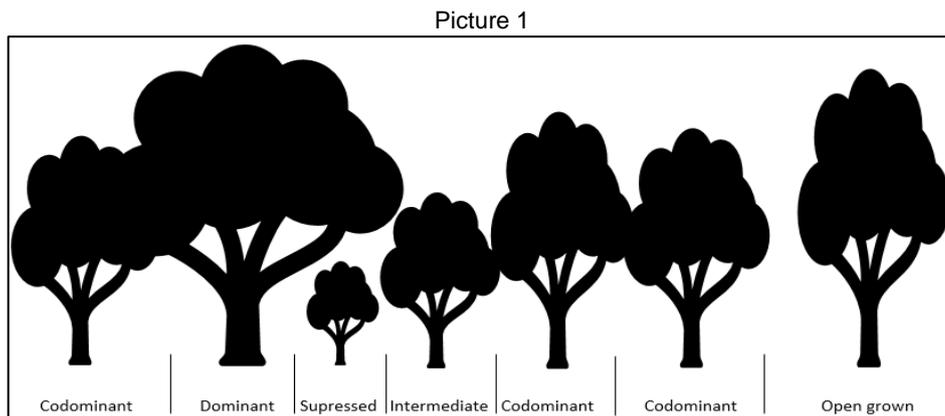


Illustration on group crown class

10.10. **Limb structure** is a general evaluation on the branch union formation, weight balance, growth formation and foliage loss (that may affect branch weight and/or dampening). This assessment is derived on typical structure of the species and its typical branch formation.

10.11. **Trunk form** assesses the flare at the base, taper, decay and cavities, formation of multi-stems that develop near or at ground level, girdling roots and growing angles.

- 10.12. **Rootzone health** visually assesses the general soil health, soil compaction and growth impediments. For example, growing environments with a high percentage of impervious seal or compaction are likely to be categorised as poor, notwithstanding the health of the tree.
- 10.13. **Amenity** considers the appropriateness and value of the tree in the setting, any cultural and/or heritage significance and general ornamental value. In a group setting, it assesses the tree's value to the group and the adverse effects to the amenity of the group if the tree were to be removed. For example, the removal of a small, suppressed tree from a group setting may have a negligible adverse effect on the group's amenity value, therefore it is likely to be assessed as 'Little value' (Very Poor).
- 10.14. **Structure** ratings require a combination of two aspects, the size of the part associated with a defect and the defect's potential to fail under normal weather conditions. Using only the worst-case scenario, two values are selected from the criteria. From these two selections, the 'best' value is taken for the tree's structure rating. Example 1; if the failure rating of the defective part is assessed to be 'unlikely' (Average) and the associated mass of affected canopy is '60%-80%' (Very Poor) then the 'Average' rating is considered to be overall rating for structure. Example 2; if the failure of the defective part is assessed to be 'Imminent' (Very Poor) and the size of canopy affected is 'less than 10%' (Good) then the Good rating is used. This is a structure rating only and does not consider risk using target evaluation – if there is potential for harm to be caused by a defective part then this will need to be discussed further. If the tree contained multiple defects the worst-case scenario is only used.
- 10.15. **Function** of the tree assesses the usefulness of the tree in its setting, for example; does the tree contribute to soil retention on the side of a bank? The provision of stormwater attenuation? The amenity of the site, the provisions of microclimates/cooling during summer months and contribution to wildlife (roosting, perching and habitat). This is weighed up against any negative issues the trees may be causing, for example: conflict and damage to structures, the value of the structure is considered, the tree's growing location – is it the correct tree for the setting's use, etc.
- 10.16. **Impediments** (rootzone and canopy) are structures that impede or suppress normal tree development and/or function. This can include hard impervious surfaces within the rootzone or powerlines and other structures within or adjacent to the canopy.

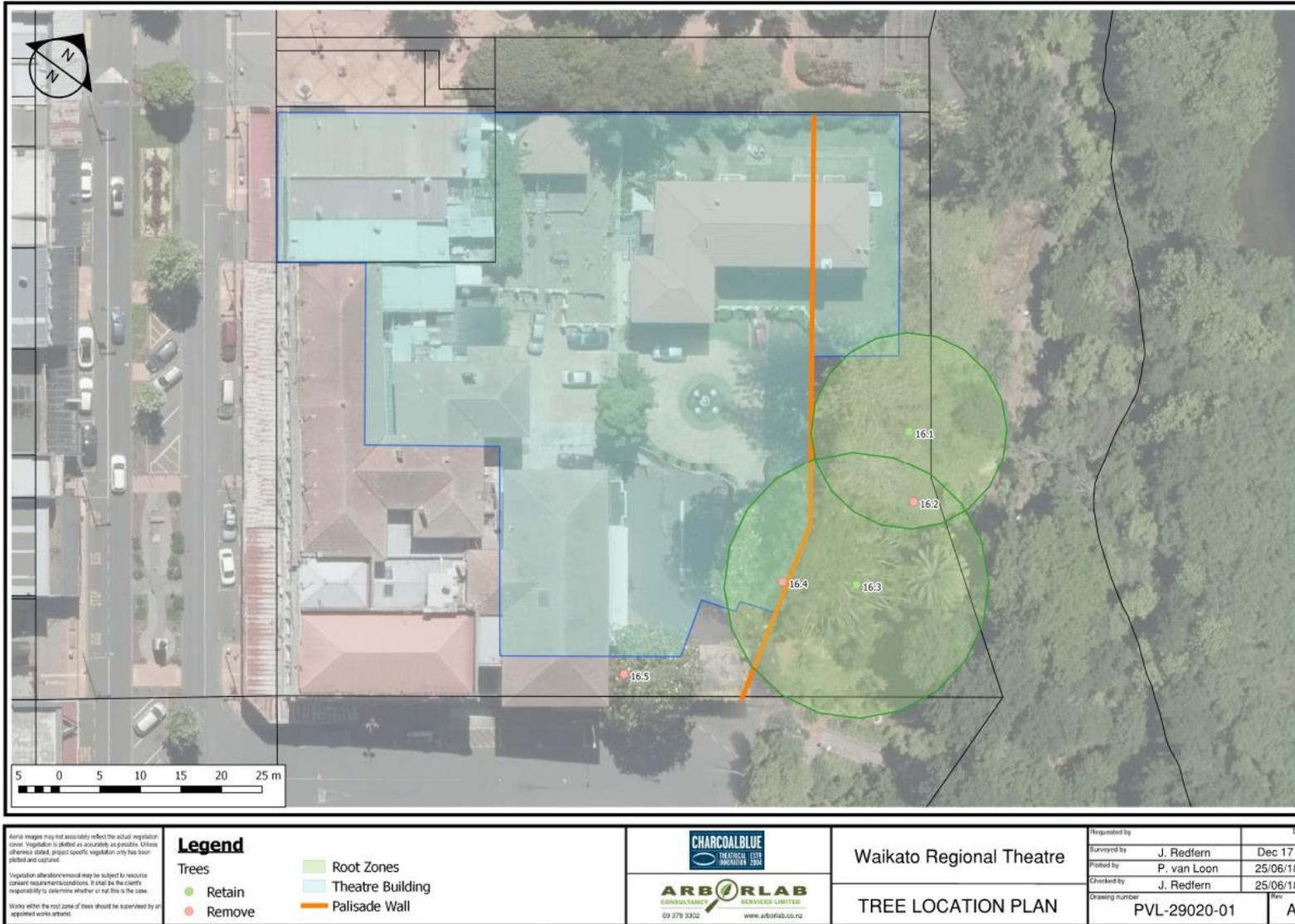
Form/Balance	Crown Shape	Guidelines
Excellent	Symmetrical and balanced - exemplary specimen	100% symmetrical
Good	Slight asymmetrical or unbalanced	90% asymmetrical
Average	Minor asymmetrical and/or unbalanced or slight suppressed	89%-60% asymmetrical
Poor	Moderate asymmetrical and/or unbalanced or suppressed	59%-30% asymmetrical
Very Poor	Significant asymmetrical and/or unbalanced or suppressed	-30% asymmetrical
Compromised	Compromises tree	
Crown Health	Leaf/needle/twig shape, colour, size and form. Foliage/bud distribution and density	
Excellent	Outstanding	
Good	Slight irregular	
Average	Minor irregular and/or some tip dieback	
Poor	Moderate irregular and/or tip dieback	
Very Poor	Significant tip dieback and/or sparse foliage density and irregular distribution	
Compromised	No sign of life	

Limb Structure	Unions and balance - branch weight distribution and unions	
Excellent	Excellent	
Good	Above average for species	
Average	Typical	
Poor	Poor	
Very Poor	Defective/ Compromised	
Compromised	Compromise tree	
Trunk	Flare, taper and/or growing angle	
Excellent	Excellent flare with no defects	
Good	Slight irregular and/or minor defects	
Average	Minor irregular and/or defects	
Poor	Moderate irregular and/or defects	
Very Poor	Significant irregular and/or defects	
Compromised	No Flare, compromised growing angle and/or defects	
Rootzone health	Rootzone health and safety	
Excellent	Unaltered, open and undisturbed in natural or managed setting	
Good	Minor modified and/or compacted in natural and/or managed setting	
Average	Up to 30% modified and/or compacted or fair management and maintenance	
Poor	More than 30% modified and/or compacted or poor management and maintenance	
Very Poor	Compromised by modification and/or compaction	
Compromised	Modification/circumstances compromising tree	
Structure (footnote 1)	Potential failure of defective part	Size of canopy effected
Excellent	Uncompromised	None
Good	Improbable	Less than 10%
Average	Unlikely	10%-30%
Poor	Likely	30%-60%
Very Poor	Imminent	60%-90%
Compromised	Compromised	90%-complete
Amenity (footnote 2)	Appropriateness in setting or tree group. Value to neighbourhood. Cultural and/or heritage significance.	
Excellent	Integral	
Good	Highly valued	
Average	Valued	
Poor	Some value	
Very Poor	Little value	
Compromised	No value	
Function	Use of tree in setting - soil retention/stabilisation, stormwater attenuation, microclimate, amenity, wildlife habitat. Weighed against poor function – damage to structures (consider structure value) etc	
Excellent	Integral role or crop for purpose	
Good	Important role	
Average	Contributing role	
Poor	Some role. Somewhat compromising adjacent immovable structures	
Very Poor	No greater than amenity provided. Unsuitable due to compromising immovable structures	
Compromised	Impedes the intended purpose of the land	
Rootzone Impediments	Root area growth restrictions, paved (impervious) or impediments	
Excellent	Not applicable	
Good	No impediments/open to minor or less than 10%	
Average	10% to 30% of rootzone	
Poor	30% to 60% of rootzone	
Very Poor	60% or more of rootzone – Compromised rootzone	
Compromised	Not applicable	
Canopy Impediments	Actual or potential impediment/s that effect canopy shape; not tree health	
Excellent	Not applicable	
Good	No impediments/open to minor effect less than 10%	
Average	10% - 30% effect on tree	

Poor	30% - 60% effect on tree
Very Poor	60% or more effect on tree – Compromised tree
Compromised	Not applicable

- 1 The structure rating requires a combination of two aspects, the mass of the part associated with a defect and the defect's potential to fail under normal weather conditions. Using the worst-case scenario, select the two appropriate values from the table. From these two values use 'better' value as the tree's structure rating. For example; if the failure rating of the defective part is assessed to be 'unlikely' (Average) and the size of affected canopy is '60%-80%' (Very Poor) then use the rating 'Average' as the overall rating within the assessment. Or; if the failure of the defective part is assessed to be 'Imminent' (Very Poor) and the size of canopy effected is 'less than 10%' (Good) then use the Good rating within the assessment. This is a structure rating only and does not take into account risk using target evaluation. If the tree contains multiple defects use the worst-case scenario only.
 - 2 In a group setting assess the tree's value to the group and the adverse effects to the amenity of the group if the tree were to be removed i.e. the removal of a small, suppressed tree from a group setting may have a negligible adverse effect on the group's amenity value, therefore it is likely to be assessed as 'Little value' (Very Poor).
- * Please be aware that these values may be amended from time to time.
 - * Default rating on all attributes should be Average (Average = typical or more or less expected).
- Variation – 4.10.17

Appendix C – Theatre Plan with Tree Rootzone (not to scale)



Some images may not accurately reflect the actual vegetation cover. Vegetation is plotted as accurately as possible. Unless otherwise stated, project specific vegetation only has been plotted and captured.
 Vegetation alteration/removal may be subject to resource consent requirements/conditions. It shall be the client's responsibility to determine whether or not this is the case.
 Works within the root zone of trees should be supervised by an appointed arborist.

Legend	
Trees	Root Zones
● Retain	■ Theatre Building
● Remove	■ Palisade Wall

CHARCOALBLUE
 THEATRICAL ESTE
 (INCORPORATED 1994)

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Waikato Regional Theatre
TREE LOCATION PLAN

Requested by	Date
Surveyed by J. Redfern	Dec 17
Plotted by P. van Loon	25/06/18
Checked by J. Redfern	25/06/18
Drawing number PVL-29020-01	Rev A