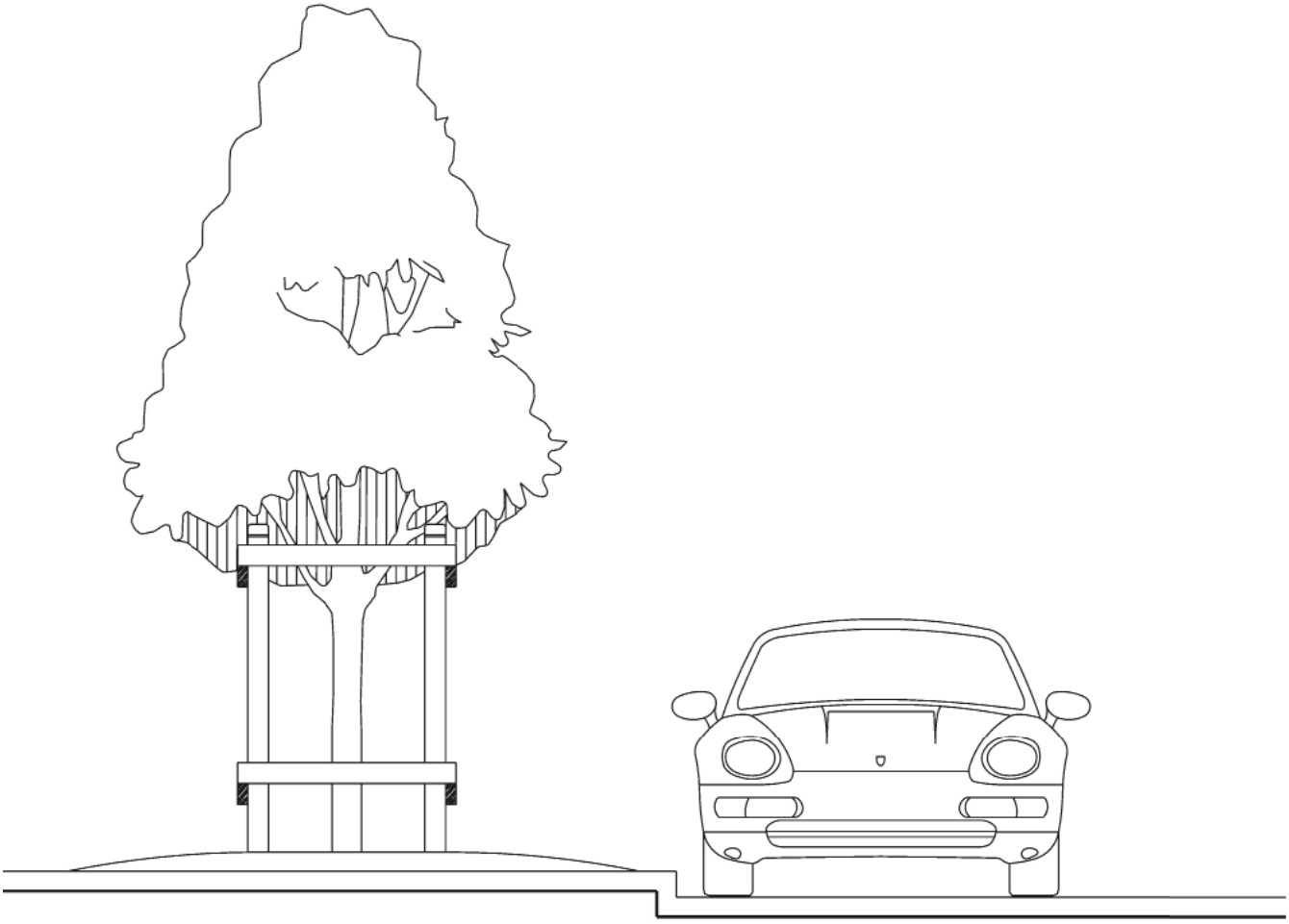
Urban Forest Technical Manual



July 2011

The City of Newcastle

Production:
The Newcastle Urban Forest Technical Manual was prepared by the Landscape Architectural Services and Asset Management Sections of The City of Newcastle.

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Version 1: July 2011

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References

Australian Standards:

AS 4970 – 2009 Protection of trees on development sites

AS 4373 – 2007 Pruning of amenity trees

AS 4419 – 2003 Soils for landscaping and garden use

AS 4454 - 2003 Compost, soil conditioners and mulches

AS 1742.3 – Traffic control devices for works on roads

AUS - SPEC

AUS-SPEC #2 Specification 305, Trenchless Conduit Installation

Tree supply standards:

NATSPEC Construction Information Guide: Specifying Trees – A guide to assessment of tree quality (2nd edition by Ross Clark, 2003)

The City of Newcastle documents:

Newcastle Urban Strategy
The City of Newcastle - Updated 2005

Newcastle Landscape Structure Plan
The City of Newcastle – 1990

Newcastle Urban Forest Policy
The City of Newcastle – 2008

Newcastle Citywide Maintenance Policy
The City of Newcastle – 2008

Newcastle Local Environmental Plan 2011 (LEP)

Newcastle Development Control Plan 2011 (NDCP)
The City of Newcastle - Version 1: October 2005
NDCP 2008 Tree Management - Section 5.03

Other documents:

Newcastle Urban Forest – Background - 2007

Soil Landscapes of Newcastle
Land and Water Conservation 1995

Statewide Best Practice Manual
Trees and Tree Root Management, Version 2 May 2003
www.statewide.nsw.gov.au

Planning for Bushfire Protection
NSW Rural Fire Service for Planning NSW 2001

Workcover:

Draft Workcover Code of Practice
Tree Work, 17th March 2008

Introduction

This manual supports Newcastle Development Control Plan (NDCP) 2011 Section 5.03 Tree Management and provides technical guidance and specifications necessary to assist in the implementation of the Newcastle Urban Forest Policy 2008, on both private and public property.

The NDCP and this technical manual are important tools that support the proactive management of all tree assets. In order to streamline the link between the DCP and this manual, sections 1 to 9 refer directly to provisions in the DCP. They should be read in conjunction with one another when preparing a proposal or determining an application.

The remaining sections of the manual are guidelines, details and specifications for the management of public and private trees across Newcastle's Local Government Area. The technical information provided supports the whole-of-life-cycle approach to the management of urban trees.

All tree works should have regard for the relevant NSW WorkCover Industry Code of Practice. These practices and standards apply to all works impacting trees.

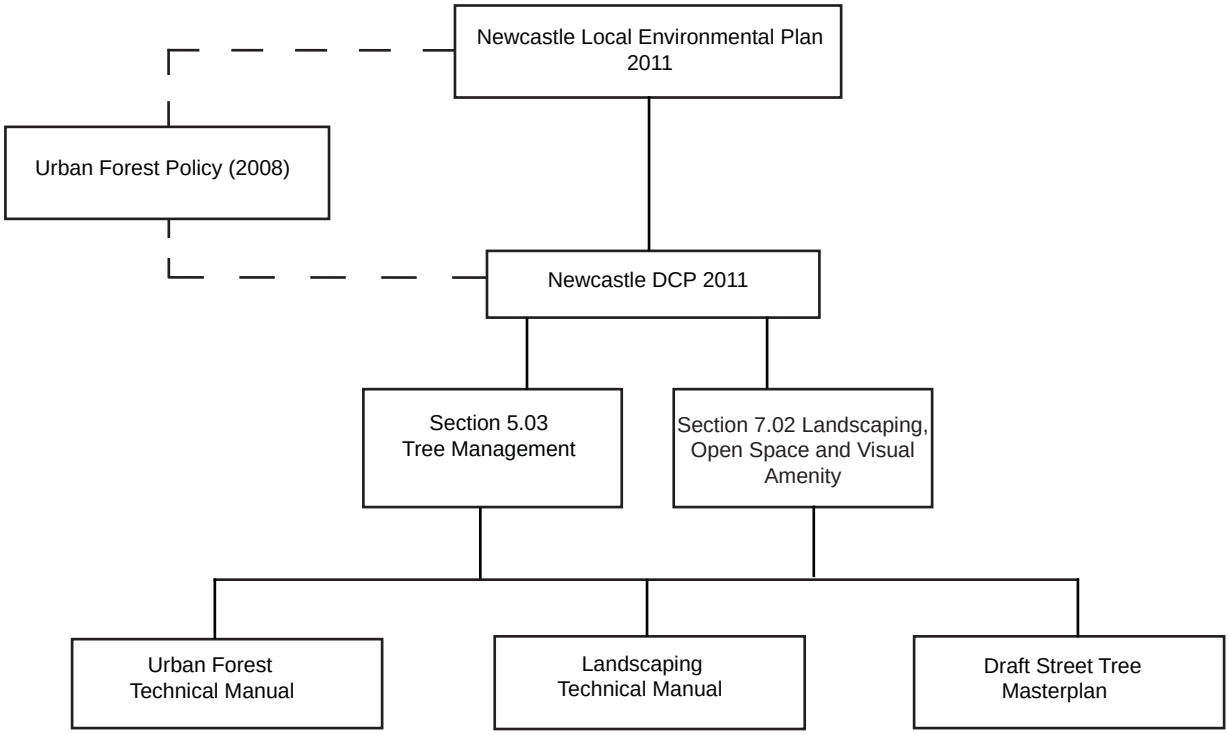


Figure 1: The City of Newcastle Document Relationship Flowchart

1.0 Undesirable species

From an urban forestry perspective, all woody species have inherent value, even those species that have some negative characteristics. For example, although Camphor Laurel is listed as 'undesirable', mature trees still provide essential shade, stormwater capture, and filter air pollution.

The urban forestry approach seeks to strategically manage 'undesirable' species by staged removal and replacement with preferred species to sustain tree canopy benefits.

Species listed in Appendix 1.1 - Undesirable Species are described as 'undesirable' due to one or more of the following:

- Seed dispersal to bushland/creek,
- Poisonous leaves, fruit or flowers,
- Root suckering,
- Garden escape,
- Non-local native species becoming an environmental weed.

Refer to Appendix 1.1 - Undesirable Species

2.0 Exempt development

2.1 Pruning as exempt development

Clause 8, schedule 1 of Newcastle's Local Environment Plan 2011 (NLEP) details circumstances under which trees may be pruned. Clause 8 should be read in full before pruning any tree. In addition to matters of heritage and threatened species, clause 8 (2) requires tree pruning to be undertaken in accordance with:

- The tree management provisions contained in Section 5.03 of Newcastle Development Control Plan 2011, and
- Australian Standard AS 4373-2007, Pruning of amenity trees.

Pruning to be undertaken in accordance with the Tree Pruning Specification included in Appendix 2 of this Technical Manual.

Refer to Appendix 2 – Tree Pruning Specification

2.1.1 Australian Standard AS4373 - 2007 Pruning of amenity trees

AS4373-2007 provides guidance on tree pruning, but does not describe how to prune a tree.

AS4373-2007 encourages pruning practices and procedures that reduce the risk of hazard development, branch failure, pathogen infection and premature tree death.

Tree work is inherently hazardous and therefore AS4373-2007 requires that pruning should be:

- Carried out by a suitably qualified person with experience in arboriculture (minimum AQF level 2 in arboriculture), **Refer to Table 1 - Australian Qualifications Framework**
- In accordance with relevant OHS guidelines.

For tree pruning to be in accordance with AS4373-2007:

1. A thorough inspection of the tree to be pruned will have been carried out by a person competent in arboricultural assessment (minimum AQF level 3 in arboriculture), and
2. The need for pruning will have been determined by the person competent in arboricultural assessment and if pruning is required, the current and subsequent pruning requirements will be specified, and
3. The specified pruning will not adversely affect the tree, and
4. All applicable planning, heritage and protected species legislation will have been considered in the context of the proposed pruning, and
5. Trees with hollows or other likely habitat will have been further assessed by an ecologist or wildlife specialist prior to pruning, and
6. The specified pruning will have been carried out by a person suitably qualified and experienced in arboriculture (minimum AQF level 2), and
7. The person undertaking the pruning will have pruned only in accordance with the specification, and
    - For dead wood pruning, the minimum diameter and location of branches removed must be specified, and/or
    - For crown thinning, the total percentage of crown to be removed and the maximum diameter and location of branches to be removed must be specified, and/or
    - For selective pruning, the branches to be removed must be specified, and/or
    - For reduction pruning, the extent of crown or limb reduction must be specified, and/or
    - For crown lifting, the clearances to be achieved and the maximum diameter and location of branches to be removed must be specified.

Lopping, topping, wound painting and flush cutting must not be specified or undertaken.

- For remedial pruning the initial and subsequent pruning events will be precisely detailed and the pruning specified as a last resort, and/or
- For pruning palm trees the disinfection of tools must be specified if there is any chance of spreading palm disease, for example Palm Wilt.

Refer to Appendix 2 - Tree Pruning Specification

NOTES

1. Tree topping and lopping are not forms or classes of pruning in AS 4373-2007.
2. NSW Work Cover Tree Work Industry Code of Practice applies to all commercial tree work including tree pruning.

2.1.2 Pruning not approved on private land

The following circumstances are not considered acceptable:

- Pruning of trees contrary to the AS 4373-2007,
- 'Topping' or tree height reduction,
- Pruning for visibility of commercial signage,
- Pruning of public trees.

2.1.3 Pruning of trees on public land

Only Council and authorities approved by Council can prune trees on public land.

Refer to Roads Act 1993, Newcastle Local Environmental Plan (NLEP) 2011 and the Local Government Act 1993.

2.2 Tree removal as exempt development

A tree may be removed from your property in some instances without the need for Council approval, other circumstances require approval.

The following information supports Newcastle LEP 2011 Schedule 1 Exempt Development, clause 9 (2b) – Tree removal. Read clause 9 in full before proceeding with tree removal as exempt development.

Trees that may be removed as exempt development meet the following criteria:

For a single trunk tree, the trunk must not be greater than 450mm in circumference at breast height (CBH)

Or;

For a multi trunk tree, none of the trunks can be greater than 300mm at CBH

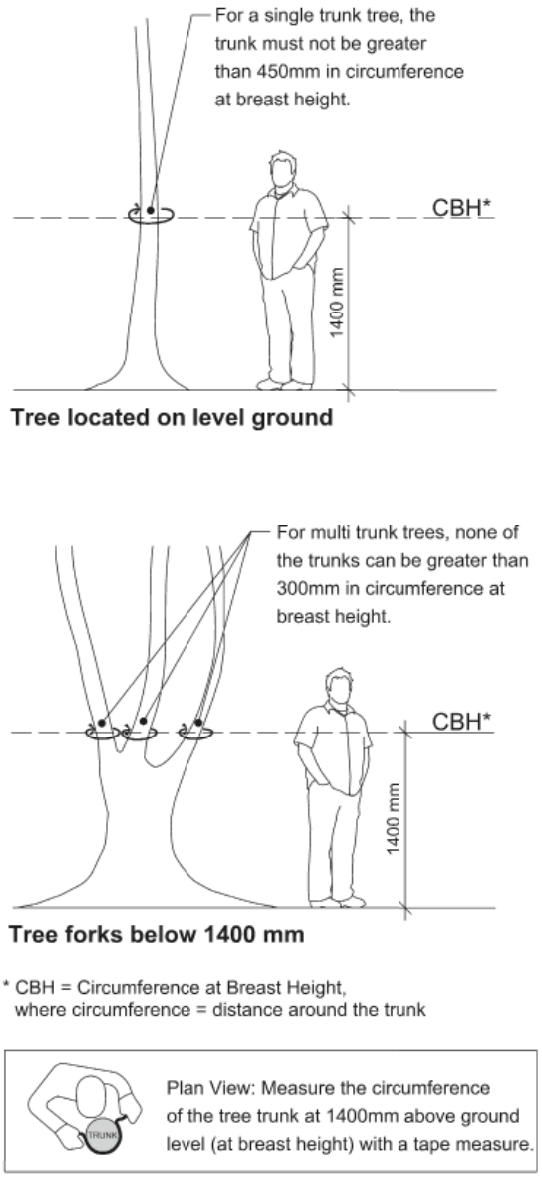


Figure 2: Single and multi-trunk trees

The following information supports Newcastle LEP 2011 Schedule 1 Exempt Development, clause 9 (2) (d) – Tree removal.

Read clause 9 in full before proceeding with tree removal as exempt development.

The tree (regardless of size) is located within 3 metres of the wall of the principal building (excluding carports, fences, retaining walls and the like, on the land on which the tree is situated or on adjacent land) when measured from the closest point of the trunk to the footing of the building. **(Refer to Figure 3 – Tree located within 3 metres of principal building)**

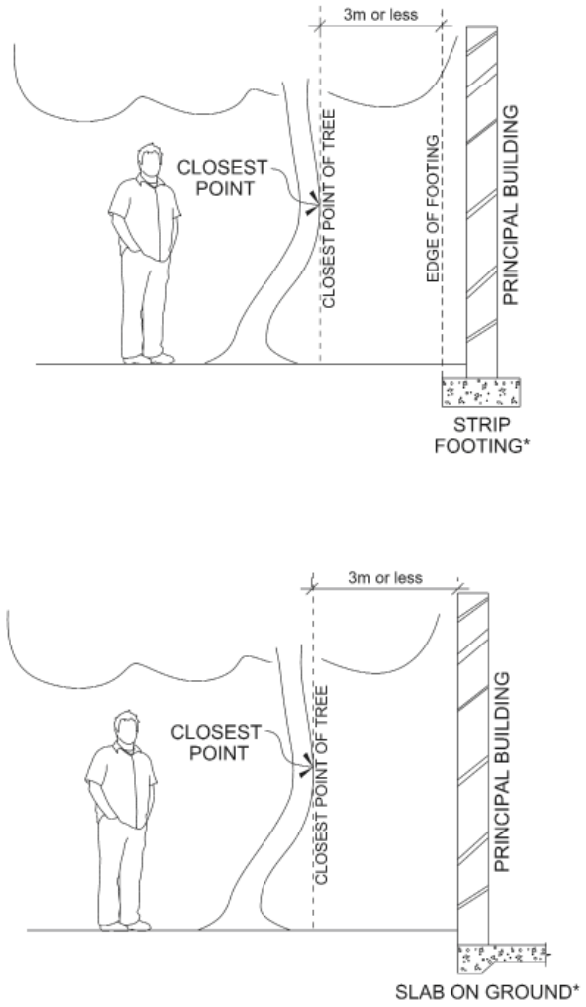


Figure 3: Tree located within 3 metres of principal building

AQF – The Australian Qualifications Framework is a national framework for education and training qualifications. It provides national recognition of competency based training on endorsed competency standards, assessed in accordance with assessment guidelines. The AQF levels and indicative employment levels for the Australian Arboricultural Industry are:

AQF	Indicative employment level
Level 2	Tree Worker
Level 3	Trade Arborist
Level 4	Supervising Arborist/ Coordinator
Level 5	Consulting Arborist/Municipal Tree Manager

Table 1 – Australian Qualifications Framework (AQF)

3.0 Complying development

Apply the following tests when considering whether a tree can or should be removed for any purpose.

The tests are to be used in determining complying development applications for tree removal and for public tree management.

3.1 Tree assessment tests

Tree removal is subject to assessment under one or more of the following tests:

3.1.1 The Unacceptable Risk Test

The tree poses an unacceptable risk that cannot be appropriately managed by arboricultural treatment, fencing, signage or other risk management measures. The level of risk must be assessed and reported by a suitably qualified arborist. Options for managing risk other than by tree removal are to be identified and reviewed.

3.1.2 The Diseased Condition Test

The tree is in a diseased condition that cannot be corrected by pruning or other arboricultural treatment. The diseased condition must be confirmed in a report by a suitably qualified arborist. Options for managing the diseased condition other than tree removal are to be considered.

3.1.3 The Property Damage Test

Public or private property (including utility services, footpaths, driveways, retaining walls and buildings) is being significantly affected by the presence/location or growth of a tree, and it is shown that tree removal is the only reasonable means to avoid further impact.

Assessment of damage must be carried out by a suitably qualified person (e.g. road/civil engineer) in consultation with a suitably qualified arborist.

3.1.4 The Suppressed Growth Test

The tree is part of a group of trees in which the spacing prevents each of the trees in the group from attaining its desired full potential. It will need to be confirmed in a report prepared by a suitably qualified arborist that the tree in question would be most beneficial to remove. This test does not apply to a traditional avenue planting of evenly spaced trees.

3.1.5 The Public Infrastructure Works Test

The tree is likely to be significantly injured or damaged as a result of public infrastructure work and it is demonstrated to be impractical to relocate or reconfigure those works to avoid such injury.

This assessment and any statements are to be made by a suitably qualified person (e.g. infrastructure designer/public works staff) in consultation with a suitably qualified arborist.

Significant injury is likely to result in tree death or in the tree posing an unacceptable risk or reducing the remaining life expectancy of the tree to less than five years.

The likelihood of significant injury must be confirmed in a report prepared by a suitably qualified arborist.

Refer to Appendix 3 - Arborists Qualifications

3.1.6 The Driveway Crossings or Works on Public Land Test

The tree would prevent the installation or essential function of a proposed driveway crossing, street awning, street balcony, or other private structure or work, where such work/structure complies with Council's design standards and other requirements, and

1. it is demonstrated that there is no reasonable alternative to removing the tree, and all reasonable alternative design considerations for the works have been considered in order to maximise the public benefits*, and

2. the Council is satisfied that the proposal would not have adverse, heritage, streetscape, pedestrian or traffic impacts.

* Public benefits include minimising driveway crossovers to maximise tree space, to retain on-street parking, and to retain safe pedestrian access.

4.0 Management of retainable trees

4.1 Management of retainable trees

Section 5.03 of the Newcastle DCP applies to all trees located on private land, on or within 5 metres of the development site.

Management of retainable trees requires that where a development proposal is likely to impact on trees on public or private land, where such does not constitute exempt or complying development, a tree retention value must be determined.
(Refer to 4.3 Exempt and complying development)

4.2 Tree retention value assessment

To establish a Tree Retention Value refer to Section 5 – Assessment of trees as part of a development application, and Section 6 - Determining tree retention values.

4.3 Exempt and complying development

Exempt and complying development is set out in the Newcastle Local Environmental Plan 2011 (NLEP 2011),
Part 2: General controls for development - Clause 10 Exempt development and Clause 11 Complying development.

5.0 Assessment of trees as part of a development application

The assessment of trees as part of a Development Application is to follow this sequence:

1. Determine the tree retention value,
2. Design for the retention of trees,
3. Explore alternative design options,
4. Determine location and species of proposed compensatory planting.

Council's preference is for new developments to incorporate retainable trees.

5.1 Determining tree retention value

Tree Retention Value is derived from a weighted combination of tree sustainability and landscape significance using a matrix. **(Refer to Figure 4: Tree Retention Values - Assessment Methodology)**

This assessment is required to identify which trees are retainable and the resulting information is used to guide the site analysis and site planning stages.

Refer to Section 6 - Determining tree retention value and Appendix 4 - Determining tree retention value.

5.2 Design for retention of trees

5.2.1 Assessment methodology

Where a development proposal is likely to impact on trees on public or private land, a tree retention value must be determined by a suitably qualified Arborist. **Refer to Appendix 3.1 – Suitably Qualified Arborist.**

Trees within 5 metres of a proposed development must be shown on the submitted development plan and will be assessed by Council in accordance with DCP Section 5.03 Tree Management.

5.3 Explore alternative design options

Alternative design options are to be considered prior to tree removal. Design to be in accordance with The City of Newcastle's Landscaping DCP 2011, and use of appropriate professional advice to design for tree retention.

Considerations include:

- minimising driveway crossover widths to retain existing trees,
- altering development footprint,
- altering hard surface design,
- utilising permeable pavement.

5.4 Determine location and species of proposed compensatory planting

Where trees on a development site cannot be retained, compensatory planting may be required. When an established tree is removed, significant growing time and resources are required to replace the canopy cover lost.

When determining compensatory tree planting, consideration must be given to:

- the relevant City of Newcastle plans and policy documents,
- the physical constraints of the site e.g. adequate space for the tree at maturity,
- the growth habits of the proposed species, e.g. crown shape and characteristics,
- the implications for neighbouring properties.

Compensatory planting should preferably be sited within the development site. Where this is not achievable, the following sequence applies:

1. Planting in the street at the front of the development site, or
2. Planting in a suitable public park or reserve determined by Council, or
3. Planting in another priority area as determined by Council.

5.5 Heritage trees

A Development Application (DA) is required to be lodged, if considering removal of a Heritage Tree. **(Refer to Newcastle LEP 2011 - Schedule 5)**

5.5.1 Heritage conservation

Trees may have historical, cultural, aesthetic and scientific value, which are representative of a particular garden style or town planning philosophy or be associated with events or persons of historical significance.

Trees may have been planted:

- by significant persons,
- to commemorate a person or persons, or significant events,
- as an example of a rare or culturally significant species.

Trees may enhance the significance or appreciation of heritage items by providing:

- an enclosed environment,
- a frame,
- a landmark, or
- a soft backdrop when viewed from a distance.

Refer to Appendix 4 – Determining Tree Retention Value.

6.0 Determining tree retention value

6.1 Determining retention value of trees

This section is a guideline only, refer to Appendix 4 – Determining Tree Retention Value for full details of methodology.

The following steps 1 through to 3 are a standardised approach for assessing the retention values of trees.

Step 1 – Assess Tree Sustainability

The health, condition and longevity of a tree increases or diminishes depending on its quality, intactness and state of maturity.

A measure of sustainability is an estimate of the relative length of time that a tree can provide amenity and other benefits.

Step 2 – Assess Landscape Significance

Make a considered evaluation of each tree's landscape significance, having regard for its environmental, heritage and amenity values.

A tree's environmental value diminishes with reduced longevity and the amenity value of a tree diminishes if it will only be maintained over a short time frame. Therefore the sustainability of a tree in the landscape is an important part of the equation and has a clear relationship with those values.

The amenity, heritage and environmental values of a tree should not be confused with the inherent values that trees provide such as shade, stormwater capture, carbon sequestration and air quality improvement. Rather, these values relate to individual trees and groups of trees in particular situations. These values vary according to the species and size of the tree and its position in the landscape.

Step 3 – Weigh Sustainability and Landscape Significance

To assess the potential impact of a development proposal, the relative contribution of individual trees and groups of trees must be evaluated and considered. To ensure a balanced decision on tree retention, these values need to be weighed up and considered together with a tree's sustainability in the landscape.

6.2 Assess tree sustainability

- Greater than 40 years,
- From 15 to 40 years,
- From 5 to 15 years,
- Less than 5 years,
- Dead or hazardous.

IMPORTANT - Sustainability must only be assessed by a person with a minimum qualification of AQF 4 in Horticulture (Arboriculture).

Refer to Table 1 – Australian Qualifications Framework (AQF).

6.3 Determine a landscape significance rating

Make an evaluation of the tree's amenity and other values to place it into one of seven categories.

Refer to Appendix 4 – Determining Tree Retention Value

6.4 Weigh sustainability and landscape significance

Weigh the sustainability and landscape significance to arrive at a retention value. These two independently assessed elements have a relationship with one another. The health, condition and longevity of a tree increases or diminishes depending on its level of intactness, quality and potential longevity.

Once there is a measure of a trees sustainability and significance in the landscape, these two factors can be weighed up using Figure 4 over-leaf which categorises the tree or trees according to its suitability or desirability for retention.

	Landscape Significance Rating						
Tree Sustainability	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Greater than 40 years	High Retention Value						
15 to 40 years			Moderate				
5 to 15 years				Low			
Less than 5 years					Very Low Retention Value		
Dead or Hazardous							

Modified by A. Morton from: Couston, Mark and Howden, Melanie (2001) Tree Retention Values Table Footprint Green Pty Ltd, Sydney Australia.

Figure 4: Tree Retention Values – Assessment Methodology

7.0 Protection measures

Tree protection to be in accordance with AS4970 2009 – Protection of trees on development sites.

7.1 Guidelines for preparing a Tree Protection Plan

Tree protection plans (TPP) are to be prepared by a suitably qualified arborist.

Tree protection measures should be applied to trees on both private and public land. Prior to preparing a TPP refer to DCP Section 5.03 Tree Management.

The DCP requires that any tree that is to be retained including any street tree that has a trunk within 5 metres of the property boundary is required to be protected during the demolition and construction phase of development.

The DCP requires submission of a tree protection plan detailing protection zones and protection measures to be submitted with the Construction Certificate application.

Tree protection plans are required for all works and activities affecting trees.

7.1.1 Preparing a tree protection plan for trees on private land

Preparation of tree protection plans for private land should be in accordance with AS4970 2009 – Protection of trees on development sites.

7.1.2 Preparing a tree protection plan for trees on public land

Preparation of tree protection plans for public land should be in accordance with AS4970 2009 – Protection of trees on development sites; however some circumstances require modification of the tree protection zone, for example trees on road verges.

Required modifications should be determined onsite by a suitably qualified arborist.

7.2 Tree protection fencing

Tree protection fencing to be in accordance with AS4970 2009 – Protection of trees on development sites.

All trees retained will require adequate protective fencing to be established prior to any tree removal works, demolition, earthworks, or construction works. The site supervisor is responsible for ensuring TPZ fencing is maintained at the required distance from the tree and kept secure to ensure no access until completion of works and rehabilitation of the site has occurred.

7.2.1 Fencing types

Tree protection fencing types to be in accordance with AS4970 2009 – Protection of trees on development sites.

7.2.2 Tree protection fencing for road verges

For trees situated within a road verge, only the verge shall be enclosed with the required tree protection fencing. Maintain pedestrian and roadway clearances for safe public use. Figure 5a and 5b indicate typical treatment, however modifications may be required.

All works adjacent to the roadway require a Traffic Control Plan as per AS 1742.3 - Traffic control devices for works on roads.

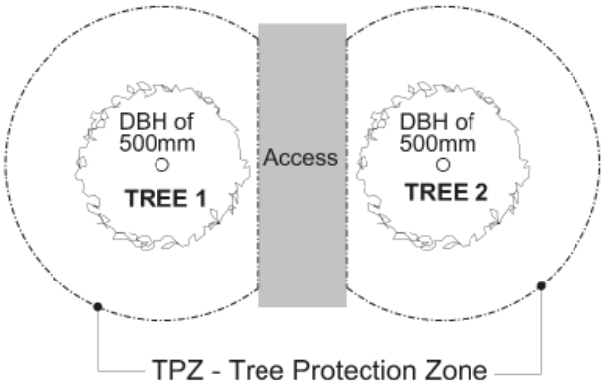
7.2.3 Tree protection fencing in parks, reserves and bushland settings.

Tree protection fencing is required for works within six metres of a park, reserve or bushland tree.

For trees in parks, reserves or bushland the TPZ is 12 x diameter at breast height (DBH).

DBH is measured at 1.4 metres above ground level.

If access is required within the TPZ, ground protection is to be provided in accordance with AS4970-2009 Protection of trees on development sites.



NOTE: A Tree Protection Plan (TPP) is required for any works within the area outlined by dashed line (e.g. DBH of 500mm requires a TPP for works within 6m or less).

Figure 5: Indicative tree protection in parks, reserves and bushland settings.

7.2.4 Tree protection signs

Tree protection signs are to comply with AS4970-2009 Protection of trees on development sites.

7.3 Trunk, branch and root protection

All trunk and branch protection on construction sites is to comply with AS4970-2009 Protection of trees on development sites.

7.4 Inspections

To ensure tree protection is in accordance with the approved Tree Protection Plan (TPP), joint inspections between the project supervisor and Council's Urban Trees Coordinator are required.

Inspections should be scheduled with Council's Urban Tree Coordinator not less than seven days prior to erection of tree protection fencing and signage.

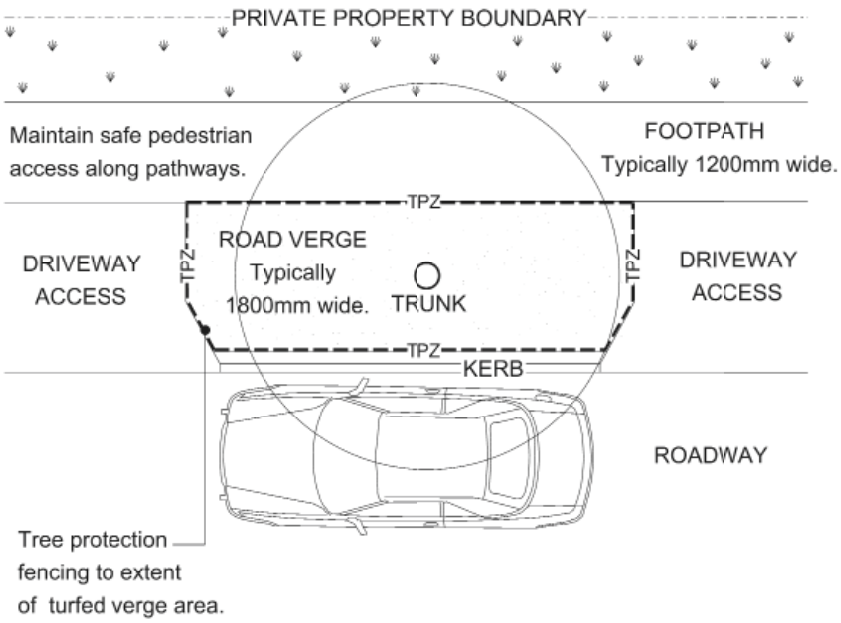


Figure 5a: Indicative tree protection on the road verge

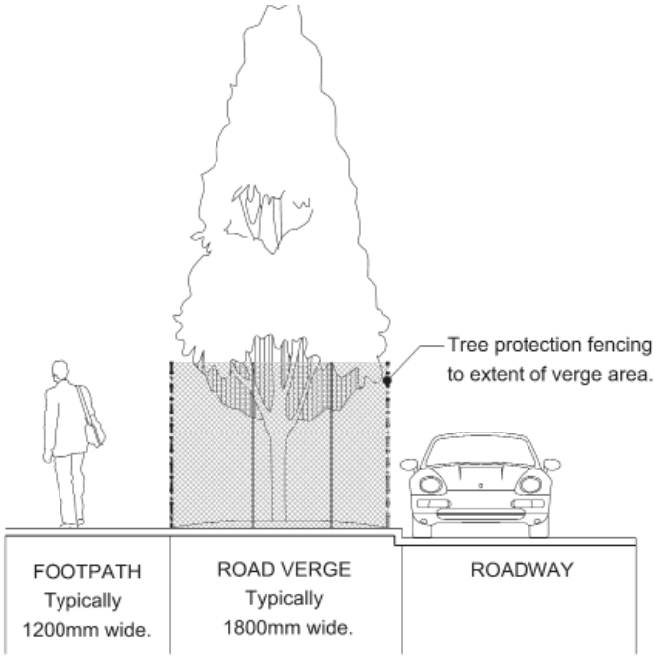


Figure 5b: Indicative tree protection on the road verge

8.0 Qualified Arborist

8.1 Arborists qualification

A suitably qualified arborist must prepare a report detailing consideration of all trees affected by the proposed development to accompany a development application (DA) or Construction Certificate (CC).

Refer to Appendix 3.1 – Suitably Qualified Arborist

8.2 Arborists report

An arborist report should include general details about the site, the purpose of the report and the specific
advice relevant to the situation.

Refer to Appendix 3.2 – Contents of an Arborist Report

Reports should use clear and precise language and consider the following:

1. be guided by theoretical and factual scientific concepts,
2. be objective and disclose any pecuniary or non pecuniary interests,
3. state findings grounded on observations and discuss the connective significance of those observations.

9.0 Greenfield Sites

9.1 Greenfield land

Greenfield land is normally undeveloped land in an urban footprint area that has been identified as being
potentially suitable for future urban, commercial or industrial development. It is generally found on the fringes of existing developed areas and may contain a large amount of existing vegetation.

For the purpose of this technical manual Greenfield sites are defined as land parcels greater than two hectares in area.

9.2 Benefits of vegetation retention

The retention and provision of vegetation on Greenfield sites provide a range of significant benefits, including;

- valuable recreational, educational and scientific resources,
- protection of habitats for native flora and fauna,
- protection of wildlife corridors,
- natural stabilisation of the soil surface,
- retention of aesthetic values,
- protection of scenic values and visual identity.

9.3 Retention of vegetation

For a site greater than two hectares, a minimum 30% of the site is to be preserved for the retention and provision of indigenous vegetation.

The total area that makes up 30% of the site is to be covered with indigenous vegetation. Provision of a single canopy layer does not satisfy Council's requirements.

Canopy, sub-canopy, shrub and groundcover layers are required to ensure coverage of the site to satisfy Council's requirements.

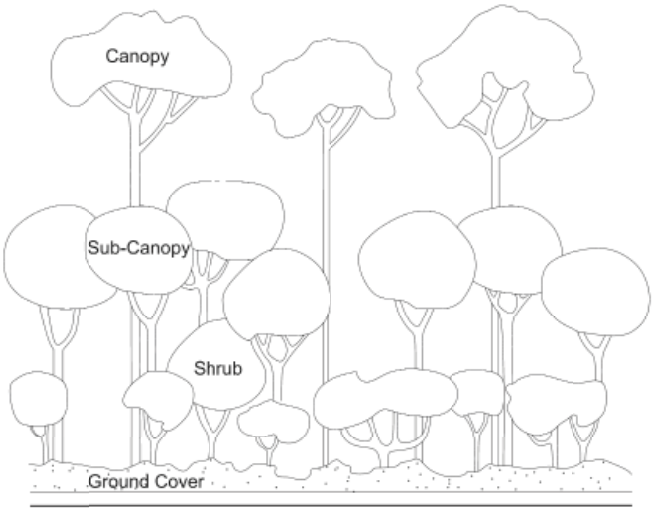


Figure 6: Example of vegetation cover required

9.4 Degraded lands

If the site is generally devoid of native vegetation or contains degraded lands, the proposal should include the restoration of this land to a minimum of 30% indigenous vegetation cover of the total site area.

9.5 Species selection

Species selection as per The City of Newcastle's Landscape Structure Plan (1990). Use a range of species from the suggested species lists in the Landscape Structure Plan.

9.6 Documentation

Areas to be retained or improved for indigenous vegetation are to be shown on Landscape Plans submitted for Development Application (DA) approval.

10.0 Management of trees on public land

10.1 Trenching

Trenching may cause damage to trees, resulting in tree death, canopy dieback or a structurally unsound tree vulnerable to collapse.

10.1.1 Trenchless techniques

Trenchless techniques provide an alternative method to open trenching for underground service installation. For new installations micro tunnelling, directional drilling, pipe jacking, impact moling and boring all reduce reinstatement work and maintain visual amenity.

Trenchless techniques require reliable location of other services and survey marks. Where high risk services are identified, consultation with the Utility/Service provider is essential.

Grassed and/or landscaped areas disturbed during trenching activities should be reinstated with the same variety of plants and/or material as that existing on site unless determined otherwise by Council's Landscape Architectural Services.

Refer to AUS-SPEC #2 Specification 305 – Trenchless Conduit Installation.

10.1.2 Underboring

Where underboring will pass within the root structure of a public tree, the minimum bore depth is to be 700mm. Where under boring or open trenching is proposed adjacent to public trees, Council's Urban Trees Coordinator is to be contacted three working days prior to commencement of works to arrange for inspection of the proposed work.

Underboring is the preferred option for installing utilities in proximity to trees. Machine excavation should cease at a distance from the tree, related to tree size. **(Refer to Table 2 – No trenching zones)**

When working within the distances prescribed in Table 2, use supervised manual excavation or directional boring.

Tree Size	Cease machine excavation
Large > 12 m height or > 500mm DBH	within 4m radius from outside of trunk
Medium 8-12 m height or 200-500mm DBH	within 3m radius from outside of trunk
Small < 8 m height or < 200mm DBH	within 2m radius from outside of trunk

Table 2: No trenching zones

10.2 Utility providers

10.2.1 Legislation

The State Environmental Planning Policy (SEPP) (Infrastructure) 2007 provides the legislative framework for the installation and maintenance of utility infrastructure.

This framework does not permit injury or damage of trees in such a way as to render them hazardous.

To reduce the potential for tree injury or failure, Council seeks utility support through:

- liaising in advance with Council's Urban Trees Coordinator,
- employing a suitably qualified arborist to supervise works in the vicinity of public trees,
- installing protective fencing to avoid damage to tree roots,
- regulate and control the use of machinery and private vehicles when operating in public open space.

10.3 Works on public land as part of development consent

To reduce the potential for damage to public tree assets adjacent to private development Council approval is required under the Roads Act.

The following may be required as part of any approval issued:

- obtain details of utilities prior to commencement of work,
- employ a suitably qualified arborist to supervise works in the vicinity of public trees,
- install protective fencing in accordance with a tree protection plan.

  Refer to Section 7 – Protection Measures,
- ensure access is maintained at all times along the footway in the vicinity of the works.

  Refer to Section 7, Figure 5a and 5b - Indicative tree protection on the road verge,
- restore any damage to public land to the satisfaction of Council following completion of the work at no cost to Council.

10.4 Tree root management

Tree roots are often blamed for cracking and lifting of adjacent infrastructure, however structures can also fail due to not being engineered to function in an urban landscape. Avoiding conflict is the most practical solution to avoiding tree root damage to infrastructure.

10.4.1 Conflict avoidance

- Select species that are best suited to the particular site,
- Investigate construction techniques and alternative pavement surfaces that will provide robust and/or flexible footpaths on soils with a high shrink/swell potential and where large trees are present,
- Investigate alternative footpath designs,
- Investigate the use of structural soils or like for incorporation as a sub-base material,

  Refer to Section 10.4.3 – Gap-graded soils
- Protect the root systems of existing trees during construction and development,
- Seek advice from a qualified arborist.

10.4.2 Alternatives to tree root removal

Based on an arborist assessment the following options may be appropriate where tree roots are conflicting with footings, kerbs, pavement and the like:

- introduce traffic calming structures near the tree,
- divert or remove the pavement or kerb alignment,
- use pier footings,
- replace the pavement with reinforced concrete,
- grinding the pavement down,
- ramping the walking surface over the roots or lifted slab with pliable paving, e.g. PermaTrak,
- routing the pathway around the tree roots,
- installation of flexible paving or wooden walkways to driveway crossovers,
- installation of root deflectors.

10.4.3 Gap-graded soils

When designing hardscape areas near trees, the Landscape Architect or Engineer should consider the use of a gap-graded soil, such as Benedict Sand and Gravel 'Smart Mix' ™ No.3 or approved equivalent.

Use of gap-graded soils allows for long term cost effective tree and infrastructure compatibility.

Gap-graded soils are particularly suited to pathway repair and replacement, new tree planting in paved areas, roads, commercial areas etc.

Refer to Appendix 7.2 - Gap-graded Soil Specification

10.4.4 Root barriers and deflectors

Installation of root barriers to the manufacturer's specification at the time of planting will assist tree roots to grow away from services, pavements and other structures.

Tree root barriers are only suitable for use in certain situations. Root directors are a second line of defence only and their installation adjacent to structures is to respond to the soil profile.

Root barriers should not be installed in such a manner as to restrict essential development of stabilising roots and essential fine roots required to sustain tree growth.

NOTE: Tree root barriers/deflectors require periodic monitoring as roots deflected downwards may return to the surface if soil oxygen levels are not sufficient to support growth at depth. Roots may also grow over the barrier in some situations.

Arborgreen 'Root Director' or approved equivalent should be installed (depending on the circumstances of the planting site, as above) in accordance with manufacturer's instructions. Ensure top of root director finishes at least 50mm below finished level of mulch.

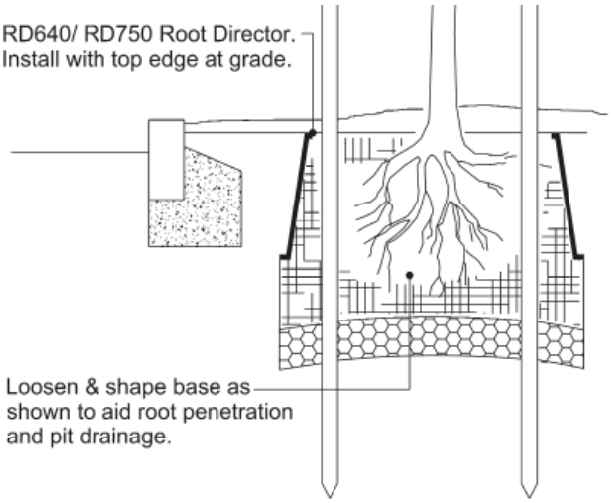


Figure 7: Root Barrier Detail

10.4.5 Removal of pavement adjacent to retained trees

Removal of existing pavement over tree roots shall include the following precautions:

- break the hardscape into manageable pieces with a jackhammer or pick and hand load the pieces onto the truck,
- the truck is to remain on undisturbed pavement and off exposed roots,
- do not remove base rock that has been utilised by established roots,
- apply untreated wood chips over the exposed area within one hour, then wet the chips and base rock and keep moist until the overlay surface is applied,
- an alternative to the severance of roots greater than 50mm diameter should be considered prior to cutting roots. If an alternative is not feasible, remove the footpath and grind roots as approved by Council's Arborist.

11.0 Design for new trees

11.1 Site Investigations

11.1.1 Tree survey and assessment

A survey and assessment of all site trees, street trees and any tree within 5m of the site boundary is required.

The survey and assessment shall include:

- Surveyed tree location,
- Species,
- Size,
- Dripline area.

11.2 Design guidelines

11.2.1 NDCP Landscaping Technical Manual

This Urban Forest Technical Manual should be read in conjunction with the NDCP 2011 Landscaping Technical Manual with regards to design decisions.

11.2.2 Newcastle Urban Forest goals

Site design should support the goals of the Newcastle Urban Forest Policy 2008.

11.2.3 Energy smart principles

Streets and other spaces can be designed to contribute to solar efficiency, chiefly through the selection and location of trees.

In Newcastle's temperate climate deciduous trees can make the greatest contribution to micro-climate management, by providing shade in summer and allowing sunlight to penetrate in winter.

Select plantings with low maintenance and low water consumption once established. Minimise the removal of vegetation from the site to optimise existing canopy cover and reduce impacts of erosion.

The retention, regeneration or planting of trees will also reduce stormwater flows by maximising infiltration, interception of overland flow and transpiration.

11.2.4 Designing for solar access

Select deciduous trees for solar efficiency where shadows may impact housing.

Plant taller tree species on the northern side of East-West aligned streets; shorter or more shade tolerant species on southern side.

11.3 Bushfire hazard and asset protection

Planning for bushfire protection may require selective removal of trees and the use of less flammable species for new tree planting.

Refer to Planning for Bushfire Protection (NSW Rural Fire Service for Planning NSW 2001) and Section 4.02 Bush Fire Protection of NDCP 2011.

11.4 Location of trees

11.4.1 Site planning

Site planning and design should ensure suitable offsets between trees, utilities and structures to avoid compromising the longevity and health of the tree.

Where practicable, trees should not be planted where they might interfere with underground or overhead services. In some circumstances Council may deem there is no other appropriate site and the planting of an appropriate tree would provide a benefit to the community.

11.4.2 Crown space and root volume

Providing adequate quantity and quality of root growth space is the key to preventing impacts of trees on structures and structures on trees.

Species selection should match the available space. It is also important to know how the root systems of different species develop normally and how they are affected by soil conditions.

Refer to 13.2.2 Calculating gap-graded soil volume

11.5 Clearances

11.5.1 Clearances from utilities

The following steps are required when working in proximity to utilities:

1. Locate public and/or private services (Dial Before You Dig on 1100),
2. Define setbacks for trenching and excavation near trees to be retained,
3. Inspect with a suitably qualified Arborist,
4. Ensure proper compaction of trenches.

11.5.2 Clearances from street fixings

Trees should be selected and located to provide the clearances indicated in Table 3 below:

Site Constraint	Nominal Clearance
Spacing between trees	8m - 10m subject to mature size
Street intersection	10m from intersection of kerb line
Driveway	3m from edge of driveway
Power or light pole	5m from centre of pole
Overhead electrical service to individual properties.	2m clearance either side of overhead wires
Storm water inlet	2m from edge of inlet
Major underground service junction	3m from edge of junction box
Bus stops	8m on the approach and 3m on the departure.
Traffic lights	10m from pole of traffic lights
Kerb and gutter	0.5m minimum from top of kerb

Table 3: Clearances from infrastructure to new tree planting

Refer to Appendix 6 - Best Practice Guidelines

11.6 Designing infrastructure compatible with trees

Early tree assessment provides an opportunity to design the building footprint and construction details to accommodate trees, which add character, shade, shelter and value to a development.

Generally designs that utilise the following elements are more considerate of trees:

- Pier and beam construction rather than strip footings,
- Lightweight fences with post and pad footing,
- Boring of services rather than trenching,
- Natural batter slopes rather than cut and fill.

Trees should not be planted at a site if there is insufficient root space for healthy and stable tree growth or if there is insufficient soil or the soil is affected by gas or disease.

11.7 Tree species selection

Species selection as per The City of Newcastle Street Tree Masterplan. Species selected should be the largest, longest living species, that are cost effective for the particular site.

The specific requirement of the individual planting site determines the appropriate species to select, with emphasis on biological tolerances, character, uniformity and levels of maintenance.

Species considered a noxious weed, undesirable or an environmental pest must not be used.

Refer to Appendix 1.1 - Undesirable Species

11.7.1 Character of area

For new street tree plantings the species selection will be determined by the Street Tree Masterplan.

Whilst replacement trees in an established street planting will generally be the same species as existing plantings; the Street Tree Masterplan must be referenced to determine the nominated species for the street. Any clarification is to be sought from Council's Landscape Architectural Services.

11.7.2 Pest and disease susceptibility

Where a pest or disease is known to affect the health and longevity of a particular species in the local tree population, that species should be avoided, or measures taken to ameliorate the potential impacts.

Refer to Appendix 1.2 - Common Tree Pests and Diseases

12.0 Supply of trees

12.1 National specification for supply of trees (NATSPEC)

Obtaining quality trees is important to achieving consistent citywide tree plantings, superior tree growth and managing future risk.

NATSPEC Construction Information Guide: Specifying Trees – A guide to assessment of tree quality (2nd Edition by Ross Clark, 2003) provides industry recognized standards and specifications for tree supply.

Council will only accept NATSPEC certified trees for planting:

- as a street tree within the City road reserve or other public land,
- for Category 2 and 3 developments. **Refer to NDCP 2011 Section 7.02 Landscaping, Open Space and Visual Amenity.**

12.2 Supply and delivery of stock

The following steps should ensure that quality trees are available to the Contractor at the time of planting:

1. Prior to ordering and on delivery to site a suitably qualified person is to inspect a representative sample of each batch of trees to comply with NATSPEC.

   This must include:
   - above-ground assessment,
   - below-ground assessment,
   - complete a tree balance assessment,
   - root growth characteristics assessment,
   - written evidence provided to Council's Landscape Architectural Section or the City Arborist in accordance with NATSPEC prior to tree planting.

2. Prior to delivery of tree stock (100 litre pot size or more) the nursery is to mark orientation of north on the side of the pot as grown. Trees to be orientated in the same direction at planting.

3. At the time of delivery ensure safe loading and handling procedures and transport in a covered vehicle to avoid damage and stress to stock.

12.3 Planting by a landscape contractor

All landscape works are to be undertaken by a Landscape Contractors Association (LCA) or an Australian Institute of Landscape Designers and Managers (ALIDM) affiliated contractor with demonstrated experience in the installation of soils, tree handling, planting and establishment of advanced trees.

12.3.1 Optimal planting season

Successful tree planting depends on the ability of the tree to rapidly initiate root growth.

Planting should occur in autumn (March to April) when lower air temperatures greatly reduce the stress on the newly planted trees and soil temperatures are the highest for the year to encourage root activity.

Summer planting is not recommended due to increased resource requirements, e.g. irrigation.

13.0 Site preparation

13.1 Soils

The properties of the growing media directly influence the growth of trees. Physical attributes of the soil affect the availability of water and the levels of oxygen in the soil. Chemical attributes influence nutrient availability.

Typically urban soils have been highly disturbed and compacted and require remediation. Soil testing will determine the type and extent of remediation required.

13.1.1 Evaluating and testing In-situ soils

Trees should be planted into in-situ soils wherever possible. In situations where the existing site soil is deemed unsuitable for the intended use by testing and cannot be appropriately remediated, alternative solutions should be investigated.

During project design and planning the following is required:

- A landscape plan that incorporates soil remediation measures,
- Full Physical and Chemical Tests to be undertaken by a National Association of Testing Authorities (NATA) laboratory.

13.1.2 Types of imported soil media

Imported soil media is to meet the performance specification provided in Appendix 7.1 of this Manual, and be supplied in accordance with Australian Standard AS 4419 - 2003.

Refer to AS 4419 - 2003 Soils for landscaping and garden use

13.1.3 Soil samples

Soil samples to meet AS4419 – 2003, Soils for landscaping and garden use.

Separate soil tests are to be carried out for all imported soil mixes. A sample of proposed soil mix, including full soil analysis details, to be available on request to Council or an Accredited Certifier for approval prior to installation. The contractor is to undertake all necessary remediation measures recommended from the soil laboratory results.

13.2 Load bearing soils

Load bearing soils are a manufactured soil system that can tolerate compaction by heavy pedestrian or vehicle activity. Currently the following load bearing products are acceptable for use within Newcastle's LGA in accordance with the products manufacturer's specifications:

- Gap-graded soils - Benedict Sand and Gravel Smart Mix™3 or approved equivalent.
- Structural cells – Rootcells or approved equivalent.

13.2.1 Gap-graded soil

Gap-graded soil shall be equivalent to the specification for Benedict Sand and Gravel, SmartMix™3 40mm Structural Soil Mix Product Data Sheet. If sourced from an alternative supplier a sample of the filler soil and additives shall be tested for compliance by a NATA accredited laboratory and results submitted to Council's Landscape
Architectural Services prior to installation for approval.

Refer to Appendix 7.2 - Gap-graded Soil Specification

Install 20mm GMB20 base to a minimum depth of 150mm over the finished surface of the gap-graded soil in accordance with the specification provided.

Refer to Appendix 7.3 - GMB20 Base Specification

13.2.2 Calculating gap-graded soil volume

Soil volume required for root growth in gap-graded soils is calculated as per Cornell University - Using CU-Structural Soil ™ in the Urban Environment 2005.

Crown Projection (CP) = πr^2
Crown Projection x 0.6 = Soil Volume (m^3)
π = 3.142

Example: A mature Tuckeroo with an average radius of 4 metres.

CP = π x $(4m)^2$ = 50m2
X 0.6m = $30m^3$

Crown projection is the mature canopy spread for that particular species. Crown projection is to be calculated by a suitably qualified arborist.

13.2.3 Structural cells

Structural cells are placed beneath the hardscape in landscaped areas to improve the volume of soil available for root development. Each planting location is different and the soil volume required varies depending on site conditions and the mature size of the tree species planted.

It is recommended that structural cells are utilised for smaller species of trees and are designed and installed as per the manufacturers specifications.

The soil specification for the chosen product should be reviewed by a NATA accredited soil laboratory and changes made to suit the chosen species.

13.2.4 Calculating structural cells area

The Structural Root Zone (SRZ) is the area required for a trees stability.

Structural cells are required to accommodate the estimated mature SRZ of the proposed species as a minimum. The SRZ is determined as per AS 4970 - Protection of trees on development sites.

The required structural cell volume is to be calculated by a suitably qualified Arborist or Landscape Architect.

Refer to Appendix 3.1 – Suitably Qualified Arborist

13.3 Soil additives at planting

A soil conditioner such as Terracottem ® or approved equivalent to be used in all tree planting. Apply in accordance with manufacturer's recommendations.

13.4 Use of fertilisers

Fertilisation of trees shall only occur where a soil nutrient deficiency affecting the performance of a tree is identified and the tree is to be retained. Where poor tree growth is identified as being nutrient related, the appropriate use of the species will be reviewed. **(Refer to Section 15.4.5 Fertilising)**

13.5 Placement of imported topsoil

Prepare subsoil by lightly fracturing then spread topsoil to required depth. Avoid subsidence and excess compaction. (Refer to 15.4.6 – Aeration of Compacted Soil) Achieve a finished topsoil surface which has the following characteristics:

- finished to design levels, smooth and free from stones or lumps of soil,
- graded to drain freely, without ponding,
- finish flush with adjoining ground surfaces,
- allow for the depth of mulch as required.

(Refer to Section 14.8 – Mulching)

13.6 Drainage

Drainage to be checked prior to tree planting by conducting the following infiltration rate (percolation) test:

Percolation Rate Test: Fill the planting hole with water and measure the depth of water and note time for the hole to drain. Calculate the average water level drop per hour. If the Percolation Rate is less than 5cm per hour implement one or more of the following subsoil or subsurface drainage measures:

13.6.1 Subsoil/subsurface drainage

One or more of these options may be considered to ensure planting holes are free draining:

- Ag-pipe: install slotted, flexible 100mm PVC pipe and fittings minimum to AS 2439.1 Perforated plastics drainage and effluent pipe and fittings. Install 5-7mm drainage gravel filter material around Ag-pipe,
- Line flushing points: provide flushing inlets and approved surface covers to permit flushing of subsoil drainage lines,
- Auger drain holes: to the bottom perimeter of the planting pit, a minimum of six that are 10cm in diameter, 60cm deep and filled with sand or fine gravel.

13.6.2 Aeration tubes

Aeration tubes may be installed when trees are being planted within hard surface areas such as pavement or roadways to ensure adequate oxygen is available for root growth.

Install Arborgreen Root Rain System or approved equivalent around the root system and in accordance with manufacturer's instructions.

Note that:

- The pipe is set at least 100mm-200mm below surface level,
- The pipe inlet is to be flush or slightly proud (25mm maximum) of the final surface levels,
- The pipe ends should be wrapped with filter fabric to stop rubbish entering the pipe,
- Use a heavy duty cap in busy public or vandalism prone areas. The pipe cap is to be visible from ground level,
- This pipe is for aeration only. Water must be applied to general rootball and NOT directly down the aeration tube. **(Refer to Section 15.4.1 - Watering)**

14.0 Tree Planting

14.1 Water prior to planting

Thoroughly water the rootball of container stock at least twelve (12) hours prior to planting.

14.2 Moving stock

Move larger trees to required planting hole by slinging under the rootball. Do not place sling around trunk.

14.3 Planting the tree

To prepare the rootball for placement in the planting hole:

1. Remove tree from the container, ensuring minimal disturbance to the rootball,
2. Root prune trees over 25 litre pot size with a clean blade. Shave 1-2cm from the outside of the rootball,
3. Place the tree plumb in the centre of the hole and orientate north as marked at the nursery.

14.4 Height of rootball

The eventual position of the top of the rootball is to be 0 - 20mm above the finished ground level to allow for initial settling. For gap-graded soil the tree should be planted at level grade. Ensure there is no backfill placed over the top of rootball.

14.5 Backfilling the hole

1. Backfill the hole halfway to its final filling requirements with original subsoil or imported soil (B Horizon),
2. Gently tamp out air pockets by adding approximately 5cm of water and allow to drain,
3. Fill the rest of the hole to grade with original topsoil or imported soil (A Horizon),
4. Construct a soil berm as detailed below, fill with water and let drain.

14.6 Soil watering berm

1. Form a soil berm 60-80mm high at the outermost edge of the rootball,
2. Ensure edge of berm overlaps top of rootball,
3. Gently fill inside of soil berm area with water at completion of each tree planting,
4. The soil berm is to be maintained intact for the duration of the Tree Establishment Period.

(Refer to Section 15.2 – Practical completion report)

14.7 Irrigation and aeration

Install irrigation and aeration as required.
Refer to Section 15.4 Establishment and maintenance works.

14.8 Mulching

Mulch is beneficial to tree planting as it retains moisture and inhibits weed growth while providing organic matter and nutrients for plant growth.

Mulch should be placed at a maximum depth of 75mm. If mulch is placed too deep (greater than 100mm) it can have negative effects including the suppression of oxygen and the prevention of surface water reaching soils and roots, inhibiting plant growth.
Refer to Figure 8 below for Correct Mulching Method diagram.

Supply mulch in accordance with AS 4454 - 2003 Compost, soil conditioners and mulches.

For trees in parks and grass verges provide a mulched bed around the tree, to prevent damage from mowing and pedestrian or vehicle movement. Mulch should be spread to the extent of the dripline as the tree grows.

Ensure mulch is placed at least 100 – 200mm clear from the base of the tree trunk.

Figure 8: Correct Mulching Method

14.9 Gravel mulch

Council prefers use of organic mulch as per AS 4454 - 2003 Compost, soil conditioners and mulches.
If gravel mulch is accepted as appropriate during the Development Application process, a 50 mm layer of gravel is to be used. Average gravel size to be 5mm to 10 mm. Top up areas of excessive wear.

14.10 Staking and tying

NATSPEC trees should not require staking. Some urban environments, e.g road verges, may require staking for protection during establishment. If staking is required, obtain approval from Council's Landscape Architectural Services.

14.11 Edging

Edging is recommended to define mulch and turf areas. Edging should be installed flush with the surrounding surface to avoid a trip hazard.

Refer to Appendix 8 - Tree Planting Details

14.12 Tree guards and grates

Street trees in pavement should be installed with a timber or a steel tree-guard (and grate if required) in accordance with Council requirements. Tree guards may be required when planting in public parks.

In addition shade cloth may be required in high wind or coastal situations.

Refer to Appendix 8 - Tree Planting Details

15.0 Establishment and maintenance

15.1 Inspections

Joint inspections of tree installation and associated works on public land, between the Project Arborist and Council's Landscape Architectural Services are required at the time of:

- Confirm NATSPEC documentation complies with stock delivered to site,
- Set out and placement of plant materials,
- Tree pits ready for backfilling,
- Completion of planting, guards and mulching,
- Periodic inspections during the tree establishment and maintenance period,
- Confirm completion of works and hand over tree asset to Council.

15.2 Practical completion report

A Practical Completion Report is required to be submitted to Council for all tree planting or tree retention works on public land as part of a Development Approval, Complying Development Certificate or other Council approval.

Rejected works to be rectified to the satisfaction of the Council.

On completion of rectification works a final Practical Completion Report is to be sent to Council's Landscape Architectural Services.

A fifty two (52) week Tree Establishment and Maintenance Period will commence at the time Council advises Practical Completion has been achieved.

Refer to Appendix 9.1 Practical Completion Report Form

15.3 Tree establishment requirements

The Establishment Maintenance Period is to ensure successful establishment of a healthy and vigorous tree.

A bond or bank guarantee may be required by Council to ensure quality tree establishment is completed.

Keep a log book of all works. The log book must be available on Council's request and include the time and date of visit, name of the person in charge of the site, the duration of site visit and works carried out.

The following activities are essential for successful tree establishment and are required for satisfactory sign-off as part of the Practical Completion Report.

- Watering to ensure optimum moisture to the rootball and the surrounding soil,
- Weeding to control weed competition,
- Rubbish removal to avoid damage and maintain a clean and tidy appearance,
- Fertilising to maintain healthy growth **(Refer to Section 15.4.5 - Fertilising),**
- Protection of trees from insect pests and diseases. **(Refer to Section 11.7.2 - Pest and disease susceptibility),**
- Tree replacement to maintain the required number and type of trees, including replanting of failed, damaged or stolen trees,
- Reinstatement of mulch to required depths,
- Formative pruning in accordance with AS 4373 - 2007 Pruning of amenity trees.

15.4 Establishment and maintenance works

15.4.1 Watering

Newly installed trees, including drought tolerant species, are dependent upon watering or irrigation until established, typically for two years.

The watering regime should be based on regular soil moisture testing.

Variable soil type and extreme weather conditions may require more or less water than outlined below:

1. Directly after planting fill the soil berm with water, repeat to ensure saturation of the rootball,
2. Apply 1 litre of water per litre of container volume directly to the rootball (within the soil berm), twice per week for the first 8 weeks, e.g. 100 litres of water to a 100L size rootball,
3. Continue watering as required to maintain optimum tree growth,
4. Monitor trees for signs of wilt and adjust water accordingly.

15.4.2 Mulching

Ensure mulch is replenished as required to maintain cover and depth specified at time of planting.
(Refer to Section 14.8 Mulching)

15.4.3 Tree pruning

Refer to Section 2 - Exempt development.
Refer to Appendix 2 - Tree Pruning Specification.

15.4.4 Mowing

Turf is not recommended under trees as it competes with the tree for water and nutrients. Mulching is the preferred treatment.
(Refer to Section 14.8 - Mulching)

15.4.5 Fertilising

Fertilising mature trees is not necessary if appropriate soil conditions are provided.

Fertilising may be specified for trees that will be affected by disturbance or a modified environment.

Benefits gained from the increase stored resources may aid the tree to overcome the stress caused by future disturbances.

Fertilising should be by subsurface injection for young trees; 60 cm out on young trees and at 1m grid intervals out to the dripline. Specific situations may justify other variations such as vertical mulch, soil fracture or surface-broadcast methods.

Unless specified otherwise, fertiliser should be a slow release, complete fertiliser with chelate trace elements and mixed at label rates. Extraordinary cases may require soil and tissue sampling to correctly target deficiencies.

15.4.6 Aeration of compacted soil

Soil that is damaged or compacted within the dripline of a tree can be loosened or aerated by:

- Vertical mulching: Auger holes 5 to 10cm diameter, 60 to 90cm deep at 1.2m centres and backfilled with porous material,
- Radial trenching: with an air excavator, excavate a soil trench to 7-15cm deep approximately 1m from the trunk out to the dripline area. Repeat with next trench starting 30cm apart at the closest point to the trunk,
- Soil fracturing with a pneumatic air-driven device,
- Subsurface injections under moderate hydraulic pressure using a 1m probe and applied on 1m centres under the dripline.

15.4.7 Weed management

Ensure the tree planting pit and adjacent mulch areas are free of weeds for the entire Tree Establishment Period.

Refer to NDCP 2011, Section 7.02 Landscaping, Open Space and Visual Amenity for Landscape Maintenance requirements.

15.4.8 Pest and disease management

Refer to Appendix 1.2 - Common Tree Pests and Diseases

Conditions that increase the risk of pest and disease attack in trees include:

- Compacting of the soil within the dripline,
- Imported fill,
- Roto-tilling, trenching or removing soil from the tree root area,
- Excessive or regular watering on or near the tree trunk area,
- Planting incompatible water loving plants within the dripline,
- Contaminated mulch.

Pest and disease problems can be reduced through:

- Use of mulch that is free of deleterious and extraneous matter in accordance with AS 4454 - 2003 Compost, soil conditioners and mulches,
- Placing mulch well clear of plant stems,
- Use of certified growing media,
- Use of certified plant material. Request certificate from Nursery supplier to certify disease free stock,
- Avoiding compaction,
- Aerating compacted soil.

15.4.9 Insect control

Generally, insect populations do not threaten tree health to the point of mortality. More often, when their populations become too great they create a nuisance.

Notify Council of any pests and diseases found.

For insect control consult an arborist or licensed pest control operator.

Glossary

Amenity: is the term used to describe the features, facilities or services that make for a comfortable and pleasant life. Amenity is not only enjoyed by residents in their homes and gardens but also in the street and public places.

Arborist: a person who holds the Australian Qualifications Framework (AQF) 5 Diploma in Horticulture (Arboriculture) or AQF 4 Certificate IV in Horticulture (Arboriculture) and is enrolled in the NSW TAFE AQF 5 Diploma in Horticulture (Arboriculture) course.

Canopy cover: refers to the total area contained within the vertical projection of the periphery of tree crowns (or other over storey). It provides an indicator of the quantity of urban forest, and its capacity to provide ecological, economic, social and aesthetic benefits.

Circumference breast height: the girth of the supporting stem of a tree at a height of 1.4m above ground level measured at the trunk centre, and so as to contain the outermost projection of any flanges or buttresses.

City arborist: person designated as such by The City of Newcastle.

Compensatory planting: tree planting required offsetting the loss of retainable tree canopy.

Council: The City of Newcastle.

Crown: portion of the tree consisting of branches and leaves and any part of the trunk from which branches arise.

Crown Size/Crown Projection: is the size of the tree canopy. An equation is used to work out the crown size. Crown size (m) = πr^2 where r equals the average distance to canopy dripline.

Compaction: compression of the soil that creates an upper layer that is impermeable.

DBH (Diameter at Breast Height): the diameter of the tree trunk at 1.4m above natural grade.

Development Control Plan (DCP): a policy document that provides more detail than contained in a local environmental plan. DCPs are prepared under Section 72 of the Environmental Planning and Assessment Act 1979. The provisions of the DCP are guidelines that shall be considered by the Council when it determines a development application.

Exotic: not locally indigenous.

Gap-graded soil: a mix of 40mm crushed basalt aggregate, filler soil and other additives to meet specification supplied. Components are thoroughly pre-mixed before placing in trench.

Hazard: anything with potential to harm health, life or property.

Infiltration: the practice of discharging drainage water into the ground soil matrix.

Injury: in relation to a tree, means a wound resulting from an activity, including but not limited to excessive pruning, cutting, trenching, excavating, altering the grade, paving or compaction within the tree protection zone of a tree. Injury includes bruising, scarring, tearing or breaking of roots, bark, trunk, branches or foliage, herbicide or poisoning, or any other action foreseeably leading to the death or permanent damage to the tree health.

Manual: the technical manual/s that support NDCP 2011.

Native: all plant species indigenous to the Lower Hunter Region.

NLEP: the Newcastle Local Environmental Plan (NLEP) is a city wide plan covering the entire local government area. The plan anticipates social and economic trends as well as the need to protect the environment. The LEP is prepared by Council and approved by the Minister for Planning and Infrastructure.

Project Arborist: a suitably qualified arborist retained by a property owner or development applicant for the purpose of overseeing on-site activity involving the welfare of the trees to be retained. The Project Arborist shall be responsible for all reports, appraisals, tree preservation plans, or inspections as required.

Property: refers to any infrastructure (e.g. underground water/sewer pipes, electrical cables etc) and structural elements on private land. Structural elements include driveways, and walls which are retaining devices only.

Public tree: any tree species growing on public land of any size.

Removal: complete tree removal such as cutting to the ground or extraction of the tree or taking any action foreseeably leading to the death of a tree or permanent damage to its health or structural integrity, including but not limited to excessive pruning, cutting, girdling, poisoning, over watering, unauthorized relocation or transportation of a tree, or trenching, excavation, altering the grade, or paving within the drip-line of the tree.

Risk: the chance of injury, loss or damage to property, a person, organisation or the community measured in terms of consequences and likelihood.

Risk management: is the process of identifying, analysing, evaluating, monitoring and communicating risks in a way that minimises losses and maximises opportunities. It is described generically in AS/NZS 4360:1999 Risk Management.

Stormwater: the runoff from rainfall events.

Streetscape: the form, character and visual amenity of the street environment.

Street tree: any publicly owned tree, shrub, or plant growing on road reserves.

Structural soil: see Gap-graded soil.

Suitably qualified person: a person with appropriate level of skills and formal training in a particular field relevant to a particular situation or works, such as a structural engineer who is required to assess structural works, a civil engineer required to assess road works.

Topping: a poor maintenance practice of cutting back large diameter branches or truncating the main stem.

Tree Protection Plan (TPP): a plan prepared by a suitably qualified arborist that outlines measures to protect and preserve trees.

Tree Protection Zone (TPZ): is a determined area of ground under a significant tree that is to be fenced off during the development of a site to ensure that activity does not cause damage to the tree or its root system.

Trenching: any excavation to provide irrigation, installation of foundations, utility lines, services, pipe, drainage or other property improvements below ground.

Urban forest: the totality of trees and shrubs on all public and private land across Newcastle's LGA, and is measured as a canopy cover percentage of the total area.

Urban Forest Technical Manual: produced by The City of Newcastle to supplement section 5.03 Tree Management of the Newcastle DCP 2011 by providing technical information for the design, implementation and management of tree planting in our local area.

Verge: the part of the street reserve between the carriageway and the boundary of adjacent lots (or other limit to street reserve). It may accommodate public utilities, footpaths, stormwater flows, street lighting poles and planting.

Vertical mulching: auguring, hydraulic or air excavation of vertical holes within a trees root zone to loosen and aerate the soil, typically to mitigate compacted soil. Holes are typically penetrated four to six feet on centre, two to three feet deep, two to six inches in diameter and backfilled with either perlite, vermiculite, peat moss or a mixture thereof.

Weed: a plant that survives in an area where it is or where it has the potential to be harmful or troublesome to the environment or desired land use.

Appendices

APPENDIX 1 - UNDESIRABLE SPECIES

APPENDIX 1.1 - UNDESIRABLE SPECIES

Scientific Name	Common Name	Notes/Exceptions	Principal Reason
Acacia baileyana	Cootamundra Wattle		Native species but an environmental weed when planted outside its natural habitat range
Acacia salignus	Golden Wattle		Native species but an environmental weed when planted outside its natural habitat range
Ailanthus altissima	Tree of Heaven		Invasive (seed)
Albizia lophantha	Cape Wattle		Invasive (seed)
Chamaecytisus palmensis	Tree Lucerne		Invasive (seed)
Chrysanthemoides monolifera	Bitou Bush		Invasive (seed)
Cinnamomum camphora	Camphor Laurel	Except where the tree height exceeds 10m or the trunk diameter at 1.4m above ground level exceeds 450mm.	Invasive (seed)
Citrus spp	Citrus		Susceptibility to pest invasion.
Cotoneaster spp	Cotoneaster	All species	Invasive (seed)
Erythrina x-sykesii	Coral Tree		Brittle structure
Ficus elastica	Rubber Tree		Invasive roots
Gleditsia triacanthos	Honey Locust	Not grafted horticultural cultivars	Root suckering
Ligustrum spp	Privet	All species	Invasive (seed)
Nerium oleander	Oleander		Toxicity
Pyracantha spp	Firethorn	All species	Invasive (seed)
Robinia pseudoacacia	Black Locust	Not grafted horticultural cultivars	Root suckering
Salix spp	Willow	All species	Invasive & root suckering
Schefflera actinophylla	Umbrella Tree		Invasive (seed)
Schinus terebinthifolius	Brazilian Mastic		Invasive (seed)
Syagrus romanzoffianum	Cocos Palm		Invasive (seed)

APPENDIX 1.2 - COMMON TREE PESTS AND DISEASES

COMMON NAME	SCIENTIFIC NAME	COMMENT
TREE DISEASES REPORTED IN NEWCASTLE		
Armillaria root rot	Armillaria luteobubalina	Soil born fungus can reduce tree stability.
Butt Rot	Ganoderma applanatum	Airborne spores enter trees via wounds. A basidiomycete that produces platform-like hard brown brackets on Palms and grey surfaced brackets on many other woody species.
White Rot	Phellinus spp	Airborne spores enter tree via wounds.
Plane Anthracnose	Apiognomonia veneta (asexual: Discula platani)	London Planes especially in humid weather.
Powdery Mildew		Common on Crepe Myrtle.
Dieback of Claret Ash	Unknown organism or cause	Fraxinus oxycarpa 'Raywood'.
Burnt Crust fungus	Kretzschmaria deusta	An ascomycete that parasitises living trees by rotting cellulose and lignin (mainly lignin) & weakens heartwood with implications for structural integrity. Causes white and brown rot - also called soft rot. No controls exist.
Fusarium wilt of Phoenix canariensis (Canary Island Date Palm)	Fusarium oxysporum f. sp.canariensis	The Botanic Gardens Trust believes palm wilt is responsible for the death of palms in Dangar Park. Soil born fungus that also infects Washingtonia species.
Root Rot	Phytophthora cinnamomi	Soil born fungus especially in wet soil conditions.
TREE DISEASES IN AUSTRALIA - NOT REPORTED IN NEWCASTLE		
Cypress Canker	Seiridium cardinale, S. unicorne and S. cupressi	Numerous conifer species affected.
EXOTIC DISEASES – POTENTIAL THREATS TO AUSTRALIA		
Sudden Oak Death	Phytophthora ramorum	Soil born fungus threat to numerous species.
Pitch Canker of Pine	Gibberella circinata/Fusarium circinatum	Threat to Pinus species.
Fire Blight	Erwinia amylovra	Threat to Rosaceae family which includes Pyrus (Pear) and Prunus (Plum and Cherry).
Eucalyptus rust	Puccinia psidii	Threat to Myrtle family which includes Eucalyptus, Corymbia, Melaleuca, Lilly Pilly, Callistemon and Turpentine.
INSECT PESTS REPORTED IN NEWCASTLE		
Spotted Gum Borer	Nascio vetusta	Kills Metrosideros spp (NZ Xmas Bush). No effective treatment.

COMMON NAME	SCIENTIFIC NAME	COMMENT
Fig Psyllid	Mycopsylla fici	Periodically defoliates Morton Bay Fig (Ficus macrophylla) and sometimes Port Jackson Fig (Ficus rubiginosa). Induced defoliation amplified under drought conditions and where soil compaction and/oOr excavation damages roots. Root damage leads to secondary pressures from pathogenic fungi which may kill trees or weaken structural integrity. A native wasp (Psyllaephagus sp.) parasitises the psyllid. The wasp emerges from leaves most of which will be in the litter layer beneath the tree. It is important to retain fallen leaves in the mulch beneath trees so that the wasp can continue its life cycle.
Bag Moth	Psychidae spp.	Occasionally on Brushbox, Illawarra Flame and Kurrajong but also some other tree species.
Winter Bronzing	Thaumastocoris peregrinus	Numerous Eucalyptus species, especially E. nicholli and E. scoparia.
Scale Insects	Numerous	Sap sucking insects on Lilly Pilly leaves and stems leading to black sooty mould forming on leaves and surrounds. Sooty mould reduces photosynthesis and weakens trees.

COMMON NAME	SCIENTIFIC NAME	COMMENT
Longicorn Beetle	Phoracantha spp.	Numerous woody species including Eucalyptus and Corymbia.
Spitfires	Doratifera spp.	Stinging moth larvae common on Eucalyptus & Corymbia.
INSECT PESTS IN AUSTRALIA - NOT REPORTED IN NEWCASTLE		
Lantana Tree Hopper	Aconophora compressa	Introduced to Queensland to control Lantana – escaped onto Fiddlewood (Citharexylum spinosum) and Jacaranda. Reported as far south as Terrigal but not reported in Newcastle.
Sycamore Lace Bug	Corythucha ciliata	Sap sucking insect feeding on the leaf undersides of London Plane (identified in Sydney City in 2007) causes white stippling of leaves.
Cuban Laurel Thrips	Gynaikothrips ficorum	Mainly on Ficus microphylla ‘Hillii’.
Ash Whitefly	Siphoninus phillyreae (Haliday) (Aleyrodidae: Hemiptera)	Sap sucking insect on Crepe Myrtle, Ash trees, Olive and numerous fruit trees.

APPENDIX 2 - TREE PRUNING SPECIFICATION

Tree Pruning Specification

Date _____

Applicant and site details

Details of the property owner

We will post reply to this address.

Mr ☐ Mrs ☐ Miss ☐ Ms ☐ Other _____

Family name (or company) _____

Given names (or ACN) _____

Postal address _____

_____ Post code _____

Phone (____) _____ Alternative phone (____) _____

Fax (____) _____ E-mail _____

Only if a company:

Contact person _____ Reference no. _____

Location and title description of the property

We need this to correctly identify the land.

Unit no. _____ House no. _____ Street _____

Locality _____

Lot(s) _____ Section _____

Deposited plan(s) _____ Strata plan _____

Other _____

(Get these details from the rate notice or property deeds, or from Council property maps)

The person competent in aboricultural assessment is:

Qualification

AQF Level: _____ in arboriculture Certificate No: _____

Course Provider: _____

OR

Equivalent Qualification _____ Certificate No: _____

Course Provider: _____

As the competent person I have:

1. carried out a thorough inspection of the tree to be pruned
2. determined the need for pruning
3. specified the current and subsequent pruning requirements
4. determined that the specified pruning will not adversely affect the tree
5. considered all applicable planning, heritage and protected species legislation in the context of the proposed pruning,
6. assessed each tree for hollows or other likely habitat and
   - found no evidence to warrant further assessment
   - have arranged for further assessment by an ecologist or wildlife specialist prior to pruning.

I recommend the specified pruning be carried out by a person suitably qualified and experienced in arboriculture with the minimum AQF level 2 in Arboriculture, and that the pruning be undertaken only in accordance with this specification.

Lopping, topping, wound painting and flush cutting shall not be undertaken and climbing spikes shall not be used except in order to assist in the aerial rescue of an injured person.

PTO

Pruning Classes and Specification Details

Note

Fill in details only for the class or classes of pruning specified.

For DEAD WOOD pruning, the minimum diameter and location of branches to be removed shall be:

For CROWN THINNING, the percentage of the total crown to be removed and the maximum diameter and location of branches to be removed shall be:

For SELECTIVE PRUNING, the branches to be removed shall be:

For REDUCTION PRUNING, the extent of crown or limb reduction shall be:

For CROWN LIFTING, the clearances to be achieved and the maximum diameter and location of branches to be removed shall be:

For REMEDIAL PRUNING the initial and subsequent pruning events and the pruning requirements shall be:

The detailed reason(s) for recommending the REMEDIAL PRUNING are:

For PALM PRUNING, tools shall be disinfected to minimise the chance of spreading palm disease including Palm Wilt.

Signature of competent person _____ Date: _____

The City of Newcastle

APPENDIX 3 - ARBORISTS QUALIFICATIONS

APPENDIX 3.1 - SUITABLY QUALIFIED ARBORIST

Qualification and Reporting Requirements for Arborist's

Task	Minimum Qualification	Recommended Practical Experience
Unacceptable Risk assessment. *Diseased condition assessment*	AQF 5 in Horticulture (Arboriculture)	Assessing, quantifying and reporting hazard and risk in trees. Application of resistance drilling technology and other methodologies for non-destructive assessment and measurement of decay in trees. Diagnosis and assessment of tree disease.
Property damage assessment	AQF 5 in Horticulture (Arboriculture)	Assessing and reporting the implications of interactions between trees and structures.
Tree retention value assessment	AQF 5 in Horticulture (Arboriculture)	Assessing the retention value of trees in relation to large and small scale development.
Tree amenity valuation	AQF 5 in Horticulture (Arboriculture)	Assessing the amenity value of trees using best management practice methodologies.
Tree impact assessment	AQF 5 in Horticulture (Arboriculture)	Assessing, quantifying and reporting the potential impacts of development activities and designs on trees. Extensive knowledge of urban soils and soil practices. Practical knowledge of tree root mapping and root plate assessment methodologies.
Suppressed growth assessment	AQF 5 in Horticulture (Arboriculture)	Sound knowledge of tree species and tree biology.
Specify tree pruning to AS 4373 – 2007	AQF 3 in Horticulture (Arboriculture)	Assessing and specifying tree pruning to meet the Australian Standard and other best practice methodologies.
Write a Tree Protection Plan	AQF 4 in Horticulture (Arboriculture)	Assessing, quantifying and reporting the likely impact of development on trees and identifying practical measures for harm minimisation.

APPENDIX 3.2 - CONTENTS OF AN ARBORIST REPORT

Arborist	Full name
	Business name and ABN
	Business address
	Qualification and AQF Level, certificate number and date of award
	Business telephone and e-mail address
The site and the brief	The full address of the site
	The full name and address of the client
	Dates of all site visits
	The project brief
	A table of contents including list of photographs
	A clear site plan showing relevant site details accurately plotting existing tree locations and actual crown spread
	A relevant site description including a summary of soil and drainage conditions
	A table listing each tree by number, common and scientific name, DBH, estimated height, age class, health, vigour and structure
	A summary of trees proposed to be removed and the reasons for removal

TYPE	THE PURPOSE	REQUIREMENT
Tree Survey To accompany a development site analysis	To identify vegetation on a proposed development site that meets the definition of 'tree' in the LEP to inform a site analysis prepared in accordance with Council's DCP.	Must include data for trees on adjoining land where the trunk is within 5 metres of the common boundary and trees anywhere on adjoining land where the canopy overhangs the common boundary.
Assessment Tree Retention Value	To rate the retention value of trees identified in a tree survey.	Documented details of the sustainability and landscape significance ratings. (Appendix 4 – Determining Tree Retention Value)
Test Unacceptable Risk	To support a complying development application to remove a tree due to risk where there is no alternative management option other than tree removal, or To support a recommendation to remove a tree on public land due to risk where there is no alternative management option other than tree removal.	A detailed tree risk assessment conducted in accordance with industry best practice tree condition assessment methodology. Provide clear, relevant photographs of trees, risks, and targets applicable. Provide a summary of the risk abatement options considered other than tree removal, and detail reasons for their rejection.

Test For Diseased Condition	To support a complying development application to remove a diseased tree, where there is no suitable alternative arboricultural treatment, or, To support a recommendation to remove a diseased tree on public land, where there is no suitable alternative arboricultural treatment.	The disease must be formally identified and an assessment made of the impact of the disease on the trees health and/or structural condition. Where the trees structural integrity is at risk, a formal risk assessment is to be conducted using industry best practice tree condition assessment methodology.
Test Property Damage* * Within 12 months of assessment.	To assess the degree of negative impact a tree is having on built assets and to demonstrate removal as the only reasonable option to avoid further conflict. Within the short term i.e. 12 months.	A review of the likely future growth and development characteristics of the tree to inform and assist the person assessing damage to the built asset.
Test Public Infrastructure Works	To ensure consideration is given to reviewing alternatives to tree removal when undertaking public infrastructure works with potential to cause major injury to a tree.	Detailed assessment of the impact of the proposed works on the health and structural condition of the tree, and a summary of the capacity of the tree to sustain injury. To be provided to the public infrastructure designer who must then document all reasonable design alternatives before recommending removal of the tree.
Test Suppressed Growth	To identify trees to be removed in order to improve opportunity for the development of adjacent trees.	A site plan and clear photographic details to indicate exactly which trees are to be removed. A statement of the method to be used and precautions to be adopted to protect remaining trees.
Test Driveway Crossings or Works on Public Land	To ensure that the design of driveway crossovers and other private structures and works gives appropriate consideration to alternatives to tree removal on public land.	A review of alternative options other than tree removal.

APPENDIX 4 – DETERMINING TREE RETENTION VALUE

APPENDIX 4.1 - DETERMINING TREE RETENTION VALUE

STEP 1 - ASSESS TREE SUSTAINABILITY

- Greater than 40 years
- From 15 to 40 years
- From 5 to 15 years
- Less than 5 years
- Dead or hazardous

IMPORTANT - Sustainability must only be assessed by a person with a minimum qualification of AQF 5 in Horticulture (Arboriculture). **Refer to Appendix 3.1 – Suitably Qualified Arborist.**

STEP 2 - DETERMINE LANDSCAPE SIGNIFICANCE RATING

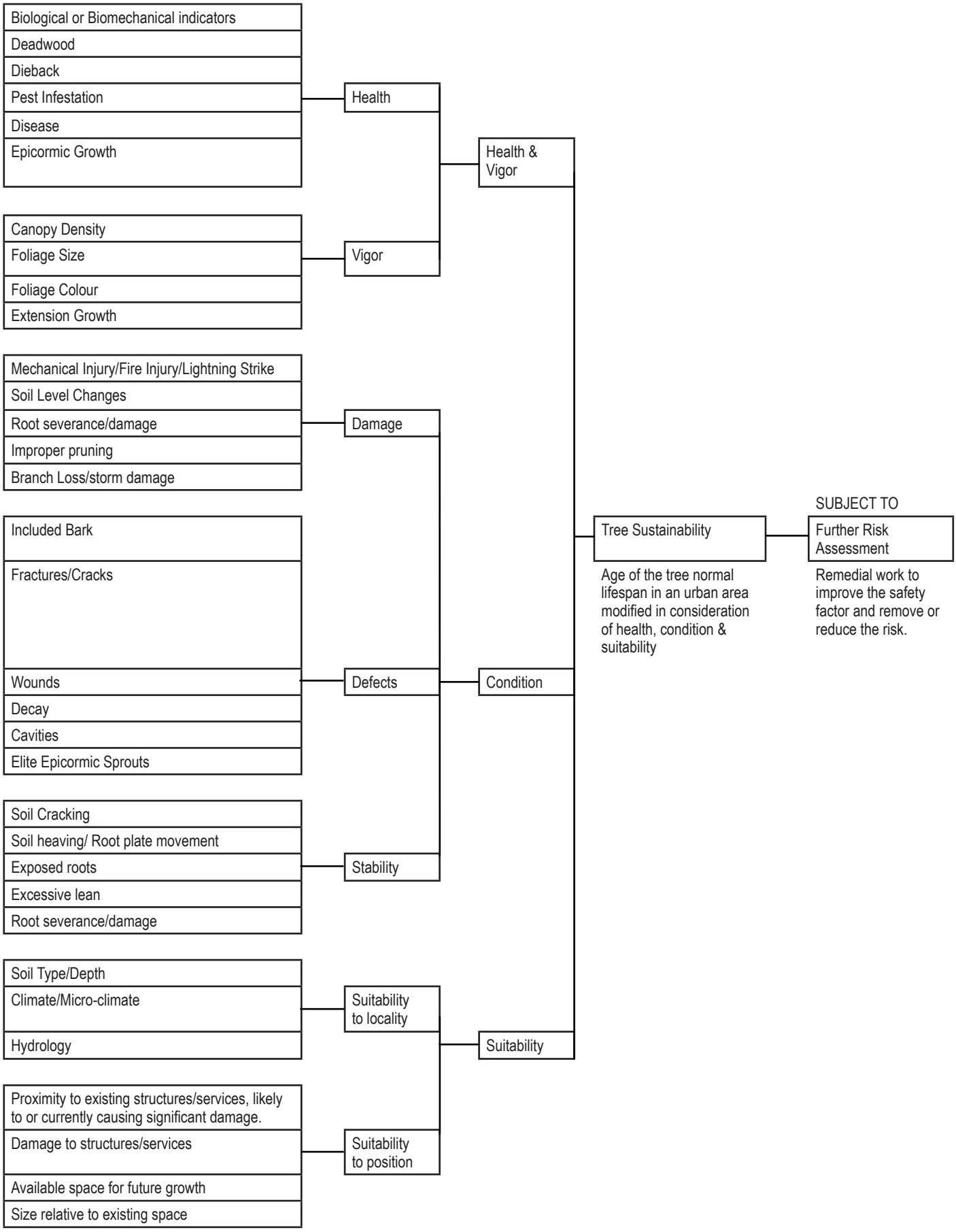


TABLE 1 - CRITERIA FOR ASSESSMENT OF LANDSCAPE SIGNIFICANCE

The level of landscape significance is determined using the following key criteria as a guide:

1. SIGNIFICANT	
	The tree is listed as a Heritage Item under the LEP 2011 with a local, state or national level of significance; or
	The tree forms part of the curtilage of a Heritage item (building /structure/artefact as defined in LEP 2011 and has a known or documented association with that item; or
	Aboriginal cultural artefact, evidence by identifiable markings or other documentary evidence; or
	The tree is a commemorative planting relating to an important historical event; or
	The tree is scheduled as a Threatened Species or is a key indicator species of an Endangered Ecological Community as defined under the Threatened Species Conservation Act 1995 (NSW) or the Environmental Protection and Biodiversity Conservation Act 1999; or
	The tree is an endemic species, representative of the original vegetation of the area and is known as an important food, shelter or nesting tree for endangered or threatened fauna species; or
	A remnant tree in existence prior to development of the local area; or
	The tree has a very large live crown size* greater than 200m² with normal to dense foliage cover, is visually prominent in the landscape, exhibits good form and habit typical of the species and makes a significant contribution to the amenity and visual character of the area by creating a sense of place or creating a sense of identity; or
	The tree is visually prominent in view from surrounding areas, being a landmark or visible from a considerable distance.
2. VERY HIGH	
	The tree has a strong historical association with a heritage item (building/structure/artefact/garden etc) within or adjacent the property and/or exemplifies a particular style or era of landscape design associated with the original development of the site; or
	The tree is a locally-indigenous species and representative of the original vegetation of the area and the tree is located within a key Wildlife Corridor or has known wildlife habitat value; or is uncommon in cultivation; and
	Visible from surrounding properties, the street or other thoroughfares (including waterways); and
	The tree has a very large live crown size* exceeding 200m²; a crown density exceeding 70% Crown Cover (normal-dense), good form and branching habit, good representative of the species or is aesthetically distinctive and makes a positive contribution to the visual character and amenity of the area.

3. HIGH	
	The tree has a suspected historical association with a heritage item or landscape supported by anecdotal evidence or based on knowledge of similar sites, tree age, etc; or
	The tree is a locally-indigenous species and representative of the original vegetation of the area; and The tree is beneficial for native wildlife; or
	The tree has a large live crown size* exceeding 100m²; and The tree is a good representative of the species in terms of its form and branching habit with minor deviations from normal (e.g. crown distortion/suppression) with a crown density of at least 70% Crown Cover (normal); and The subject tree is visible from surrounding properties and makes a fair/neutral contribution to the amenity of the property/visual character of the area.
4. MODERATE	
	The tree has a medium live crown size* exceeding 40m²; and The tree is a fair representative of the species, exhibiting fair form and habit, moderate distortion or suppression with a crown density of more than 50% Crown Cover (thinning to normal); and The tree makes a fair contribution to the visual character and amenity of the area; and The tree is visible from surrounding properties. Not visually prominent – view may be partially obscured by other vegetation or built forms, or
	The tree has no known or suspected historical value or association.
5. LOW	
	The tree has a small live crown size* of less than 40m² and can be replaced within the short term with new tree planting; or
	The tree is a poor representative of the species, poor form and habit with significant distortion or canopy suppression, with a crown density of less than 50% Crown Cover (sparse); and The tree is not visible from surrounding properties (obscured by other trees or built forms) and makes a negligible contribution to the amenity of the property/surrounding properties, or detracts from the visual character of the area.
6. VERY LOW	
	The tree is listed as an undesirable species as listed in Council's Urban Forest Technical Manual; and
	The tree has no heritage importance or value, no known or suspected historical association.
7. INSIGNIFICANT	
	The tree is a declared Noxious Weed under the Noxious Weeds Act (NSW) 1993 or is an undesirable species as listed in Council's Urban Forest Technical Manual

The material in this section of the Urban Forest Technical Manual has been adapted with permission of the author, Andrew Morton, Earthscape Horticultural Services. Sydney, Australia.

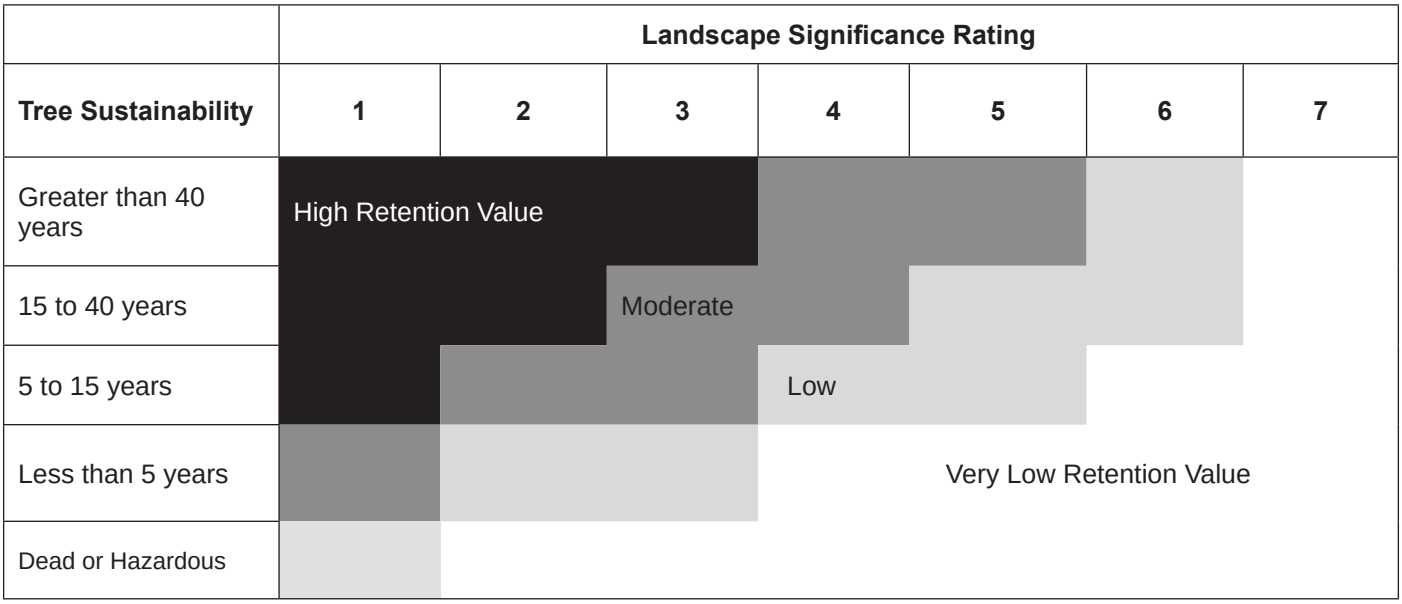
* Crown Size (m2) = πr2
r = the average distance to canopy dripline. To work out the average distance to the canopy line add (+) the radial distance of the canopy at four (4) cardinal points and divide (÷) by four (4).

STEP 3 - WEIGH SUSTAINABILITY AND LANDSCAPE SIGNIFICANCE

Determining Tree Retention Value
Weigh the sustainability and landscape significance to arrive at a retention value. These two independently assessed elements have a relationship with one another. The health, condition and longevity of a tree increases or diminishes depending on its level of intactness, quality and potential longevity.

Once there is a measure of a trees sustainability and significance in the landscape, these two factors can be weighed up using the matrix below which categorises the tree or trees according to its suitability or desirability for retention.

TREE RETENTION VALUES – ASSESSMENT METHODOLOGY



Modified by A. Morton from: Couston, Mark and Howden, Melanie (2001) Tree Retention Values Table Footprint Green Pty Ltd, Sydney Australia.

Figure 4: Tree Retention Values – Assessment Methodology

APPENDIX 4.2 - RISK MANAGEMENT STRATEGIES FOR EXISTING TREES

Strategy	Description
Monitor trip points	Where no other practical method can be employed to prevent this occurring, a regular trip point inspection program should be instigated and pavement replaced or repaired as necessary.
Flexible pathways	Use of flexible material such as bitumen, paving, or rubber compounds for footpaths and tree surrounds, will reduce the occurrence of trip points and is less expensive and easier than concrete to maintain or replace when necessary.
Re-direct pathways	Where space allows, pathways should be re-directed away from trees/tree roots. It may also be beneficial to reduce the newly directed pathway width.
Bridging Footpaths	Self-supporting construction methods, such as pier and beam could be used to raise pathways above the roots, allowing for root expansion without damaging the pavement. Timber bridges are an effective option.
Root pruning	Non-structural roots could be pruned on a predetermined basis under the guidance of a qualified arborist. This practice could be combined with installation of root barriers where appropriate.
Root barriers	Where future problems are perceived, barriers could be installed to deflect roots away from pavement or services.
Tunnelling for services	Tunnelling (directional boring) rather than open trenching for underground services will greatly reduce public risk as well reducing injury to tree roots. If located deeply, root contact with the pipeline may be minimised as the majority of roots of most species will remain within the top 1 metre of soil (based on a soil with medium texture).
PVC welded piping	Replacement of old porous clay pipe mains with PVC or polyurethane mainlines will significantly reduce the potential for tree root entry.
Preventative tree maintenance	Trees in public areas should be regularly inspected and maintenance, such as dead-wooding and developmental pruning carried out as prescribed. Pruning should always be undertaken in accordance with AS 4373-2007 Pruning of amenity trees.
Raising pathways	Where appropriate, pathways could be raised to reduce direct root pressure on the pavement. Care must be taken not to build up soil against the trunk of a tree. Aeration piping, in conjunction with geo-textile fabric and gravel should be installed between root zone and new pavement to aid with gas exchange to roots. Care should be taken to shape the new surface to drain water away from the trunk of the tree.
Insulated (ABC) cabling	Replacement of uninsulated overhead powerlines with insulated & bundled cables will reduce both the clearance needed and the pruning costs and severity.
Underground power and communications cables	The initially high cost of installing power underground may in fact be a practical option when compared with the projected cost of repeated pruning, the risk that this work involves to operators, the negative impact on trees, loss of public amenity and of urban forest economic contributions.
Diverting services	Services could be diverted along roadways, rather than in the nature strip where a valuable stand of trees is present. To make this option more attractive to service providers, Council's may wish to consider waiving road opening fees.
Diverting kerb/gutter	When possible, kerb/gutter could be diverted around tree roots or further away from the trunk, creating an island around the tree.
Enlarging root zone	Where space allows, a designated area above the root zone of the tree should be enlarged/created to accommodate surface roots. Rather than turf, this area could be formed into a garden bed, mulched or covered with a suitable tree grate.
Formative pruning	Early pruning will reduce the development of structural weaknesses in older trees. Refer to AS4373-2007 Pruning of amenity trees.
Remove target	In some situations it is preferable to remove a potential target, such as a seat rather then to remove a tree in order to abate a hazard.
Remove the defect	This could include pruning of live or dead branches or the removal of co-dominant stems.
Tree engineering	In some cases cabling may be used to support tree structure or to control the direction of a possible failure. This is highly specialised work.
Tree removal	In some situations it may be preferable to remove a tree and replace with a more suitable species, perhaps in an alternative location. In all cases of tree removal it is necessary to ensure that the removal is mitigated in order to ensure the future integrity of the urban forest.

APPENDIX 5 - CITY WIDE MAINTENANCE POLICY 2008 - EXTRACT

Tree work *that will not be* undertaken or approved by Council
PRUNING
Pruning of trees contrary to the Australian Standards AS 4373 - 2007
'Topping' or tree height reduction,
Pruning for visibility of commercial signage
REMOVALS
Removal of healthy, structurally sound trees, unless removal is the outcome of a properly conducted tree assessment test as detailed under Section 3 - Complying Development.
Removal of trees for views
Removal of trees claimed to be inhibiting turf or other garden vegetative growth
Removal of trees to prevent or reduce the normal shedding of leaves, flowers, fruit, seeds or small elements of deadwood, having regard for the Tree Dispute Principle Urban Trees and Ordinary Maintenance Issues of the NSW Land and Environment Court.
Removal of trees to prevent sap drop, bird or bat droppings
Removal of a tree for solar access
Removal of trees interacting with non-structural built assets e.g. garden pathways, fences and the like
Removal of trees, or the application of pesticides to control termites. (see also NCC Termite Management Policy)
Removal of trees that are claimed to cause allergies

APPENDIX 6 - BEST PRACTICE GUIDELINES

APPENDIX 6.1 - COMMON INTERACTIONS AND IMPACTS BETWEEN TREES AND STRUCTURES

Structure	***Typical causes of conflict with trees***	***Impact by trees***	***Impact on trees***
Footpaths Concrete, Pavers and Bitumen	Pathways located too close to trees, bitumen laid over tree roots.	Lifting, heaving and cracking leading to trip hazards & increased risk.	Root pruning and root scalping leads to root decay & a potential loss of stability; reduced water and nutrient uptake; reduction of soil oxygen; loss of natural nutrient recycling; and elevated tree stress
Kerb and Gutter Concrete	Pathway cross overs located too close to trees. Lifting, heaving, cracking and displacement.	Lifting, heaving, cracking and displacement. Drainage interruptions.	Restricted root distribution effects tree stability and the critical availability of water and elements.
Underground Services Power; fibre optic, water, gas	Improperly laid e.g. poorly jointed, inadequately compacted backfill; inappropriate backfill materials, pipes retained past their useful life and requiring renewal, use of technology that does not account for the dynamics of tree root development.	Blockages, crushing, displacement and heaving.	Root loss during installation; incipient decay following excavation. Changes in water table fluctuations; gas leaks; soil saturation.
Overhead Services Power lines, Phone and Cable TV	Inappropriately located poles, poles shorter than prescribed heights, wires lower than prescribed height, uninsulated wires where insulated cables would be less restrictive on tree planting and safer near people, above ground transformers.	Branch & whole tree failures; wind whipping. Electrical outages, blackouts, fire, restricted access to poles.	Reduced amenity and environmental contributions i.e. shade and shelter, aesthetics, PM 10 absorption; incipient decay. Poor public image for street trees.
Buildings & other load bearing structures	Minimum distances not observed, reactive soils.	Lifting and cracking of foundations; subsidence; branch and fruit shedding; eactive soils drying and wetting cycles.	Damage during site preparations and construction, reduced sunlight, wind tunnelling.
Traffic & pedestrians	Compaction.	Vehicle hitting trees. Blocked vision of road signs and access places. Trip points in footpaths.	Trees damaged or killed by vehicle accidents. Heavy and repeated pruning to achieve visibility. Decay of roots and loss of stability from root grinding for footpaths.

APPENDIX 6.2 TREE PLANTING RISK ZONES IN STREETS

	ZONE A **Most constraints** **(Greatest risk)**	**ZONE B** **Moderate constraints** **(Moderate risk)**	**ZONE C** **Fewest constraints** **(Minimum risk)**
Electrical and telecommunications	uninsulated low and high voltage wires bushfires areas	bundled cables (ABC) insulated cables	no powerlines
Below ground services typical layouts	fibre optic cables high voltage power	water mains gas mains stormwater	no underground services
Slope	steep slope	moderate slope	generally flat land
Paved areas	area wholly paved surface wholly sealed brick pavers laid on sand bedding	partially paved areas non reinforced concrete	grass up to 6m
Verge width	less than 3.0m	from 3m to 4m	4m or wider
Building set back	None	Less than 6m	6m or greater
Street lighting	over pedestrian crossing traffic intersections	street lighting other than crossings and intersections	no street lighting
Safety signage i.e. traffic signs	dual carriageways arterial roads high density residential streets	medium density residential streets arterial roads in rural zones	low density rural/residential streets
Traffic	heavy vehicles public transport in heavy volumes	public transport in moderate volume heavy vehicles in moderate volumes	public transport in low volume residential traffic in low volume Cul-de-sacs.
Soils	severely compacted shallow reactive clay acid sulphate poor drainage	moderately compacted urban fill moderate drainage	undisturbed soil deep profile medium texture good natural drainage
Water table	high	moderate depth	deep water table

APPENDIX 6.3 RISK MANAGEMENT CONTROL STRATEGIES

Control Strategy	Description
Root Barriers	Installation of root barriers to manufacturer's specification at the time of planting will assist tree roots to develop away from services, pavements and other structures. NOTE OF CAUTION Tree root barriers do require periodic monitoring as roots deflected downwards will return to the surface if soil oxygen levels are not sufficient to support growth at depth. Roots can also grow over the barrier in some situations.
Soil Compaction	Proper compaction of the soil when back filling trenches or around utility easements and house footings will direct tree roots away from these areas. By achieving and maintaining compaction to 95% root growth can be inhibited through the depravation of oxygen.
Pseudo Street Trees	Residents could be encouraged to plant trees within their boundaries in preference to street tree planting. This might allow larger species to be used, and reduce pressure on pavements and services.
Design of new roads and pathways	The design of new roads and footpaths should be undertaken with consideration for tree planting on the nature strip or in the road pavement to ensure appropriate allocation of space.
Provision of aeration and irrigation	Where there is to be continuous paving around a tree, the installation of an aeration and irrigation system should be considered. Where irrigation is installed and properly operating, a tree root system will be proportionally smaller than without irrigation.
Pavement Openings	Pavement openings at the base of the tree should be as large as possible to reduce the future impact of buttressing roots on pavements. Position of the tree should be a good distance (e.g. 1m) from the kerb line to reduce the likelihood of future cracking.

APPENDIX 6.4 TREE PLANTING SITE CHARACTERISTICS

	A **Most Constraint**	**B** **Moderate Constraint**	**C** **Least Constraint**
Climate	• Frontline salt wind exposure • Prevailing wind exposure • Rain shadow • Extensive sealed ground surface	• Second line coastal salt influence • Moderate wind exposure • Partial rain shadow • Partial ground surface sealed	• Minimum salt influence • Minimal wind exposure • No rain shadow • Minimal ground surface sealed
Slope	• Steep slope	• Moderate slope	• Minor slope to flat land
Aspect	• Southern & western exposure	• Either southern or western exposure	• Northern & eastern exposure
Street Width and Usage	• Narrow; CBD residential and commercial • Arterial (high traffic volume)	• Non CBD; narrow residential & commercial • Suburban collector roads (medium volume traffic)	• Average to wide residential/commercial • Wide residential
Soil Type and Drainage	• Reactive clay • Poor drainage • Salinity	• Non reactive clay • Average drainage	• Free draining open textured soil
Services	• Above ground and below ground utilities	• Above or below ground utility services	• No utility services

APPENDIX 7 - MATERIALS SPECIFICATION

APPENDIX 7.1 SOIL PERFORMANCE SPECIFICATION FOR A AND B HORIZON SOIL

Separate soil tests shall be carried out for all soil mixes.

Tests for batches to be delivered to the site must be tested by an approved Soil Laboratory. Test results must confirm that the material meets the performance specifications as below. The contractor shall incorporate all necessary amendments and undertake all remediation or amelioration recommended from the soil laboratory results.

Samples:
Submit representative samples of each material to the Site Supervisor, packed to prevent contamination and labelled to indicate source and content.

Sampling Schedule:

Item	Quantity
Gap Graded Soil	As required by soil testing
Planting Pit Soil Mix A	200g approx
Planting Pit Soil Mix B	200g approx
Fertilisers	200g approx

Soil that meets the following performance specification shall be supplied and installed in the planting pits.

Property	Unit	A Horizon	B Horizon
pH in water (1:2)	mS/cm	5.5 – 7.0	5.5 – 7.5
EC (1:2)	%ECEC	< 1.0	< 1.2
Sodium	%ECEC	< 5	< 5
Potassium	%ECEC	5 - 15	5 - 15
Calcium	%ECEC	60 - 75	60 - 75
Magnesium	%ECEC	5 – 25	5 – 25
Aluminium	%ECEC	< 1	< 1
Ca:Mg		3 - 6	3 - 6
Phosphorous (Bray)	mg/kg	<25	n/a
Organic Matter	% by mass	5 – 15	< 1
Permeability (AS 4419)	cm/hr	> 30	> 50
Max. Particle Size	mm	40	40

APPENDIX 7.2 GAP-GRADED SOIL SPECIFICATION

Gap-graded soil shall be equivalent to the specification for Benedict Sand and Gravel, SmartMix™3 – Structural Soil Mix Product Data Sheet. If sourced from an alternate supplier a sample of the filler soil and additives must be tested for compliance with the specification and results submitted to Council prior to installation.

Gap-graded Soil Transportation

Gap-graded soil shall be delivered to site pre-blended. The soil mix shall be transported in a moist condition to prevent segregation of components.

Gap-graded Soil Mix Components by Volume

- 80% 40mm Basalt aggregate. Narrowly graded uniform sized angular clean hard and durable gravel sized 25mm to 75mm.
- Filler Soil – 10% Screened Menangle Sandy Loam and 10% Screened Virgin Clay (remove any clay greater than 15mm)

Required Filler Soil Properties

Property	Unit	Quantity/ Acceptable Range
Chemical		
pH in water (1:2)	mS/cm	5.5 - 7.0
pH in CaCl2	mS/cm	5.5 - 7.0
Electrical Conductivity	dS/m	< 2.5
Soluble Cations		
Sodium	% ECEC	< 5
Potassium	% ECEC	5 - 15
Calcium	% ECEC	60 -75
Magnesium	% ECEC	5 - 25
Calcium : Magnesium		2 - 6
Nutrient mg		
Phosphorous (Bray)	Mg/kg	< 30
Ammonium	Mg/kg	< 200
Nitrate	Mg/kg	< 100
Sulphate	Mg/kg	40 < 100
Physical		
Organic matter	% by mass	<1
Permeability - AS4419	cm/hr	2 - 100
Toxicity Index		> 50
Wet ability		> 5
Bulk Density (Standard)		> 0.7
Particle Size Distribution (Aggregate)AS1141.11	% Passing through sieve	
75 mm		100
53 mm		91
37.5 mm		64
26.5 mm		34
19 mm		24
13.2 mm		22
9.5 mm		22
6.7 mm		21
4.75 mm		21
2.36 mm		21
1.18 mm		20
0.60 mm		18
0.30 mm		12

APPENDIX 7.3 GMB 20 BASE SPECIFICATION

GMB 20
(Reference: RTA - Unbound and Modified Base and Sub-Base Materials for Surfaced Road Pavements)

Install 20mm GMB 20 to a minimum depth of 150mm over the finished surface of Gap-graded soil.

Table 3051.1 - Unbound Material (Based on Particle Size Distribution) - Specification Requirements

Property	Defect Weighting Value	GMB 20 Base
RTA T106: (a) Coarse Particle Size Distribution [i] passing AS Sieve (% by mass)		
75.0 mm	2	-
53.0 mm	2	-
37.5 mm	2	-
26.5 mm	2	100
19.0 mm	2	95-100
13.2 mm	2	50-70
6.70 mm	2	30-55
2.36 mm		20-30
RTA T106 & T107: (b) Maximum Permitted Deviation of Material Supplied from Nominated Particle size distribution [i, iv] Passing AS Sieve (% by mass)		-
75.0 mm	1	-
53.0 mm		-
37.5 mm		-
26.5 mm		-
19.0 mm	2	±8
13.2 mm	2	±5
6.70 mm	2	±4
2.36 mm	2	±3
425 µm vii	1	±2
75 µm vii	1	
RTA T107: (a) Fine Particle Size Distribution Ratios expressed as percentages		
A. Pass 425 µm sieve % / Pass 2.36 mm sieve		30-50
B. Pass 75 µm sieve % / Pass 425 µm sieve		30-50
C. Pass 13.5 µm sieve % / Pass 75 µm sieve		-
RTA T108: Liquid Limit (if material non-plastic) [i] For natural or manufactured		max 20[v]
For recycled building material		max 27
RTA T109: Plastic Limit (if plastic) [i]		max 20

APPENDIX 7.4 ADDITIVES AND FERTILIZER SCHEDULE

The following additives are to be thoroughly mixed with the filler soil prior to blending with crushed aggregate. Additives will be tested for compliance, and results submitted to the Principal's representative prior to blending with the crushed aggregate.

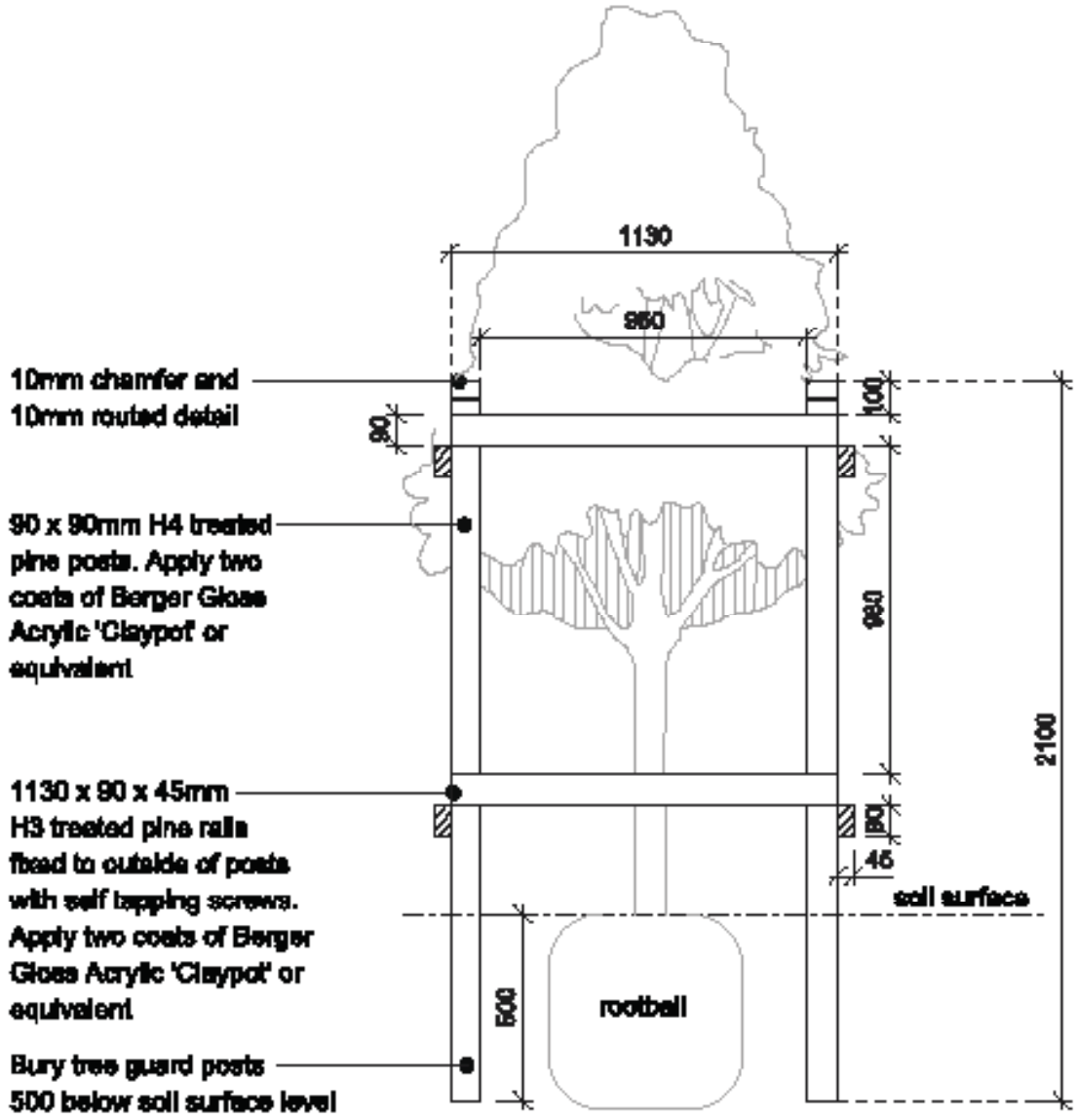
Additives/ Fertiliser Schedule

Additives	Rate
Magrilime	600g/m3 (to bring pH to 5.5 – 6.5)
Trace element mix	300g/m3
Potassium nitrate	500g/m3
Ammonium nitrate (Nitram)	500g/m3
Superphosphate	500g/m3
Iron sulphate	1500g/m3
8-9 month control release fertiliser	500g/m3
Magnesium sulphate	400g/m3

APPENDIX 8 – TREE PLANTING DETAILS

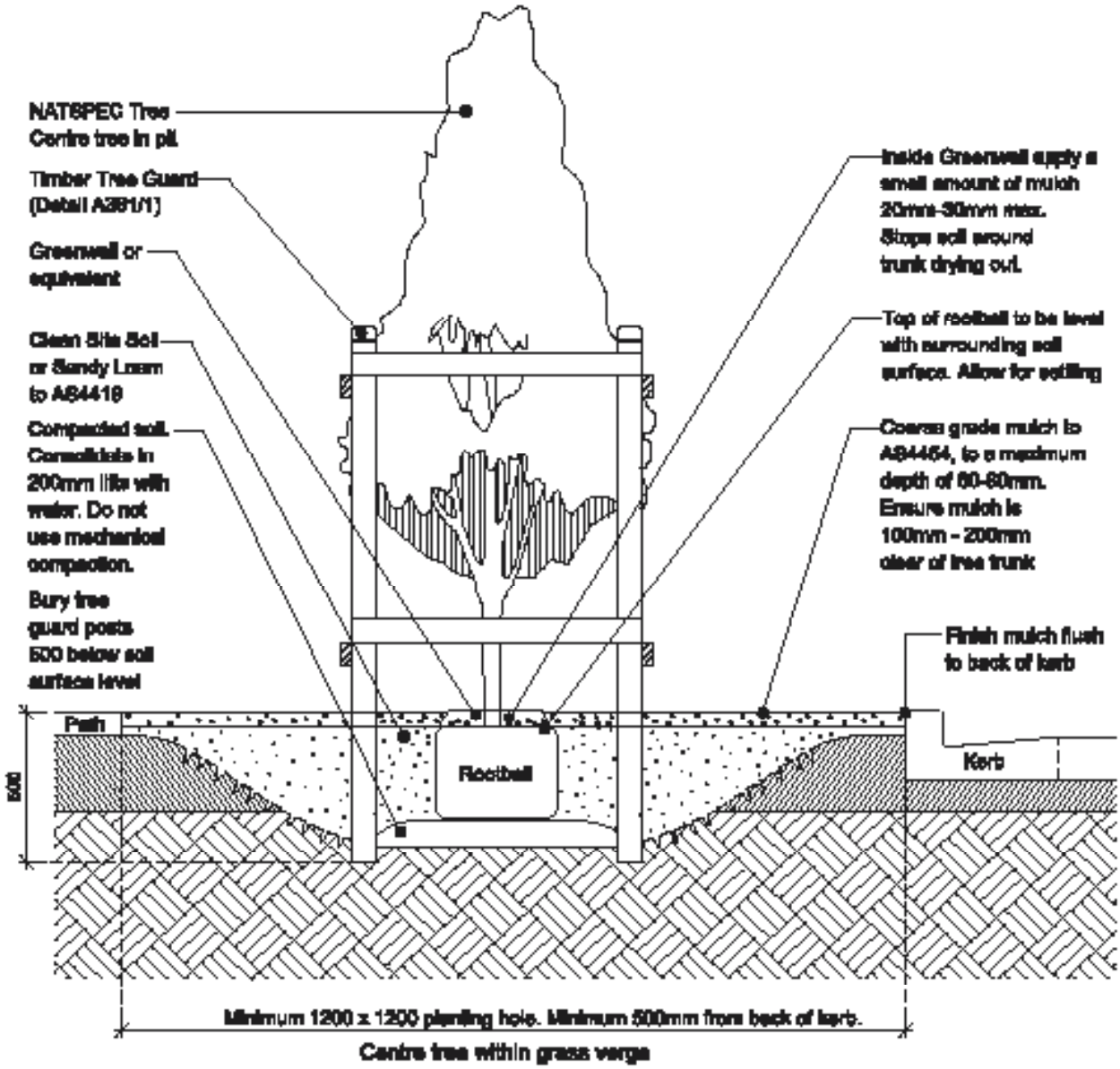
Plan Number	Plan Title
A361/1	Typical timber tree guard
A362/1	Tree planting in grass verge with timber tree guard
A363/1	Tree planting in grass verge with civic tree guard
A364/1	Tree planting in grass verge with wooden stakes
A365/1	Tree planting in turf with a spade edge and timber tree guard
A366/1	Tree planting in turf with a spade edge and civic tree guard
A367/1	Street tree planting in gap graded soil
A368/1	Street tree planting in structural cells

Typical Tree Planting Detail



The City of Newcastle	Typical timber tree guard Scale 1:20	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A361/1

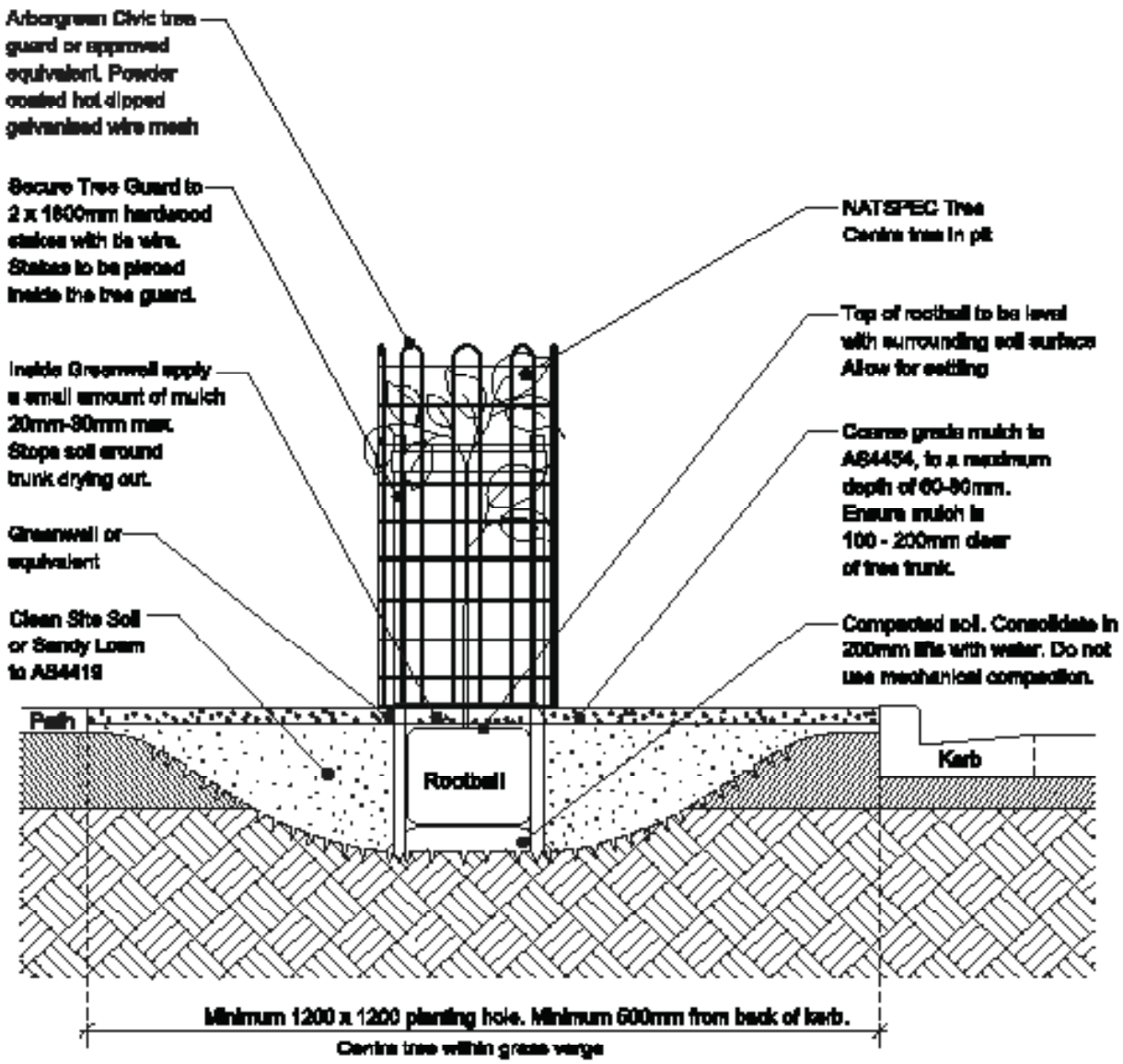
Typical Tree Planting Detail



Ensure sides and base of tree pit are not compacted. Backfill with 100% clean site soil where possible.
If existing site soil is not appropriate import a soil mix of Sandy Loam (AS4419)
Mix in Terracottem as per manufacturers instructions. Water the plant in throughly during backfilling.
Variations with consent from CoN Landscape Architectural Section (02) 4974 2570.

The City of Newcastle	Tree planting in grass verge with timber tree guard Scale 1:25	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A382/1

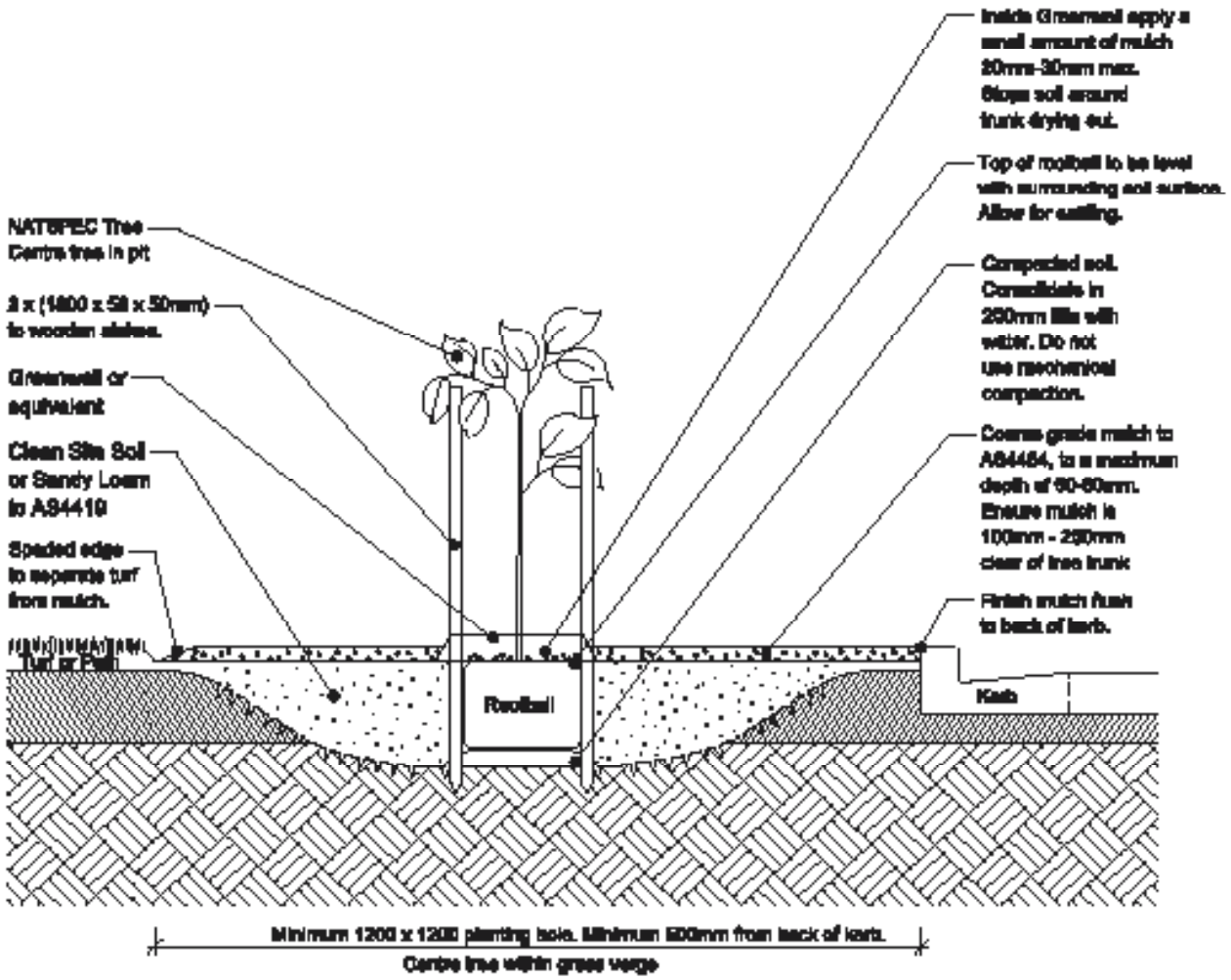
Typical Tree Planting Detail



Ensure sides and base of tree pit are not compacted. Backfill with 100% clean site soil where possible.
If existing site soil is not appropriate import a soil mix of Sandy Loam (AS 4419).
Mix in Terracottem as per manufacturers instructions. Water the plant in throughly during backfilling.
Variations with consent from CoN Landscape Architectural Section (02) 4974 2670.

The City of Newcastle	Tree planting in grass verge with civic tree guard Scale 1:25	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A363/1

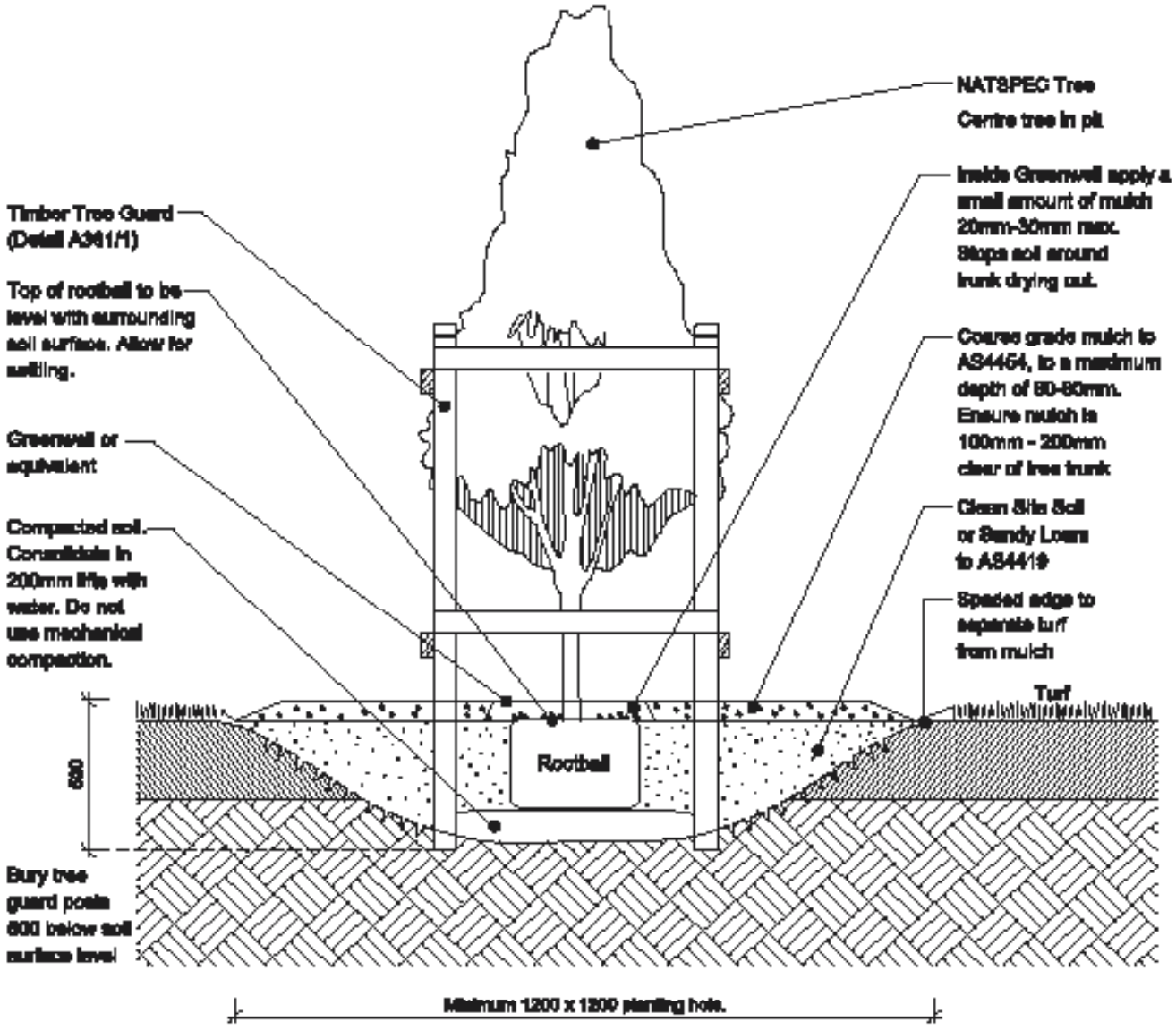
Typical Tree Planting Detail



Ensure sides and base of tree pit are not compacted. Backfill with 100% clean site soil where possible.
If existing site soil is not appropriate import a soil mix of Sandy Loam (AS 4419).
Mix in Terracottem as per manufacturers instructions. Water the plant in throughly during backfilling.
Variations with consent from CoN Landscape Architectural Section (02) 4974 2670.

The City of Newcastle	Tree planting in grass verge with wooden stakes Scale 1:25	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A364/1

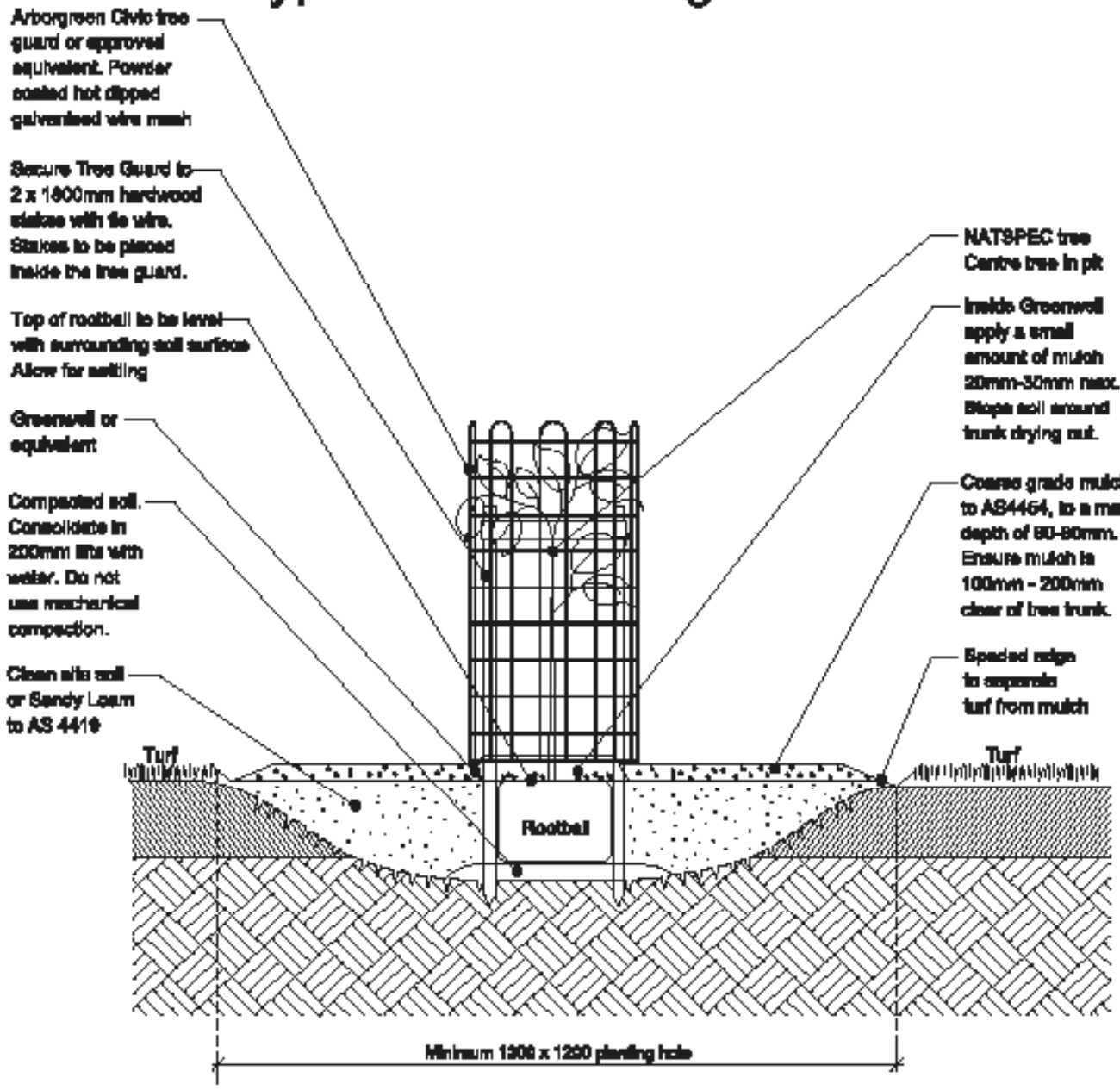
Typical Tree Planting Detail



Ensure sides and base of tree pit are not compacted. Backfill with 100% clean site soil where possible.
If existing site soil is not appropriate import a soil mix of Sandy Loam (AS 4419).
Mix in Terracottem as per manufacturers instructions. Water the plant in throughly during backfilling.
Variations with consent from CoN Landscape Architectural Section (02) 4974 2870.

The City of Newcastle	Tree planting in turf with a spade edge and timber tree guard. Scale 1:25	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A365/1

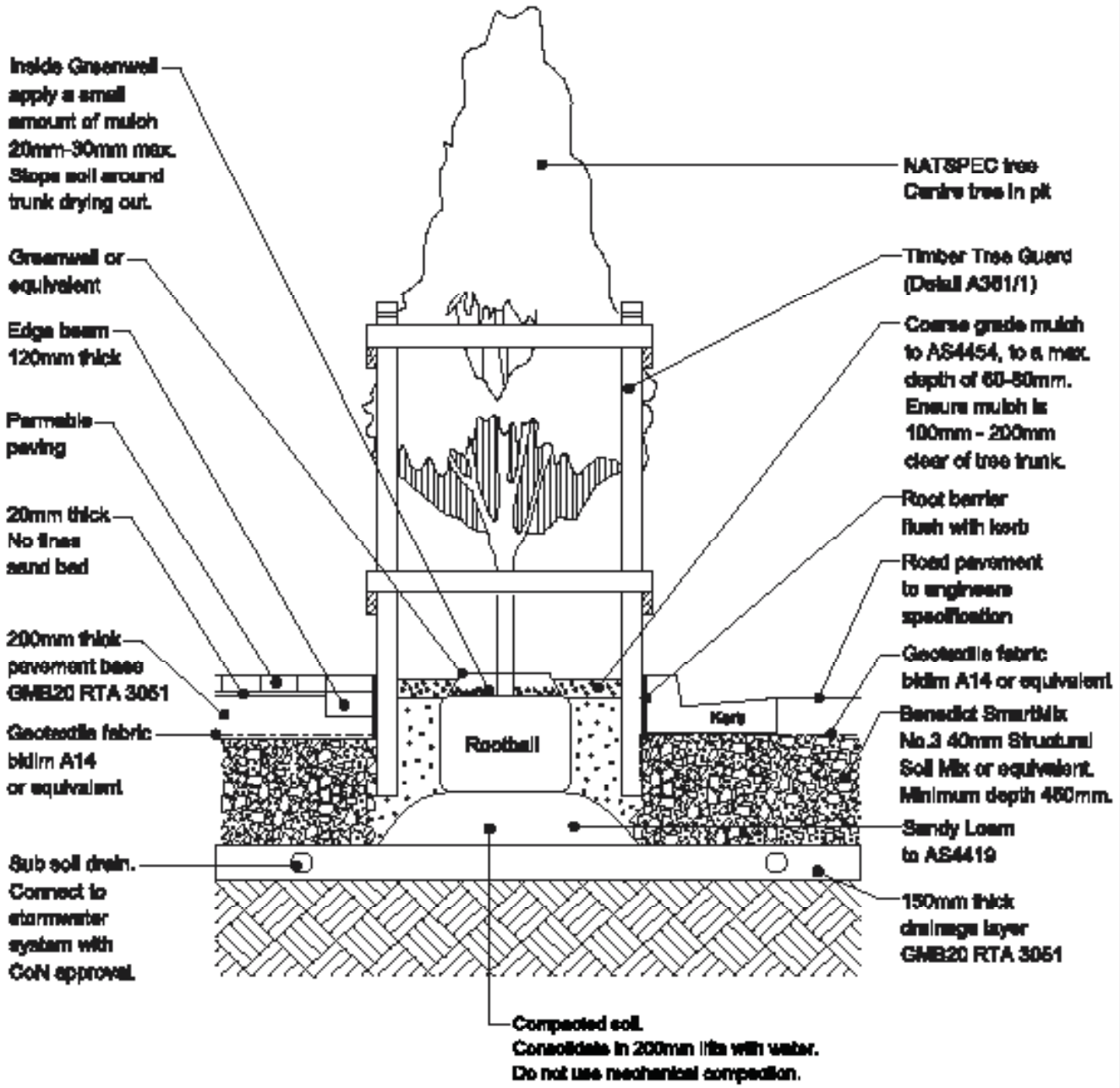
Typical Tree Planting Detail



Ensure sides and base of tree pit are <u>not</u> compacted. Backfill with 100% clean site soil where possible.
If existing site soil is not appropriate import a soil mix of Sandy Loam (AS 4419).
Mix in Terracottem as per manufacturers instructions. Water the plant in throughly during backfilling.
Variations with consent from CoN Landscape Architectural Section (02) 4974 2670.

The City of Newcastle	Tree planting in turf with a spade edge and civic tree guard. Scale 1:25	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A368/1

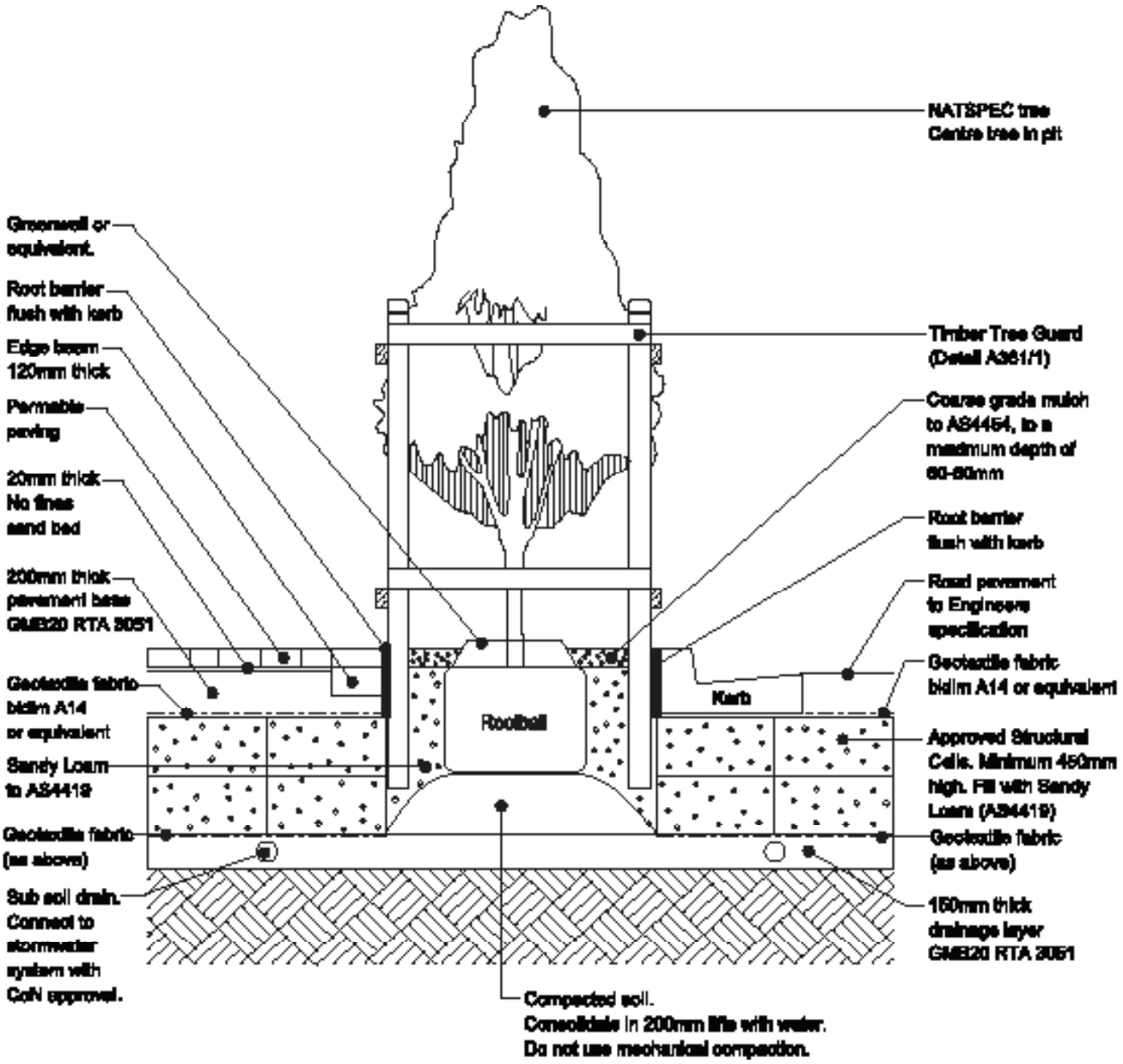
Typical Tree Planting Detail



This detail is concept only. Individual projects to be designed by a suitably qualified person.

The City of Newcastle	Street tree planting in gap graded soil. Scale 1:25	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A367/1

Typical Tree Planting Detail



This detail is concept only. Individual projects to be designed by a suitably qualified person.

The City of Newcastle	Typical tree planting in structural cells Scale: 1:25	Drawn By:	ALS
		Checked By:	SM
		Date:	NOV 10
		Plan Number:	A368/1

APPENDIX 9 - REPORT AND APPLICATION FORMS

APPENDIX 9.1 - PRACTICAL COMPLETION REPORT FORM

CITY OF NEWCASTLE
LANDSCAPE PRACTICAL COMPLETION REPORT
(CATEGORY 2 & 3 Refer to DCP 2011)

All required landscape works are to be implemented by members of the Landscape Contractors Association of NSW/or similar qualified contractors.

In the case of Category 3 development, Council recommends that implementation/construction be under the supervision of the Landscape Architect responsible for the design. Where the Landscape Architect is not involved in the contract administration/supervision of the works, the applicant is to fill out the form.

SITE DESCRIPTION			
Street		DP	
Lot		Suburb	
Stage		Application No.	
Category of development			
Type of development	Residential ❒	Industrial ❒	Commercial ❒
Other			

LANDSCAPE CONTRACTOR		
Name and Address of firm:		
Contact Person:		Phone:
Membership of:		

LANDSCAPE ARCHITECT/CONSULTANT OR SUPERINTENDANT		
Name and Address of firm:		
Contact Person		Phone:
Title		
Qualifications:		

DEVELOPMENT FIRM	
Name and Address of firm:	
Contact Person	Phone:
Title	

1. Have works been completed according to approved plans? Yes ☐ No ☐
2. If No: List the variations and give reasons (attach separate list if necessary)

   ……..

   ……..

   ……..

   ……..
3. Have the variations been approved? Yes ☐ No ☐
4. Name of Council officer who approved variations: ……
5. Rectification works to be carried out: ……
6. Period of approved Establishment Maintenance: Months: Start……Finish……..

Signed: ……Date of Inspection: ……

NOTE: ALL FORMS SHALL BE SIGNED BY THE APPLICANT OR LANDSCAPE ARCHITECT AND RETURNED TO CON