



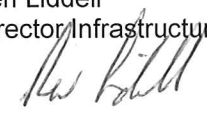

Technical Manuals

Technical Manual
Newcastle Urban Forest
(updated February 2018)

Urban Forest Technical Manual
prepared by Newcastle City Council

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Updated February 2018
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Newcastle Urban Forest Technical Manual

Part A Private Trees

February 2018

The urban forest is the collection of trees, shrubs, and other vegetation types, on both public and privately owned land within the Newcastle Local Government Area. The urban forest and associated tree canopy across Newcastle provides a range of benefits for the community. Some of these benefits include shade, microclimate regulation, air quality, sense of wellbeing, diverse flora and fauna, storm water management and interception. The liveability of the city is greatly improved by having a sustainable tree canopy and green spaces.

In May 2008, Council adopted the Newcastle Urban Forest Policy and Urban Forest Background Paper in recognising the importance of the urban forest. The goals of the Urban Forest Policy include sustaining and maximising the Newcastle urban forest on an intergenerational basis. In June 2013, Council adopted the Newcastle 2030 Community Strategic Plan which is the community's long term vision for the city. The Community Strategic Plan identifies that over the next 20 years the Newcastle community wants a greater connection with nature, with a greener more enriching environment where the urban forest is maintained and connected.

This Technical Manual contributes to Newcastle's urban forest by providing guidance on the management of trees (including shrubs) on both public and private land within the Newcastle Local Government Area. The Manual is an accompaniment to the Newcastle Development Control Plan Section 5.03 Vegetation Management. It is separated into three parts based on the land on which the tree is located and the type of vegetation present:

- Part A provides guidance on the management of trees and shrubs located on private land.
- Part B provides guidance on the management of trees and shrubs located on public land.
- Part C provides guidance on the management of native vegetation communities on private land

Use the Part that relates to the land on which the tree, shrub or other vegetation is located, regardless of the proposed activity.

Urban Forest Technical Manual

Part A Private Trees

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1.0 Introduction

Part A of the Urban Forest Technical Manual is to be used for all activities relating to trees on private land. Private trees are trees located on land that is not managed by Council, and includes all private residential land and land managed by other government agencies.

To sustain canopy cover across the local government area, Council requires the appropriate management of private trees to maximise the useful life of the trees and that suitable replacement planting is undertaken when trees are removed.

Where development is undertaken it is preferred that healthy trees are retained and protected by appropriate design and construction methods. Where the retention of trees is not possible, then adequate space is to be made available on the site for new tree planting.

1.1 How to use this manual

Part A of this Manual is presented in 12 sections:

Section 1.0 Introduction - outlines when this part of the Manual is to be used.

Section 2.0 Pruning - outlines when pruning does / or does not require approval and provides the pruning specification.

Section 3.0 Tree and shrub removal not associated with development - provides the process to be followed for tree removal on private land that is not associated with a development application. Outlines when tree assessment tests are required, and details what is required to undertake each of the five tree assessment tests on private land.

Section 4.0 Tree removal on private land associated with development - provides the process to be followed for tree removal on private land associated with a development application. Outlines what is to be submitted with the development application where trees may be impacted.

Section 5.0 Greenfield sites - outlines what is to be considered during the design of a subdivision.

Section 6.0 Arborist reports and qualifications - sets out the level of qualification required for reporting on private trees.

Section 7.0 Protection measures - provides specific detail on tree protection in relation to any works undertaken as part of private development.

Section 8.0 Designing for new trees - details the process and considerations for incorporating new trees into the design of subdivisions or other large scale developments. This advice also assists residents in planting trees on their property.

Section 9.0 Tree species selection and supply - details the ordering and supply of tree stock in accordance with NATSPEC.

Section 10.0 Tree planting - provides extensive detail on best practice planting techniques and requirements for subdivisions and large commercial developments. This advice also assists residents in planting trees on their property.

Section 11.0 Biosecurity - identifies the biosecurity requirements to be implemented for tree maintenance activity.

Section 12.0 Callaghan Campus - provides details for tree management on Callaghan Campus (University of Newcastle).

2.0 Pruning

2.1 Pruning requiring a permit

A permit for pruning of tree(s) or shrub(s) on private land is required from Council when:

- the tree or shrub being pruned is a heritage listed item, that is or forms part of an Aboriginal object or is within a place of Aboriginal significance.

For pruning of a tree/shrub that is a heritage listed item, forms part of an Aboriginal object or is within a place of Aboriginal significance the following information must be submitted to Council:

- a completed *Notification - Heritage Minor Works or Maintenance* form obtainable from Council's website www.newcastle.nsw.gov.au/Council/Forms-Publications/Forms/DA-Heritage-Notification-Form, and
- a *Tree Pruning Specification* form (see **Appendix 5**) completed by an arborist with minimum Level AQF 3 qualification.

Note 1: The pruning of vegetation in a threatened ecological community or a threatened plant species listed under the *Biodiversity Conservation Act 2016* requires a licence under that Act. For further information see the Office of Environment and Heritage website. A permit application is also required from Council, refer Part C of this manual.

Note 2: The pruning of marine vegetation under the *Fisheries Management Act 1994* requires a permit under that Act. For further information see the Department of Primary Industries website.

Note 3: A permit from Council is required prior to clearing or pruning any other native vegetation including understorey plants, groundcovers and plants occurring in a wetland and is less than the biodiversity offsets scheme threshold identified under the *Biodiversity Conservation Act 2016*. Refer to Part C of this manual.

Note 4: Pruning of public trees and shrubs can only be undertaken by Council. Refer to Part B of this manual.

2.2 Pruning that does not require a permit

A permit from Council is not required for the pruning of tree(s) or shrub(s) on private land in the following circumstances:

- Pruning with a pruning specification (section 2.2.1)
- Pruning without a pruning specification (section 2.2.2).

2.2.1 Pruning with a pruning specification

A permit is not required to prune declared vegetation (trees and shrubs) where the following criteria are met:

- (a) landowners consent has been obtained; and
- (b) for a tree or shrub greater than 5m in height:

- (i) the pruning is undertaken in accordance with the *AS4373 -2007*, and
- (ii) a pruning specification (**Appendix 5**) is completed by a suitably qualified arborist, and
- (iii) the pruning specification is retained by the landowner for a period of two years.

2.2.2 Pruning without a pruning specification

A permit is not required to prune declared vegetation (trees and shrubs) and a pruning specification is not required where the following criteria are met:

- (a) for pruning of individual branches from a tree or shrub that overhangs a dwelling, formal path or driveway:
 - (i) the pruning is to remove branches that are within 1m of the dwelling, formal path or driveway, and
 - (ii) the pruning does not alter the overall shape or structure of the tree, and
 - (iii) the branches removed are less than 100mm in diameter at the final cut, and
 - (iv) the final cut is at a branch collar or appropriate growth point (refer to Section 2.3), or
- (b) the height of the shrub/s is less than 5m, and
 - (i) it is maintained without reducing the height, or
 - (ii) is pruned for the purposes of hedging, topiary, clearing of driveways or formal pathways, or similar.

2.3 Australian standard and pruning specification

All tree pruning is to be undertaken in accordance with the Australian Standard *AS 4373-2007 Pruning of Amenity Trees (AS 4373 - 2007)*. This standard provides guidance on tree pruning and encourages pruning practices and procedures that reduce the risk of hazard development including branch failure, pathogen infection and premature tree death.

AS 4373-2007 requires that pruning specifications are prepared by a person with a minimum level in arboriculture of AQF 3 (refer to **Table 1**). *AS 4373-2007* also requires pruning should be carried out by a suitably qualified person with experience in arboriculture (minimum AQF level 2) and in accordance with relevant WHS guidelines. **Table 1** outlines the Australian Qualifications Framework for arboriculture.

Table 1 - Australian Qualifications Framework (AQF)

| AQF* | Indicative employment level |
|---------|---|
| Level 2 | Tree Worker |
| Level 3 | Trade Arborist |
| Level 4 | Supervising Arborist/Coordinator |
| Level 5 | Consulting Arborist |
| Level 8 | Municipal Tree Manager/ Urban Forest Management |

* 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 following steps outline what is required for tree pruning to be in accordance with AS 4373-2007:

1. A thorough inspection of the tree is to be carried out by an arborist competent in arboricultural assessment (minimum AQF level 3).
2. The arborist will determine if pruning is required and the pruning requirements will be specified in a tree pruning specification (see **Appendix 5**).
3. The specified pruning will not adversely affect the tree.
4. All applicable planning, heritage and protected species legislation will have been considered in the context of the proposed pruning.
5. The specified pruning is to be carried out by a person qualified and experienced in arboriculture (minimum AQF level 2).
6. The person undertaking the pruning must do so in accordance with the specification that addresses the following pruning types from AS 4373-2007:
 - all pruning cuts are to be at a suitable branch collar or appropriate growth point, 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, and/or
 - 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 to reduce the risk of spreading palm disease, for example Palm Wilt see **Appendix 1**.

Note 1: Tree topping and lopping are not forms or classes of pruning in AS 4373-2007.

Note 2: Safe Work NSW Amenity Tree Industry Code of Practice applies to all commercial tree work including tree pruning.

3.0 Tree and shrub removal not associated with development

This section outlines the processes to be followed when tree or shrub removal is being undertaken, and the removal is not associated with other development (eg. building a residential dwelling), including:

- tree and shrub removal (not associated with other development) that requires development consent
- removal of a heritage listed tree
- tree or shrub removal that does not require a permit
- tree or shrub removal that requires a permit in accordance with Section 5.03.04 of Council's *Development Control Plan 2012*.

If the tree or shrub removal is associated with other development see section 4.0 of this Manual.

Note: Tree removal on private land in relation to bushfire 10/50 rules are not to be submitted to Council. Refer to the Rural Fire Service website.

3.1 Tree removal on private land that requires development consent

The following trees/vegetation requires development consent from Council prior to removal:

- (a) a tree that is listed as a heritage item unless removal is of a minor nature (refer to Section 3.2)
- (b) a tree that forms part of an Aboriginal object or is within a place of Aboriginal significance unless removal is of a minor nature (refer to Section 3.2)

A development application is to be lodged with Council. Forms can be obtained from Council's website: www.newcastle.nsw.gov.au/Development/Application-Guide/Development-Application-Process or phone (02) 4974 2000.

3.2 Removal of a heritage listed tree

3.2.1 Heritage listed tree

A heritage listed tree or shrub, including trees or shrubs that form part of an Aboriginal object or is within a place of Aboriginal significance, may potentially be removed if Council considers the works to be of a minor nature or will not adversely affect heritage significance. To make application to Council for determination of the works to the heritage listed tree or shrub as being minor or not adverse to heritage significance the following information must be submitted:

- (a) a completed *Notification - Heritage Minor Works or Maintenance* form obtainable from Council's website: www.newcastle.nsw.gov.au/Council/Forms-Publications/Forms/DA-Heritage-Notification-Form, and
- (b) an arborist report prepared in accordance with **Appendix 7** (qualification minimum AQF 5).

3.3 Tree and Shrub removal on private land that does not require a permit

A permit (*Application for Tree Removal* form) is not required from Council to remove a tree or shrub on private land in the following circumstances

1. The tree or shrub poses an immediate risk to life or property due to a demonstrated sudden change to its structure as a result of severe storm or wind events. Landowners consent is required to be obtained and the *Report Storm Damage Tree Removal* form in **Appendix 6** must be completed by the person carrying out the removal. The report must be retained by the resident for at least 2 years.

Clear and relevant photos are required to support the removal of the tree under this section. The photos are to show:

- the tree in context, showing relationship to dwellings, other trees or structures, and
- clear images of the damaged sections of the tree, and

- clear images to demonstrate the sudden change to the trees structure, and that it poses an immediate risk to life or property as a result of severe storm or wind events.

If the storm damaged private tree is a heritage listed item, then Council is to be notified by supplying the completed *Report Storm Damage Tree Removal* form in **Appendix 6**. The completed form and relevant photos are to be forwarded to Council within 5 working days of the tree removal.

Note: Trees or shrubs on public land cannot be removed in these circumstances. If a public tree or shrub appears to be damaged by a storm then this must be referred to Council who will carry out the required works.

2. The tree is dying or dead (refer to Glossary), and
 - is not required as the habitat of native animals, and
 - is not a heritage listed item (refer to Section 3.2.1 for requirements for heritage listed trees), and
 - is not part of a native vegetation community, and
 - an arborist (minimum AQF 3) has confirmed in writing (see **Appendix 11 *Dead or Dying Tree Removal Form***) that the tree meets the definition of dead or dying, and
 - the landowners consent has been obtained in writing.

Clear and relevant photos are required to support the removal of the tree under this section. The photos are to show:

- the tree in context, showing relationship to dwellings, other trees or structures, and
- clear images of the tree that clearly show the tree is dead or dying, and
- the land owner is to retain the completed Dead or Dying Tree Removal Form and all relevant photos for a period of 2 years.

3. The tree is less than 3m in height or with a circumference at breast height (1.4m above ground level) less than 450mm for a single trunk tree, or less than 300mm for each trunk of a multi-trunk tree (see **Figure 1**), and is not part of a native vegetation community.
4. The shrub is less than 5m in height and is not part of a native vegetation community.
5. The tree or shrub is located within 3m of the wall of an existing principal building (excluding carports, garages, pergolas, fences, retaining walls and the like) on the land where it is situated or on adjacent privately owned land (where the land owners consent for the works has been obtained).

Note 1: The 3m distance is measured from the closest point of the trunk to the footings of the building (see **Figure 2**).

Note 2: It is preferable that a replacement tree is planted on the same lot as the removed tree where space is available, and that this planting is outside the 3m buffer to the principal building.

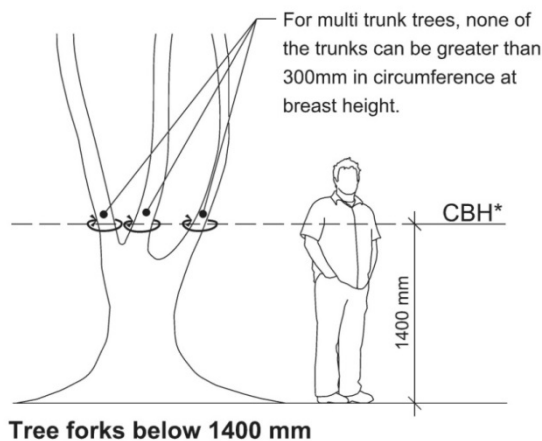
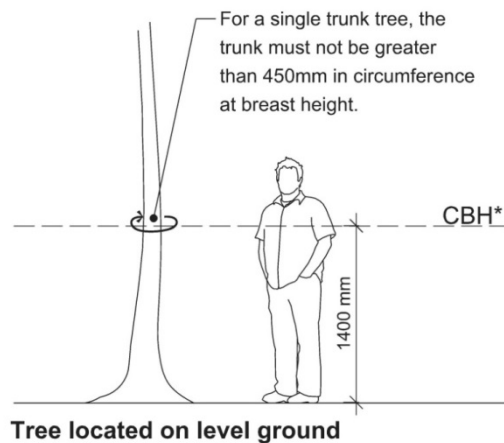
Note 3: This clause does not apply to trees or shrubs on land managed by a public authority including Council, this clause only applies to trees on privately owned land.

6. The tree or shrub is native vegetation previously planted for agriculture, agroforestry, forestry, horticulture or woodlot purposes.

Note 1: The removal of vegetation in a threatened ecological community or a threatened plant species listed under the *Biodiversity Conservation Act 2016* requires a licence under that Act. For further information see the Office of Environment and Heritage website. A permit application is also required from Council refer Part C of this manual.

Note 2: The removal of marine vegetation under the *Fisheries Management Act 1994* requires a permit under that Act. For further information see the Department of Primary Industries website.

Note 3: A permit from Council is required prior to clearing (removal) any other native vegetation including understorey plants, groundcovers and plants occurring in a wetland and is less than the biodiversity offsets scheme threshold identified under the *Biodiversity Conservation Act 2016*. Refer to Part C of this manual.



* CBH = Circumference at Breast Height, where circumference = distance around the trunk

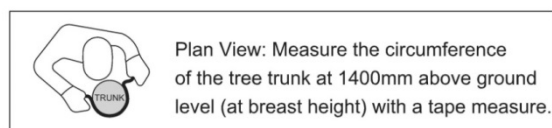
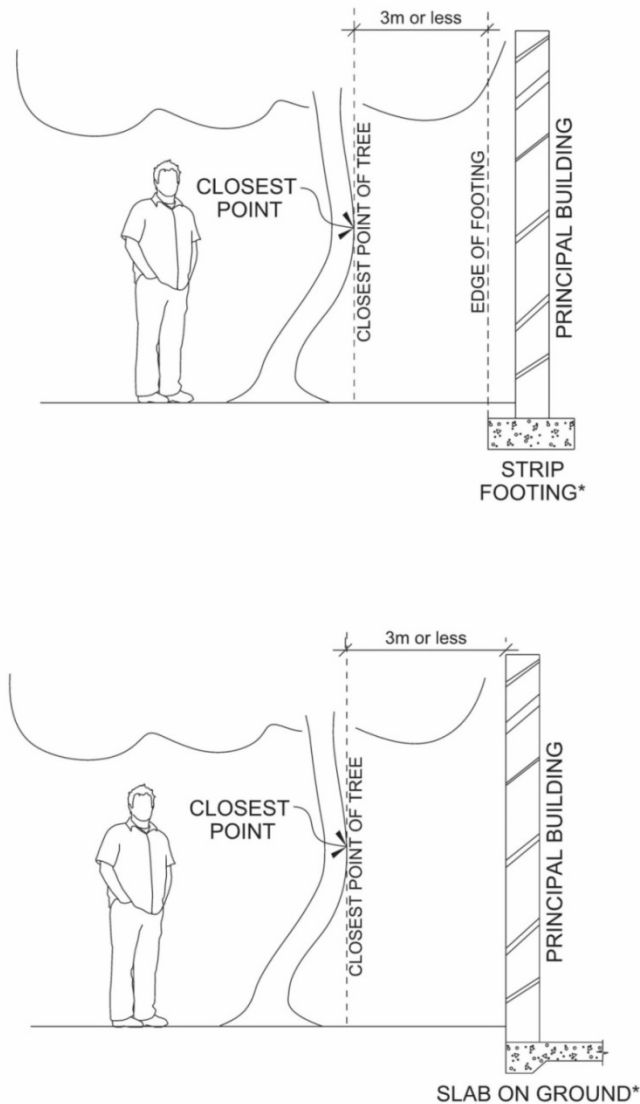


Figure 1 - Single and multi-trunk trees



* The difference in the diagrams is the footing type.

Figure 2 - Tree located within 3 metres of principal building

3.4 Tree and shrub removal on private land requiring a permit

A permit is required from Council to remove trees (or shrubs greater than 5m in height) on private land as detailed in (a) to (c) below:

- (a) a tree that is required to be retained or planted as a condition of a permit, complying development certificate or development consent, or
- (b) a tree that was planted as a replacement tree, or
- (c) any other tree/shrub that is not listed in sections 3.1, 3.2 or 3.3 above.

Note: All trees and shrubs within Council's road reserve are declared vegetation and the maintenance or removal of these trees is undertaken by Council.

The removal of trees as a permit is separated into two distinct processes. These two processes are:

1. A permit *Application for Tree Removal* form (no Arborist Report) of up to 3 trees and where replacement planting is to be undertaken (Section 3.4.1).
2. A permit *Application for Tree Removal* form (with Arborist Report) for removal of more than 3 trees, OR where no replacement planting is to be undertaken (Section 3.4.2).

3.4.1 Application for removal of up to three (3) trees and where replacement planting is to be undertaken

This process is used where it is proposed to remove up to three (3) trees, and plant a minimum of one new tree. Additional replacement trees are encouraged where space permits. The replacement plantings should be species that are suitable to the site and the available space. The planting of an appropriate size tree for the space minimises the likelihood of future interaction with built structures and maximises the life of the tree (refer to Section 10).

An arborist report (including the tree assessment tests) is not required for this permit for tree removal process.

A permit application for removal of up to three (3) trees, and replant with a minimum of one new tree, is to include the following:

- (a) a completed *Permit Application for Tree Removal* form, and
- (b) a site map which identifies the location of the tree(s) to be removed and the location of replacement plantings in relation to the principal building and other ancillary structures, and
- (c) the botanical and common name of the replacement tree species.

Note 1: Where the removal of up to three trees does not include the replacement planting of at least one tree, then section 3.4.2 below applies.

Note 2: Council does not assess the appropriateness of the proposed planting location or nominated species.

3.4.2 Application for removal of more than three (3) trees or where no replacement planting is to be undertaken

This process is used where it is proposed to remove more than three (3) trees, OR where no replacement planting is to be undertaken.

Where more than three (3) trees are to be removed the replanting of replacement trees is encouraged, provided adequate space permits. The replacement plantings should be species that are suitable to the site and available space. The planting of an appropriate size tree for the space minimises the likelihood of future interaction with built structures and maximises the life of the tree (refer to Section 10).

The circumstances where no replacement tree/shrub planting is acceptable may include:

- small courtyard areas such as town house or terrace houses
- the only space available to plant is in the narrow areas between houses along the property boundary
- the offsets from all of the existing structures and associated hard stand areas, results in a space that is inadequate to support the tree/shrub at maturity without significant damage.

Where it is proposed to remove more than three (3) trees, or where no replacement tree planting is proposed, and where the trees are not part of a native vegetation community, a *Permit Application for Tree Removal* is to include the following:

- (a) a completed *Permit Application for Tree Removal* form, and
- (b) an *Arborist Report Permit Application* completed by a suitably qualified arborist (AQF5) (refer to **Appendix 7**) that
 - demonstrates that at least one of the tree assessment tests under section 3.4.4 has been met, and
 - is prepared in accordance with section 6.0.
- (c) A site map which identifies:
 - the location of the tree(s) to be removed, and
 - location of replacement plantings (where proposed) in relation to the principal building, other ancillary structures (eg. carport/garage/garden shed) and hardstand areas, and
- (d) The botanical and common name of the replacement tree species.

Note 1: Council does not assess the appropriateness of any proposed planting location or nominated species.

Note 2: The removal of vegetation in a threatened ecological community or a threatened plant species listed under the *Biodiversity Conservation Act 2016* requires a licence under that Act. For further information see the Office of Environment and Heritage website. A permit application is also required from Council refer Part C of this manual.

Note 3: The removal of marine vegetation under the *Fisheries Management Act 1994* requires a permit under that Act. For further information see the Department of Primary Industries website.

Note 4: A permit from Council is required prior to clearing (removal) any other native vegetation including understorey plants, groundcovers and any plants occurring in a wetland and that is less than the biodiversity offsets scheme threshold identified under the *Biodiversity Conservation Act 2016*. Refer to Part C of this manual.

Note 5: For tree removal within a native vegetation community refer to Part C of this manual.

3.4.3 Designing for new tree planting

Where it is proposed to undertake replacement plantings, refer to Section 8.0 for information on designing for new tree planting.

3.4.4 Tree assessment tests

The tree assessment tests are required for permit applications where it is proposed to remove more than three (3) trees, or where no replacement planting is to be undertaken.

The purpose of the tree assessment tests for permit applications is to ensure that tree removal is only undertaken where necessary. This is achieved by ensuring existing private trees are only removed where it is demonstrated that no practical alternative is available, and that this has been fully investigated and documented.

Private tree removal requires one or more of the following tests to be met to support a permit application for tree removal.

3.4.4.1 The unacceptable risk test

The objective of this test is to determine if the private tree poses an unacceptable risk that cannot be appropriately managed by arboricultural treatment, fencing, signage or other risk management measures.

The following is to be provided by a suitably qualified arborist:

- a documented tree inspection, and
- a detailed tree risk assessment in accordance with industry best practice tree condition assessment methodology, and
- supporting evidence, which is to include clear and relevant photographs of the tree(s), any hazards, targets, and demonstrate the risk, and
- a review of options for managing risk other than by tree removal, and
- a summary of the risk abatement options and implications.

3.4.4.2 The diseased condition test

The objective of this test is to determine if the private tree is in a diseased condition that cannot be corrected by appropriate arboricultural treatment.

The following is to be provided by a suitably qualified arborist:

- an inspection of the tree and formal identification of the disease, and
- an assessment of the impact of the disease on tree health and/or structural condition, and
- supporting evidence, which is to include clear and relevant photographs of the tree(s), any visible signs of disease, and
- a review of options for managing the disease other than by tree removal, and
- a summary of the options and implications.

Where the trees structural integrity is at risk, a formal risk assessment is to be conducted using industry best practice tree condition assessment methodology.

3.4.4.3 The property damage test *within 12 months of assessment*

The test is to determine if public or private property are being significantly affected by the presence/location or growth of a private tree, and it is shown that tree removal is the only reasonable means to avoid further impact.

Council uses this test where private trees are interacting with infrastructure.

The purpose of this test is to assess the degree of impact a tree is having on built assets (including utility services, footpaths, driveways, retaining walls and buildings) and to demonstrate whether removal is the only reasonable option to avoid further conflict, within the short term, ie. 12 months.

The following is to be undertaken:

- A suitably qualified arborist is to:
 - review the condition and proximity of all existing and previously removed trees that are relative to the part of the built asset that is, or is likely to be damaged within 12 months, and
 - assess the likely future growth and development characteristics of the tree(s), and

- undertake investigations to demonstrate that the tree(s) are interacting where existing damage is claimed or evident, and
- provide supporting evidence, which is to include clear and relevant photographs of the tree(s), damage, root interaction and relationship of this to nearby trees, and
- consider appropriate options, other than tree removal, for managing the interaction between tree(s) and built asset, and
- provide a final review of options and their feasibility for managing the interaction between tree(s) and built asset.

3.4.4.4 The suppressed growth test

The objective of this test is to determine if 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.

The following is to be provided by a suitably qualified arborist:

- an assessment of all trees in a group, and
- a report that:
 - demonstrates why the tree(s) in question would be the most beneficial tree(s) to remove, and
 - a site plan and clear photographic details to indicate exactly which tree(s) are to be removed, and
 - the method to be used and precautions to be adopted to protect remaining trees.

Note 1: This test does not apply to a traditional avenue planting of evenly spaced trees, or trees that are typically understorey plants.

Note 2: Caution should be exercised in removing trees from a mature/established group as changes in wind exposure could increase the likelihood of failure.

3.4.4.5 The public infrastructure works test

This test can only be applied by Council. The test is applied when Council is undertaking infrastructure works on public land that impact on an adjacent private tree. The information will be provided in accordance with Council's requirements and address the matters below.

The objective of the test is to determine if a private 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.

Significant injury or damage is defined as resulting in:

- tree death, or
- the tree posing an unacceptable risk, or
- a reduction in the remaining service life of the tree to an unacceptable timeframe.

The likelihood of significant injury must be confirmed in a report prepared by a suitably qualified Council approved consulting arborist who must:

- conduct a tree inspection, and
- undertake a detailed assessment of the impact of the proposed works on the health and structure of the tree to determine if significant injury or damage will occur, and
- provide a summary to the public infrastructure designer.

The public infrastructure designer must:

- document all reasonable design alternatives to retain healthy trees, and
- discuss the likely impacts of the options with the arborist, and
- liaise with the tree owner where there are no design options that can retain the tree/s, and
- where the owner agrees with the removal, complete a *Permit Application for Tree Removal*, and obtain the owner's signature, and
- submit the form to City Greening Services, note the receipt of the permit and removal of the tree on appropriate plans.
- Council arranges removal of the tree(s) and a new tree(s) is provided to the owner for planting on their own land.

Note: Private trees that are within 5m of the boundary **must** be considered when designing and installing public infrastructure. Failure to consider this can result in creation of a foreseeable risk.

4.0 Tree removal on private land associated with development

This section applies to tree removal associated with single lot development (eg. construction of a residential dwelling on a single lot). The process for greenfield development is outlined in Section 5.0.

Council requires new developments to consider incorporation of retainable private trees into the design of the development. Where this is not possible, suitable replacement planting should be undertaken. An assessment of both public and private trees is required for a proposed development.

Public trees within 5m of a proposed development must be shown on the submitted site plan, and will be assessed by Council in accordance with the Part B, Section 2 of this manual.

Where the development affects private trees located on the lot, or where the trunk of a private tree is located within 5m of the development footprint, the following information is to be submitted with the development application:

- (a) A report (see Section 6.0) from a consulting arborist (AQF5) that:
 - (i) includes an assessment of each trees health and structure, and
 - (ii) incorporates a tree retention value assessment in accordance with Section 4.1, and

Note: Tree retention value assessments are not required for development that has a total footprint greater than 2ha. Assessment requirements for sites of this size are incorporated into the greenfield site controls of Section 5.

- (iii) includes evidence to substantiate any claims made about tree condition. Evidence may include clear and relevant photographs of the tree(s) and any other relevant factors, and
- (iv) defines tree protection zone offsets and protection requirements in accordance with Section 7.0, and
- (v) provides a summary of trees to be retained and removed, and
- (vi) must be provided to the designer who is to consider and document design options to retain suitable trees (see Section 4.2).

Note: Development and development footprint includes any ancillary works or associated excavation such as driveways, utility trenches, stockpiling of materials or soil, wash out areas and vehicle movements.

- (b) Where it is demonstrated that the development design cannot retain trees, a landscape concept plan for the site is to be prepared. The plan is to identify suitable locations and species for compensatory tree planting within the site (see Section 4.3).
- (c) Where the proposed development will impact on more than 1000m² of bushland, or where the development will impact on trees or bushland within a riparian corridor, a flora and fauna assessment must be prepared by a suitably qualified consultant. An arborist report is not required for these areas.

4.1 Determining tree retention value

Note: This Process is not required for Public Trees, or private land tree complying development certificate applications.

Tree Retention Value is derived from a weighted combination of tree sustainability and landscape significance using the matrix in **Table 3**. This assessment is required to identify which trees are retainable with the resulting information used to guide the site analysis and site planning stages. The following three steps are to be undertaken in assessing tree retention value.

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 a tree can provide amenity and other benefits. For the purposes of this test, sustainability is to use the following classifications:

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

To assess tree sustainability, the heads of consideration in **Figure 3** are to be assessed by the arborist to determine the relevant classification.

Sustainability must only be assessed by a person with a minimum qualification of AQF 5.

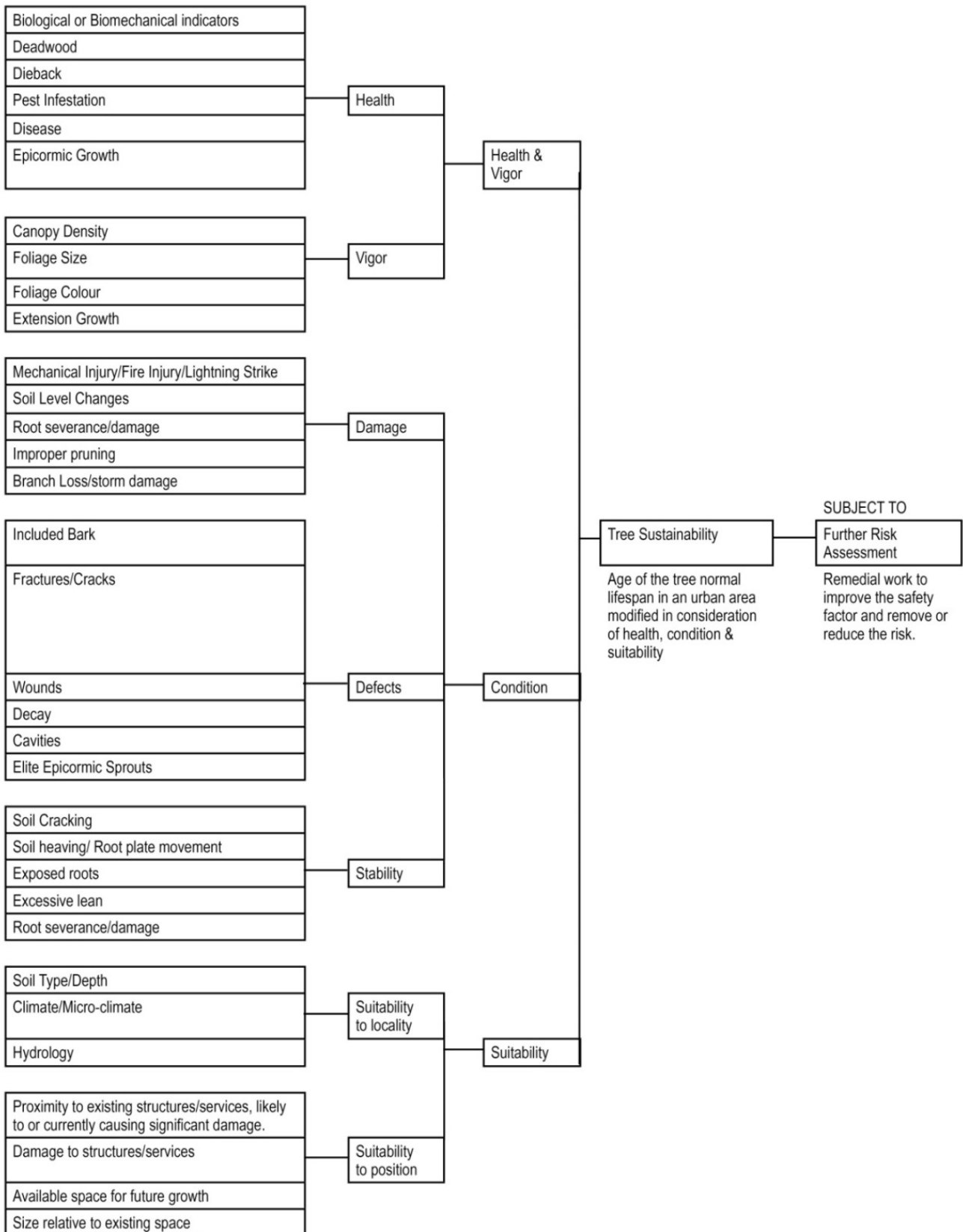


Figure 3 - Tree Sustainability Heads of Consideration

Step 2 - Assess landscape significance

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

The level of landscape significance is determined using the following criteria in **Table 2**.

Table 2 - Criteria for assessment of landscape significance

| 1. SIGNIFICANT |
|---|
| The tree is listed as a heritage Item under the <i>Newcastle Local Environment Plan (LEP) 2012</i> with a local, state or national level of significance, or |
| The tree forms part of the curtilage of a heritage item (building /structure/artefact/place of significance) as listed in <i>Newcastle LEP 2012</i> 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 listed as a threatened plant species or is a key indicator species of a threatened ecological community under the <i>Biodiversity Conservation Act 2016</i> or the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> , 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 200m ²) 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 200m ²); 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 100m ²), 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 40m ²), 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 (less than 40m ²) 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 Part A, Table 7 of this Technical Manual; and |
| The tree does not meet any of the above criteria and has no heritage importance or value, no known or suspected historical association. |
| 7. INSIGNIFICANT |
| The tree is an undesirable species as listed in Part A, Table 7 of this Technical Manual. |

The material in **Table 2** has been adapted with permission of the author, Andrew Morton, Earthscape Horticultural Services. Sydney, Australia.

* Crown Size expressed in (m²) is calculated by $\pi \times r^2$

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 - Determine Tree Retention Value

After determination of the tree sustainability and significance in the landscape the matrix in **Table 3** is used to evaluate the tree retention value.

Table 3 - Tree retention values assessment methodology

| | Landscape Significance Reading | | | | | | |
|-----------------------|--------------------------------|---|----------|-----|--------------------------|---|---|
| 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.

4.2 Explore alternative design options

Alternative design options are to be considered where removal of trees of moderate or high value (as determined in accordance with Section 4.1) is proposed. The information in the arborist report (including tree condition, tree protection offsets, and tree retainability assessment) is to form the basis for determining suitable development design options.

Alternative design considerations could include:

- relocating and/or minimising driveway crossover widths to retain existing trees
- altering development footprint
- altering hard surface design
- utilising permeable pavement
- move footpath alignment, or location
- ramp or bridge over tree roots, or use elevated walkways
- install footpath on surface without excavation and reduced batter
- move above or below ground utilities (eg. powerlines, water, gas) away from trees
- avoid level changes near trees.

4.3 Compensatory planting

Where it has been demonstrated it is not reasonable to retain a tree of moderate to significant value compensatory planting on private land will be required. A guide to compensatory planting rates for trees of moderate or high value is provided in **Table 4**.

Table 4 - A guide to compensatory planting on the development site

| | Total area of crown projection to be removed ¹ | Number of standard trees ² to be planted |
|---|---|---|
| 1 | Up to 20m ² | 1 standard tree |
| 2 | 21 m ² – 40m ² | 2 standard trees |
| 3 | 41 m ² - 60m ² | 3 standard trees |
| 4 | 61 m ² - 80m ² | 4 standard trees |
| 5 | 81 m ² -100m ² | 5 standard trees |

Note 1: Crown Projection (m2) = average canopy radius x π

Note 2: A standard tree is a minimum 45L container volume, a minimum crown projection at maturity of 20m² and of a desirable species.

Compensatory planting is to be located on the development site. The required compensatory planting is to be achieved by designing for planting of new trees in accordance with **Table 4** above.

Where it is demonstrated compensatory planting cannot be carried out in accordance with the above table, incorporating smaller trees into the landscape area will be required. Trees of different sizes and species can be planted to suit the site.

The compensatory planting locations and species are to be shown on the landscape concept plans. The landscape plan is to indicate opportunities for canopy cover, biodiversity and occupant amenity.

Note 1: Public land is not to be used for compensatory planting.

Note 2: Where space permits, the preferred planting location is within the front of the property. The planting location should take into account services and other infrastructure. Planting should be offset a minimum 1.5m from the front property boundary.

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

- physical constraints of the site, eg. adequate space for the tree at maturity including clearances required for driveways and other utilities
- site soil conditions and microclimate
- growth habits of the proposed species, eg. crown shape and characteristics
- implications for neighbouring properties.

4.4 Designing for new trees

When designing for new trees on a single lot development the information in Section 8.0 is to be incorporated into the development application documentation.

4.5 Tree protection

Where tree protection is required on a single lot development, the information in Section 7 is to be incorporated into the tree protection plan and any relevant development conditions.

5.0 Greenfield sites

Greenfield sites are undeveloped land that has been identified, through land use zoning, as having potential 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 2ha in area.

A development application for the development of a greenfield site is to include:

- (a) A detailed site plan and report that identifies:
 - (i) vegetation to be retained, and defines tree protection zone offsets and protection requirements in accordance with Section 7, and
 - (ii) defined asset protection zones and relationship to vegetation to be retained, and
 - (iii) the location of habitat trees (to be retained and removed), and
 - (iv) a separate plan layer identifying locations of proposed street and park tree plantings, and nominated species selected in accordance with Council's Street Tree Selection Manual 2016.
- (b) A flora and fauna assessment prepared by a suitably qualified and experienced ecological consultant where the development will impact on 1000m² or more of bushland, or where the development will impact on trees or bushland within a riparian corridor.
- (c) A report from a consulting arborist (AQF 5) where individual trees are to be retained on residential zoned lots or public land that:
 - (i) includes a Tree Impact Assessment (see **Table 5**), which assesses the condition of the trees, determines the impacts from clearing of adjacent vegetation, and identifies trees suitable for retention, and
 - (ii) identifies individual trees along fringes of bushland that are compromised by the development works and require removal, and
 - (iii) defines tree protection zone offsets and protection requirements in accordance with section 7, and
 - (iv) is prepared in accordance with section 6.0.

Note: Arborist's reports do not need to assess bushland, other than as outlined in clause 5.0(c).

5.1 Retention of vegetation

5.1.1 Benefits of vegetation retention

The retention and provision of vegetation on greenfield sites provides 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.

5.1.2 Percentage of site as bushland

Greenfield sites with a total site area greater than 2ha are to have a minimum of 25% of the site area preserved for the retention or provision of native bushland. Trees on residential lots are excluded from the 25% vegetation calculation.

Priority for native bushland retention should be given to the communities of highest ecological value as identified in the flora and fauna report.

Land set aside for stormwater detention basins, roads, and other infrastructure associated with the development will not be included in the calculations of the area set aside for native bushland.

If the site is generally devoid of native vegetation or contains degraded lands, the development is to include the restoration of at least 25% of the site area to native bushland. Species selection is to be consistent with the endemic vegetation of the area.

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 (see **Figure 4**). Areas to be retained or improved for indigenous vegetation are to be shown on landscape plans submitted for development application approval.

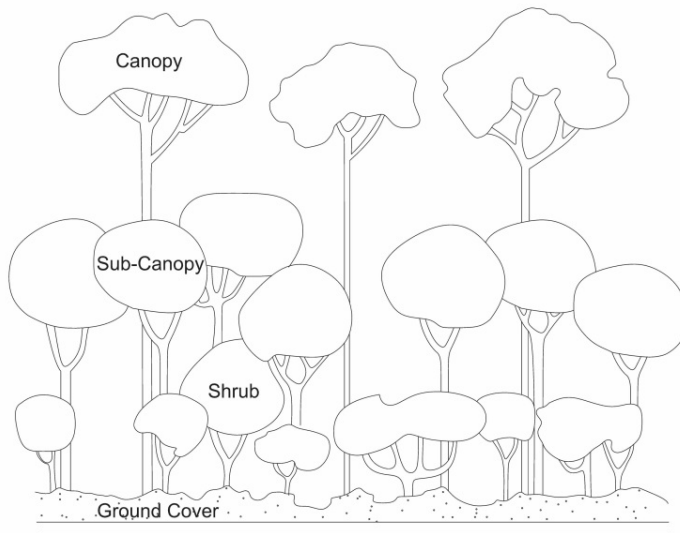


Figure 4 - Example of vegetation cover required

6.0 Arborist reports and qualifications

Arborist reports, specifications and tree protection plans are to be prepared by an arborist with the minimum qualifications and experience as detailed in **Table 5** below.

Table 5 - Arborist qualifications for preparation of reports and specifications

| Task | Minimum Qualification | Recommended Practical Experience |
|---|---------------------------------------|--|
| <i>Unacceptable Risk Assessment Test</i> | 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. |
| <i>Diseased Condition Assessment Test</i> | AQF 5 in Horticulture (Arboriculture) | Assessing, reporting on disease in trees. Diagnosis and assessment of tree disease Application of appropriate methodologies for non-destructive testing of disease in trees. |
| <i>Property damage Assessment Test</i> | AQF 5 in Horticulture (Arboriculture) | Assessing and reporting the implications of interactions between trees and structures. |
| <i>Suppressed Growth Assessment Test</i> | AQF 5 in Horticulture (Arboriculture) | Sound knowledge of tree species and tree biology. Experience in assessment or management of multi-storey vegetation |
| <i>Public Infrastructure Works Test (used by Council only)</i> | AQF 5 in Horticulture (Arboriculture) | Assessing, quantifying and reporting the potential impacts of infrastructure designs and construction activities on trees. Extensive knowledge of urban trees and soils. Practical knowledge of tree root mapping and root plate assessment methodologies. |
| Prepare an <i>Arborist Report to support Tree Removal Application Form (Appendix 7)</i> | AQF 5 in Horticulture (Arboriculture) | Assessing tree/s, reviewing options to retain trees and experience as detailed in The Tree Assessment Tests listed above, relevant to the circumstance. |
| Prepare a <i>Dead or Dying Tree Removal form (Appendix 11)</i> | AQF 3 in Horticulture (Arboriculture) | Assessing tree/s. Sound knowledge of tree species and tree biology/physiology. Demonstrated ability to provide clear and relevant evidence to support the claim of dead or dying. |
| Prepare a <i>Storm Damage Tree Removal form (Appendix 6)</i> | AQF 3 in Horticulture (Arboriculture) | Assessing tree/s. Sound knowledge of tree species and tree biology. Demonstrated ability to provide clear and relevant evidence to support the claim of storm damage. |
| Complete <i>NATSPEC tree stock inspection form (Appendix 8)</i> | AQF 4 in Horticulture (Arboriculture) | Demonstrated experience in assessing tree stock against NATSPEC Landscape Trees (or Australian Standard). Thorough understanding of NATSPEC requirements and heads of consideration. Experience in tree planting and maintenance. |

| Task | Minimum Qualification | Recommended Practical Experience |
|--|---------------------------------------|---|
| <i>Tree retention value assessment</i> | AQF 5 in Horticulture (Arboriculture) | Assessing the retention value of trees in relation to large and small scale development. |
| <i>Tree impact assessment or Tree Survey</i> | AQF 5 in Horticulture (Arboriculture) | Assessing, quantifying and reporting the potential impacts of development designs and activities on trees. Extensive knowledge of urban soils and soil practices. Practical knowledge of tree root mapping and root plate assessment methodologies. |
| <i>Specify tree pruning to AS 4373 –2007</i> | AQF 3 in Horticulture (Arboriculture) | Assessing and specifying tree pruning to meet the Australian Standard and other best practice methodologies. |
| <i>Write a Tree Protection Plan</i> | AQF 4 in Horticulture (Arboriculture) | Assessing, quantifying and reporting the likely impact of development on trees and identifying practical measures for harm minimisation. |
| <i>Tree amenity valuation</i> | AQF 5 in Horticulture (Arboriculture) | Assessing the amenity value of trees using best management practice methodologies. |

Arborist reports must 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.
4. Provide suitable evidence, including clear relevant photographs, and references to support claims/recommendations.
5. Provide the relevant detail of the tree assessment test where required.
6. Include the information contained in **Table 6** in addition to any other requirement.

Table 6 - 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 email 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 as provided by the client |
| | 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 |

7.0 Protection measures

The purpose of this section is to ensure that appropriate tree protection measures are documented and implemented to prevent damage to all trees on Council managed land. The Australian Standard *AS4970-2009 Protection of trees on development sites* applies for trees on both private and public land, and contains information required to determine the tree protection zone and prepare a tree protection plan.

The tree protection zone (TPZ) is the distance specified within documentation and construction plans that is to be protected during all phases of any works. The TPZ is calculated as 12 x trunk diameter at breast height (DBH) which is measured at 1.4m above ground level. The trunk diameter (DBH) of multi stemmed trees is calculated using Council's online calculator to achieve a single stem figure www.newcastle.nsw.gov.au/Living/Environment/Trees/Public-Trees/Online-Calculator

The following information is supplied as a summary of the key elements of *AS 4970 - 2009* and is to be read in conjunction with that standard. The information provided below applies to the protection of tree/s on public land.

7.1 Trees and development applications

Australian Standard *AS4970-2009 Protection of trees on development sites* requires the preparation of a tree protection plan. Arborist reports submitted as part of a development application are required to include a tree protection plan and tree protection requirements for public trees will be included as part of conditions of consent. This is to ensure that any public tree retained within 5m of the property boundary is adequately protected during the demolition and construction phase of development. A final tree protection plan for public trees is to be submitted to and approved by Council prior to issue of a Construction Certificate.

Inspections are to be undertaken by the Certifying Authority to ensure the tree protection measures are installed and maintained in accordance with the approved tree protection plan. Tree protection measures are to be implemented prior to the commencement of construction and remain in place until construction is complete.

7.2 Preparing a tree protection plan

Tree protection plans are to be prepared by an arborist with minimum qualification level of AQF 4.

Tree protection plans are to be prepared in accordance with *AS 4970-2009* and the information detailed in the following sections. In some circumstances the tree protection zone may require modification, for example trees on road verges. All modifications should be determined prior to construction or, where issues arise on-site, by a suitably qualified arborist who will document the modification and reasons why.

7.3 Tree protection zone (TPZ) fencing

All retained trees will require tree protection fencing to be established prior to any tree removal works, demolition, earthworks, or construction works. The tree protection fencing is to be installed in accordance with the approved tree protection plan.

The site supervisor is responsible for the implementation of tree protection zone fencing. The site supervisor must also ensure the fencing is maintained at the required distance from the tree, and kept secure to exclude access until completion of works and rehabilitation of the site has occurred.

7.3.1 Fencing types

The type of tree protection fencing to be used is to be specified within the tree protection plan, and is to meet the requirements and intent of the *AS 4970-2009*. The fence is to be stable and robust so as to withstand weather events and accidental impact, and is to have signage stating Tree Protection Zone No entry (see **Figures 5 & 6**).

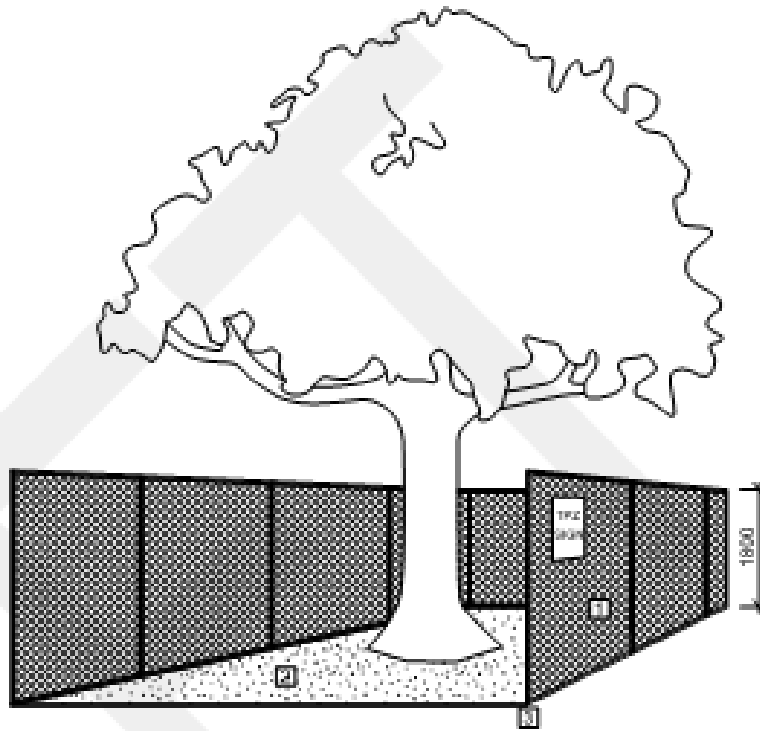


Figure 5 - Generic Tree Protection Fencing



Figure 6 - Tree Protection Fence Sign

7.3.2 Tree protection fencing for public footways

For trees situated within a road verge, only the area between the footpath and road shall be enclosed with the required tree protection fencing for a 3m distance each side of the tree to allow access to the property. Maintain pedestrian and roadway clearances for safe public use. **Figure 7a** and **7b** indicate typical treatment, however modifications may be required.

All works adjacent to the roadway require a Traffic Control Plan as per AS 1742.3-2009 - *Traffic control devices for works on roads*.

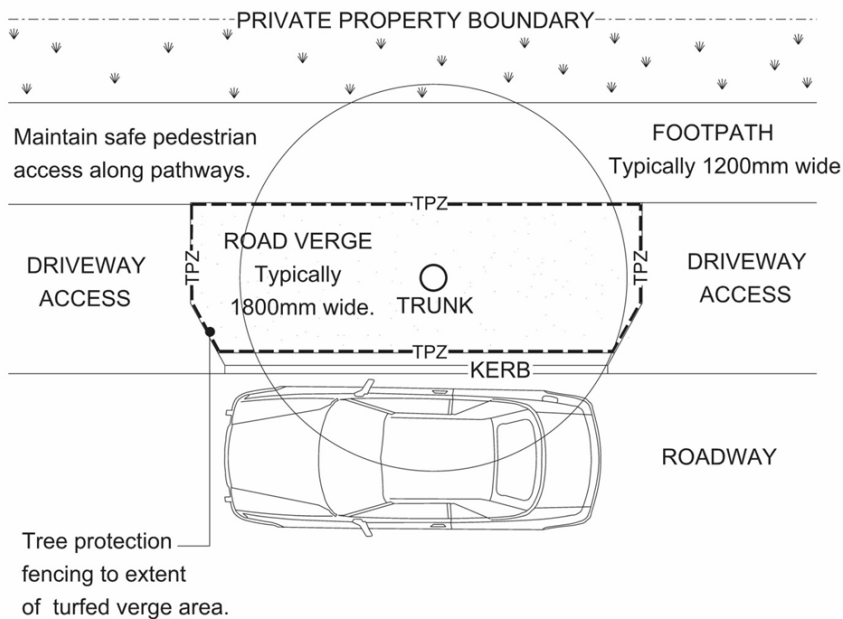


Figure 7a - Indicative tree protection on the road verge

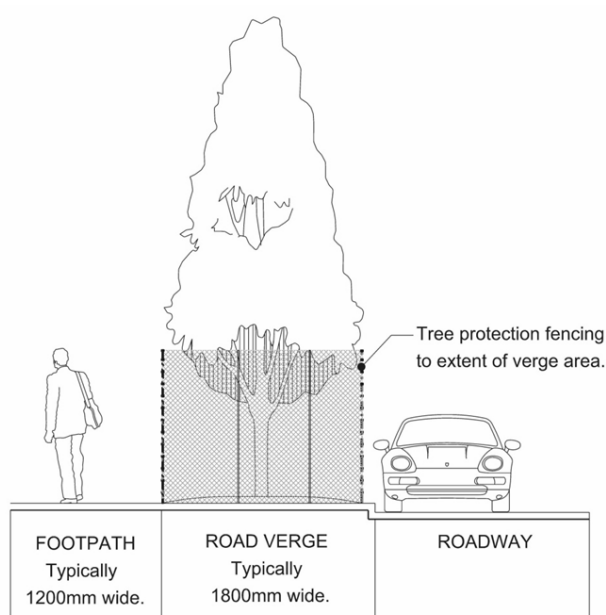


Figure 7b - Indicative tree protection on the road verge

7.3.4 Tree protection in limited space

Where construction works are required in limited space, then trunk, stem and ground protection are to be implemented in accordance with AS 4970-2009 (See **Figure 8**). This may also occur where access to a site is within proximity of a tree(s).

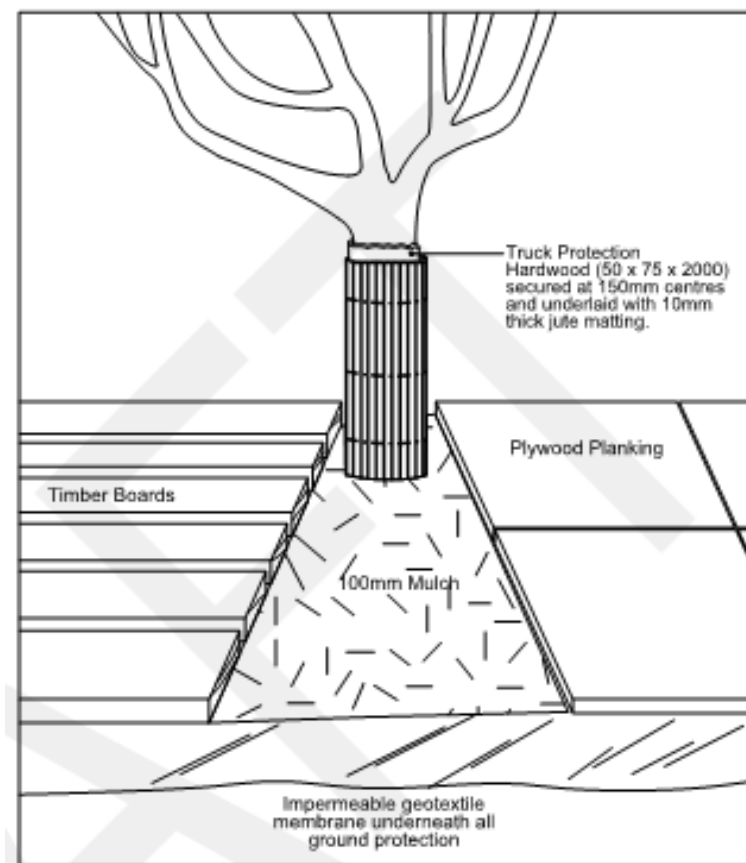


Figure 8 - Trunk and ground protection

7.3.5 Tree protection fencing in parks, reserves and bushland settings

Tree protection fencing is required for subdivision works, or works on private land that are adjacent to a park, reserve or bushland, where the works or associated ancillary activities are within the trees required tree protection zone.

The TPZ is calculated as $12 \times$ trunk diameter at breast height (DBH) which is measured at 1.4m above ground level. The trunk diameter (DBH) of multi stemmed trees is calculated using Council's online calculator to achieve a single stem figure. See Council's website www.newcastle.nsw.gov.au/Living/Environment/Trees/Private-Trees/Online-Calculator.

The protection fence is to be stable and robust so as to withstand weather events and accidental impact, and is to have a signage stating Tree Protection Zone No entry (see **Figures 5 & 6**).

In some circumstances the density of planting can require access through the TPZ of trees (see **Figure 9**). Where this access is required ground protection is to be provided, which may include 200mm mulch, gravel and/or rumble boards (see **Figure 8**).

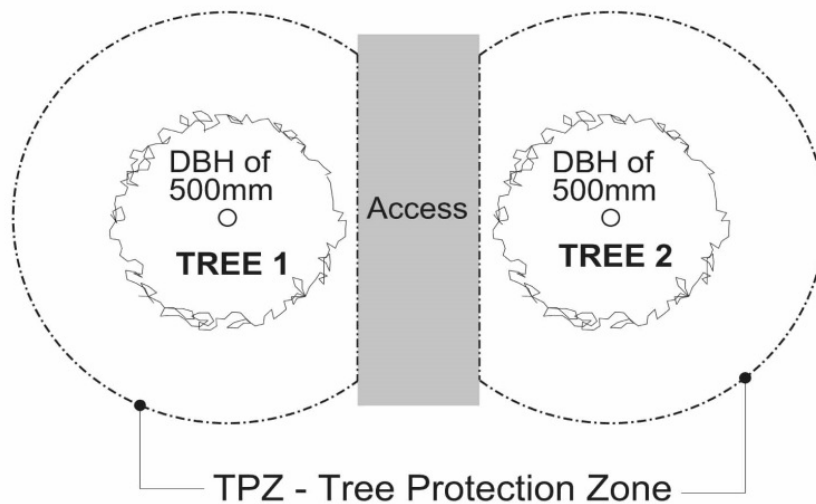


Figure 9 - Access between trees when space is limited

8.0 Designing for new trees

Assessment of the site early in the design phase provides an opportunity to ensure trees are appropriately incorporated into the proposed development. The following information is provided to inform tree planting on private land in subdivisions or other large scale developments, however the general principles and information is also applicable to residential planting. The design and implementation of tree planting on land that is, or will become, public managed land is to be undertaken in accordance with Part B, Section 5.2 of this manual.

When designing for new trees on private land the following should be considered:

1. Consider the context in which the planting is to occur (see Section 8.1).
2. Determine required soil volume and clearances from infrastructure (see Section 8.2).
3. Consider alternative designs for creating additional space (see Section 8.3).
4. Incorporate aeration and drainage into planting design (see Section 8.4).

8.1 Consideration of context

When designing new plantings consideration of the context of the planting area, particularly where structures, infrastructure or neighbouring properties may be impacted by tree root development or overshadowing, needs to be undertaken. The following sections detail the contextual factors that are to be considered as part of a design, or before undertaking tree planting.

8.1.1 Solar access

Solar access can be impacted by species selection and planting location. These impacts can include reduced sun or light entering the property, or increased cooling costs due to lack of shade. Solar access should be considered when selecting species and determining planting locations. The planting should also take into account the location of solar panels where they currently exist.

8.1.2 Bushfire hazard and asset protection

Prior to the selection of species or determining planting locations on bushfire prone land a review of potential impacts from bushfire is to be undertaken. Refer to Planning for Bushfire Protection 2006 (NSW Rural Fire Service) and the Bush Fire Protection section of Council's Development Control Plan.

8.2 Space required below ground and clearances from structures

8.2.1 Calculating mature tree soil volume

Trees require an adequate root system for tree stability, to maintain biological function and healthy growth. The amount of suitable soil that a tree has available will determine the amount of root system that the tree can develop and the amount of soil water and nutrients available to the tree. Tree roots are generally limited to the top 60cm of soil, with the majority located in the top 30cm, and form a broad root plate which can extend well beyond the canopy. In some cases tree roots may grow deeper in the soil, subject to oxygen levels, and are known as sinker roots. The overall stability of a tree is achieved through a combination of the shallow root plate and the sinker roots. See Council case book study on tree failure at the link below for further information and **Figure 10**.

[Tree Failure Casebook History - Informing Tree Management in Newcastle - 2000-2011](#)



Figure 10 - Tree root development

The generalized & unimpeded root system is broad and shallow (often only 200-300mm deep) with load bearing (structural) roots extending radially 2-4m with descending (sinker) roots below the trunk. Non-structural fine 'feeder' roots are wide-spreading often well beyond the edge of canopy (drip line).

Graphic source - The Morton Arboretum.

Soil volume required for root growth in soils is calculated as per the Cornell University formula which is widely accepted. The Cornell University formula requires the crown projection to be calculated first. Crown projection is the mature canopy spread for that particular species. Crown projection is to be calculated by a suitably qualified arborist.

- Crown projection (CP)(m²) = $\pi \times r^2$ $\pi = 3.142$ $r = \text{average radius(m)}$

Soil volume is then calculated by:

- Soil volume (SV)(m³) = CP x 0.6

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

$$CP = \pi \times 4^2$$

$$CP = 50\text{m}^2$$

$$SV = 50\text{m}^2 \times 0.6$$

$$SV = 30\text{m}^3$$

Note: The soil volume calculation does not include the percentage consumed by the inorganic fraction where gap graded soils (eg. structural soils) are used. Therefore, the total volume of a gap graded soil with high proportion of rock particles will be greater than for other options.

Once the soil volume has been calculated the area required to achieve this volume is to be determined based on a maximum soil depth of 60cm. Depth of soil below this may allow for some sinker roots but lower oxygen levels generally restrict fine root growth.

Using the example above the mature Tuckeroo requires a soil volume of 30m³. At 60cm deep the surface area required can be calculated as follows:

- Surface area (SA) (m²) = Soil Volume/depth (m)
- SA = 30/0.6
- SA = 50m²

This cannot effectively be achieved in confined planting locations. Therefore, it is important to provide as much soil as possible in a given situation. Break out zones are generally ineffective as these often lead to interaction between tree roots and infrastructure. When designing new areas or full road rehabilitation, wider footways with an area clear of footpaths and utilities provide the best opportunity for increased soil volume. This results in faster establishment of canopy, healthy trees and reduced interaction with infrastructure.

The allocation of the required square metre area into width and length is to account for the development of the trees future radial structural root zone. Therefore, narrow planting beds are not suitable. See Council's online calculator or *AS4970-2009* to determine the radius of the structural root zone. www.newcastle.nsw.gov.au/Living/Environment/Trees/Public-Trees/Online-Calculator

8.2.2 Clearances from structures and utilities

New tree planting areas are to be appropriately designed to provide clearance from utilities, hard stand areas and structures to avoid damage. Species should be selected and located to provide adequate clearance as the tree grows to maturity.

Prior to selecting a species and planting location the following should be undertaken:

- Locate all underground services through Dial Before You Dig.
- Identify where structures, paths and services are located in relation to each other to consider what space may be available for planting.

- Consider tree species that are suitable to the space.
- Review the potential for the chosen location and species to significantly impact neighbouring properties.

8.3 Consider alternative designs for creating additional space

There are a range of possible options for designing space for trees. The above ground design needs to consider the mature size of the tree in relation to the surrounding surface and proximity of buildings. The required soil volume below ground can be difficult to achieve given the competition for space with the various structures, utilities and hardstand areas required as part of the urban environment

The following list provides a number of options that can be used to incorporate new trees in the design of the development, and is to be used once the required space has been calculated (refer to Section 8.2.1). The following list is to be considered:

- locate pathways and structures away from the tree planting areas
- allocate a specific area for tree planting free of services and consolidate services wherever possible into common trenches
- create large planting pits or continuous trenches where space permits (Section 8.3.1)
- use improved planting soil below porous pavement located adjacent to trees Section 8.3.2)
- installation of structural cells or load bearing soils (Section 8.3.3)
- use of suspended slab pavements (Section 8.3.3)
- installation of root barriers (Section 8.3.4).

8.3.1 Large planting pits or continuous trenches

Large pits or continuous trenches provide the greatest opportunity for trees to quickly establish. This is due to the volume of feeder roots and associated Mycorrhizal fungi that can be established, which significantly increase soil and nutrient uptake.

Trenches or pits should be a minimum 3m wide and to a depth of 600mm, with the existing soil either improved or replaced with suitable planting soil. The trench or pit is to be free draining or drainage must be installed. While the tree may look small for the size of the planting pit or trench when installed, it will quickly develop into a larger canopy within a few years.

8.3.2 Improved planting soil below porous pavement

A suitable soil specification and installation method for use under porous paving can be found at **Appendix 2a** and **Appendix 2b**. This soil consists of a rapidly draining bedding layer for the paving, which sits over a horticultural soil.

The soil specification can also be used for general planting and can be installed under footpath pavement to increase the area for root growth. This approach can extend the life of both the tree and built assets. The added use of flexible joint products (such as Trip stop) further decreases the likelihood of interaction between trees and paths.

This specification and installation method is a cost effective way of providing underground space and improved water infiltration and gaseous exchange.

8.3.3 Installation of structural cells or load bearing soils

Load bearing soil systems allow for horticultural grade root space beneath a load bearing surface. The technologies include suspended slab pavement, structural cells and gap graded soils.

Suspended pavement designs involve the use of piers, eg. concrete pillars or other precast concrete supports, which bridge horticultural grade soil.

Structural cells or gap graded soils are placed beneath hard surfaces 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 installed as per the manufacturer's specifications.

The soil to be used is to meet Council's specification as per Standard Drawings series 3000 www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Standard-Drawings. The soil is to be tested by a NATA accredited soil laboratory and changes made to suit the specification and chosen species.

Gap graded soil (eg. Structural Soil®) should not be used within the structural root zone of the chosen species, often called the zone of rapid taper. This is to ensure the tree has the opportunity to develop larger structural roots. Where gap-graded soil is to be used the 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 for approval prior to installation. 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.

Note: Refer to **Appendix 4** for Material Specification for Gap-graded Soil and GMB20 Base

8.3.4 Root barriers and deflectors

The installation of root barriers at the time of planting may assist tree roots to grow away from services, pavements and other structures. Root barriers should not be installed in such a manner as to restrict essential development of stabilising roots and fine roots required to sustain tree growth.

Tree root barriers are only suitable for use in certain situations and may fail because:

- they were not installed correctly including: poor jointing, inadequate depth or length for the circumstance, or
- the tree roots have bypassed the barrier either by going over, under, around or through the joints. This can be limited by ensuring only qualified persons using proven methods for installation of root barriers, and by embedding the top of the root barrier in concrete wherever possible.

Note 1: 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.

Note 2: Root barriers should not be used to restrict roots so that the tree is prevented from developing a mechanically and biologically efficient root system to achieve maturity.

8.4 Additional requirements for design of new trees

The addition of aeration tubes and drainage can significantly improve the success of tree planting. The following information is to be considered within any design that is to incorporate new plantings. See also Council's Standard Drawings 3000 series

www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Standard-Drawings.

8.4.1 Drainage

Check drainage through infiltration rate testing prior to selection of tree species. This can be provided for by either:

- geotechnical advice obtained by sampling at the planting holes, or
- conduct falling head infiltration testing.

8.4.2 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 2439.1-2007 (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: install a minimum of six drain holes to the bottom perimeter of the planting pit. Drain holes are to be 10cm in diameter, 60cm deep and filled with sand or fine gravel.

8.4.3 Aeration tubes

Aeration tubes may be installed when trees are being planted to maximise gaseous exchange at depth for root growth.

Install slotted agricultural pipe within the planting hole ensuring that it has access to the atmosphere at both ends.

Note that:

- the pipe is to be set at the base of the root ball
- the pipe inlets are 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 slotted cap in busy public or vandalism prone areas. The pipe cap is to be visible from ground level and the slots are to occupy 50% of the caps surface area
- this pipe is for aeration only.

9.0 Tree species selection and supply

All tree species selections for planting on Council managed land are to be undertaken using the process defined in Council's *Street Tree Selection Manual 2016*.

The use of a species at any given location is subject to the plants individual requirements and site conditions. Procuring the specific species can be difficult either due to poor tree stock quality, or the plant no longer being available commercially. The critical factor is that the chosen tree species is suitable for the space and capable of growing into a mature healthy tree in the site conditions.

It is important that species considered an undesirable species or an environmental pest must not be used. The undesirable tree species list is not a list of trees that have to be removed from current locations. However, they are a list of species that will not be planted in the foreseeable future.

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' as a replacement species, the mature trees still provide essential shade, stormwater capture, and filter air pollution. The urban forestry approach seeks to strategically manage 'undesirable' trees by discouraging the further planting of these species rather than wholesale removal.

Species deemed as undesirable for use as replacement plantings are listed in **Table 7**. These species are described as 'undesirable' due to one or more of the following:

- excessive or unmanageable seed dispersal
- poisonous leaves, fruit or flowers
- excessive or unmanageable root suckering
- garden escape
- readily self-propagating from pruning and other materials from gardens
- non-local native species that is becoming an environmental weed as determined by Council
- known irritant species in certain high use areas as determined by Council.

Table 7 - Undesirable replacement tree species in the Newcastle LGA

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

9.1 Supply of trees

Obtaining quality trees is an important step to achieving superior tree growth, extending the life of the tree 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 recognised standards and specifications for tree supply.

See **Appendix 8** for further detail on how to assess tree stock in accordance with NATSPEC.

Council will only accept NATSPEC certified trees for planting as part of subdivisions or large commercial development (see Section 9.1.1).

Private residents are encouraged to plant using quality tree stock that meets the NATSPEC guide Specifying Trees.

9.1.1 Ordering and delivery of stock

The following steps should ensure that quality trees are available 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 relevant planner in accordance with NATSPEC prior to tree planting.
2. Prior to delivery of tree stock the nursery is to mark orientation of north on the side of the pot as grown. Trees are to be orientated in the same direction at planting.
 3. Transport of tree stock is to be undertaken in a covered vehicle to avoid damage and stress to the plants. Safe loading and handling of stock is to be undertaken with trees slung by the root ball and not the trunk.

10.0 Tree planting

Successful tree planting depends on the ability of the tree to rapidly initiate root growth. Planting is best undertaken 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 high temperatures with potential extremes and increased resource requirements, eg. additional watering.

It is important to note that, the root ball of a new tree can only hold enough water for one day until the root system establishes in the surrounding soil.

The success and long-term objectives of any planting is achieved by:

- completing full assessment of the site, eg. soils, microclimate, drainage, and
- selecting species appropriate to the site and suitable to the space (see Section 9), and
- application of best practice site preparation, stock handling, and
- planting in accordance with best practice, and
- ensuring adequate establishment maintenance for the circumstance.

All planting undertaken as part of a subdivision or commercial development, is to be undertaken by a Landscape Contractors Association (LCA), or an Australian Institute of Landscape Designers and Managers (ALIDM) affiliated contractor or Arborist (minimum level AQF3), with demonstrated experience in the installation of soils, tree handling, planting and establishment of advanced trees.

10.1 Full assessment of the site

The following information is provided to assist with undertaking a full assessment of the site.

10.1.1 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 while chemical attributes influence nutrient availability. Typically urban soils have been highly disturbed and/or compacted and require remediation. Soil testing will determine the type and extent of remediation required.

Trees should be planted into existing soils wherever possible. Improved soil meeting Council's specification should be used in situations where the existing site soil is deemed unsuitable for the intended use and cannot be appropriately remediated.

10.1.2 Soil testing general

Where soil testing is to be undertaken, the testing should incorporate samples taken from one or more of the proposed planting locations. The onsite testing is to include a soil texture test and pH test of both the top soil and subgrade soil to 600mm deep.

10.1.3 Soil testing - subdivisions and commercial developments

During design and planning for private subdivision or commercial developments where tree planting is to be undertaken, the following soil testing is required:

1. Geotechnical assessment (including infiltration rates) of the proposed planting holes is to be conducted at the same time as other geotechnical works.
2. Full physical and chemical tests are to be undertaken by a National Association of Testing Authorities (NATA) laboratory.
3. The above information is to be provided on a plan and in documentation that incorporates soil remediation measures where required.

10.2 Best practice site preparation and stock handling

10.2.1 Site preparation

Site preparation should be undertaken in accordance with the sections below.

10.2.2 Types of imported soil media

Imported soil media used for tree planting should be suitable for the species of tree to be planted. The soil should have sufficient water holding capacity and adequate coarse component to ensure root growth. The soil specification provided in **Appendix 2a** of this manual may assist as a guide.

10.2.3 Soil samples

Samples of the planting soil are to be tested prior to delivery for subdivision or large commercial development. The supplier is to undertake all necessary remediation measures recommended from the soil laboratory results.

For subdivision works a sample of proposed soil mix, including full soil analysis details, is to be retained and provided immediately on request to Council, or an Accredited Certifier, for approval prior to installation.

Soil delivered to site is to be covered where there is a risk of weed contamination.

10.2.4 Tree planting preparation

The key steps in site preparation are:

- Site investigation.
- Creation of the largest planting pit possible for the site. This may include under pavement zones for root growth.
- Removal of surface material, which may be hard stand, grass, or other vegetation such as weeds or compacted/contaminated soil. Only spraying grass can lead to increased maintenance and risk of tree health/death when trying to manage grass.
- Replacement or remediation of unsuitable soils.
- Installation of sub soil drainage to improve growing conditions.
- Watering of the soil as it is installed to remove voids and improve establishment rates.
- Application of mulch at the time of planting by hand or mulch blower.
- Installation of tree protection measures.

10.2.5 Broad acre planting preparation

Planting should occur within an entire bed rather than augured holes.

The key steps to achieving success of broad acre plantings are:

- Site investigations.
- Weed grass treatment and removal.
- Soil ripping both A and B horizon.

- Rotary hoeing (or similar) of the A horizon.
- Improve drainage where required.
- Application of mulch at the time of planting by hand or mulch blower.

10.2.6 Stock handling

Trees can easily be damaged during transportation and installation, which can affect tree health, structure and long term viability. Damage to tree trunks can effectively ring bark the trees, and crushing of root balls can reduce stability and limit root growth. The following is to be applied when transporting or installing trees:

- Thoroughly water the root ball of the container stock at least twelve (12) hours prior to planting.
- Ensure the root ball is moist when it arrives at site and maintain root ball moisture by using a moisture probe if planting is delayed. Do not over water.
- Larger trees must be slung and lifted by the root ball only. In some cases a support sling is required to assist with guiding the tree, but should take no weight.
- Plan and prepare where trees will be planted to avoid further lifting. Holes should be correct depth and base material levelled. Never use weight of any kind to push trees down into the holes, including buckets of machines or stamping with boots.
- The root ball of trees must never be dragged or pulled by any means, including machinery or ropes to vehicles.

10.3 Planting

10.3.1 Moving stock

Move larger trees to the dedicated planting hole by lifting or slinging under the root ball. Do not lift by the trunk or place slings around the trunk. In some cases, a support sling is required to assist with guiding the tree however this should take no weight. Smaller stock should be carried by the pot and not the trunk.

10.3.2 Tree planting

To avoid multiple lifts of the tree and potential damage ensure tree planting holes are of suitable depth and width for the size of root ball that is to be planted. The top of the root ball must finish at the predetermined height, eg. root ball to finish level with surrounding soil or just below to allow for mulch.

When the trees arrive on site:

- measure the rootball depth and width and adjust hole accordingly, and
- ensure base of the planting hole is level and at the correct height before tree is lowered into the hole.

10.3.3 Soil additives at planting

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

10.3.4 Consolidating backfill

The consolidation of backfill is to occur to ensure soil doesn't sink post planting. This assists with stabilising the tree and helps prevent any paved surface from deforming. The following process is to be used:

1. Water in the soil as the planting hole is being backfilled to remove air pockets.
2. Ensure backfill is not placed over the top of root ball.

Note: The bark layer is live tissue that is critical to the trees survival as this layer transports soil water and photosynthates. This tissue is extremely vulnerable in young trees and must be protected.

10.3.5 Soil watering berm

A berm of soil is to be built around the edge of the root ball to hold water. The berm is to be covered with mulch, but must not be made of mulch. The following steps are to be used:

1. Form a soil berm 60-80mm high at the outermost edge of the root ball.
2. Ensure edge of berm overlaps the outer edge of the root ball.
3. Apply mulch to the specified depth across the planting area and over the berm.
4. Gently fill inside of soil berm area with water at completion of each tree planting.
5. The soil berm is to be maintained intact for the duration of the tree establishment period.

10.3.6 Watering

Newly installed trees, including drought tolerant species, are dependent upon watering or irrigation until established, typically for two years. The use of irrigation systems can be problematic due to unreliable performance and can result in shallow root systems. Trees require watering to below the root ball depth to sustain and establish the root system and manual watering is to be undertaken.

The root ball of a new tree can only hold enough water for one day in summer and regular watering is critical to the establishment and survival of the tree. Conversely in winter the root ball may hold sufficient water for up to six days. Therefore, it is vital that the frequency and amount of water is determined by the time of year that planting occurs, and is subject to soil moisture tests using a soil moisture probe prior to and during watering in both the root ball and surrounding soil.

The best mechanism to achieve this is a water budget based on individual site conditions and species requirements. The water budget is to be provided as part of the planting documentation for subdivisions or commercial developments.

Watering of the new tree is to be focused on the root ball through the early establishment period. However, additional watering of the surrounding planting bed soil can slow the loss of water from the root ball. A proven method for rapid establishment and growth of new trees is contained within **Table 8** and **Figure 11**. While this may not be possible in broad acre plantings, it provides a guideline against which water budgets can be established.

Table 8 - Watering frequency by season

| Season | Frequency from planting | Amount |
|--|---|-------------------|
| Late Spring to early Autumn (includes Summer) | Daily first six weeks, Every second day for 3 weeks Every third day for 3 weeks Weekly or as required. | To field capacity |
| Autumn | Every second day for 3 weeks Every third day for 3 weeks Weekly or as required | To field capacity |
| Winter | Every third day for 3 weeks Weekly or as required | To field capacity |
| Spring | Every second day for 3 weeks Every third day for 3 weeks Weekly or as required | To field capacity |

Figure 11 - Example of two magnolias planted at same time (2005) with different planting and maintenance approaches. Tree on left was watered using Table 8 above, the tree on the right was not (photo 2015).



10.3.7 Mulching

Trees are to be provided with a mulched bed at the base of the tree to prevent damage from mowing, pedestrian or vehicle movement.

The addition of **inorganic** mulch (eg. rock or gravel or recycled hardwood) benefits tree health by conserving soil moisture and reducing weed growth.

The use of **organic** coarse mulch derived from live composted material benefits tree health by conserving soil moisture, reducing weed growth, increasing soil organism activity, providing soil organic matter and plant growth nutrients.

The mulch should be retained at 75mm depth and should never exceed 100mm in depth. Mulch placed at greater than 100mm depth will limit gaseous exchange between the soil and the atmosphere reducing soil organism activity and suppressing root development. In addition, it will reduce water infiltration which further inhibits plant growth.

The supply of organic mulch should be in accordance with AS 4454–2003 Compost, soil conditioners and mulches.

The area covered with mulch is to be:

- the area cultivated for planting, or
- the extent of the dripline as the tree grows.

Correct installation of mulch will:

- result in mulch tapering down to zero at the base of new trees next to the trunk, or
- result in a mulch free gap of not less than 100mm and preferably 200mm clear from the trunk of maturing or mature trees, and
- ensure that buttress or other large surface roots are not covered.

Refer to **Figure 12** for correct mulching method diagram.

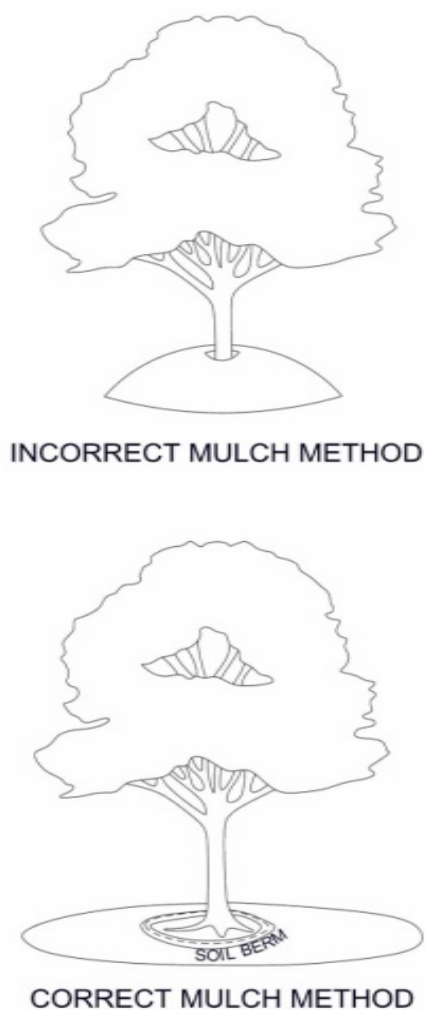


Figure 12 - Mulch diagram

10.3.8 Tree staking

Trees that conform to NATSPEC quality should not normally require staking. Some circumstances, eg. areas of high wind exposure, may require staking for protection during tree establishment. The staking is to be loose so as to not restrict trees, but must not damage tree trunks by rubbing.

10.3.9 Edging

Use edging to separate mulch areas from turf areas. Edging will aid in reducing turf growth into mulch areas and minimise maintenance. Edging should be installed below ground and higher than surrounding grass. However, install flush with the surrounding surface in pedestrian areas, where applicable, to avoid a trip hazard.

10.4 Establishment maintenance

The establishment maintenance period is essential to ensure the tree develops a healthy and mature canopy. Where works are undertaken for commercial or subdivision development, a bond or bank guarantee may potentially be required by Council to ensure quality tree establishment is completed. The following sections detail the requirements during the establishment maintenance period for all large subdivisions and commercial developments. The information below may also assist residents planting trees on their property.

10.4.1 Inspections

Inspections of all new tree plantings are to be scheduled to ensure that weeding, watering and mulch requirements are met in a timely manner. The schedule is to be prepared in advance and is to cover the 104 weeks intensive establishment maintenance period. The schedule needs to be flexible enough to allow for increased inspections during periods of low rainfall, or times of greatest grass and weed growth (eg. spring).

10.4.2 Practical completion report

A Practical Completion Report is required to be submitted to Council for all tree planting undertaken by large subdivisions and commercial development. Rejected works are to be rectified to the satisfaction of the Council. The following information is to be kept to support the practical completion report:

10.4.2.1 Log book record

The contractor undertaking the planting maintenance is to 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 should be recorded:

- watering events including dates and amount
- non chemical weeding events and method used
- rubbish removal dates, amount and type
- fertiliser application dates, product specification and rate
- treatment of trees for insect pests and disease, include method, rate and date

- tree replacement date, species, root ball size, reason for replacement including failed, damaged or stolen trees
- reinstatement of mulch to required depths dates, mulch used, and volume
- formative pruning include dates and works undertaken. Pruning in accordance with *AS 4373-2007* (conducted at 102 weeks).

10.4.3 Establishment and maintenance works

10.4.3.1 Watering

Regular watering should occur during the establishment period in accordance with the predefined water budget (refer to Section 10.3.6).

10.4.3.2 Mulch replenishment

Ensure mulch is replenished as required to maintain cover and depth specified at time of planting (refer to Section 10.3.7).

10.4.3.3 Fertilising

Fertilising trees should not be necessary if appropriate soil conditions are provided or if the trees are in a load bearing structure. Fertilising may be required for trees that have been affected by disturbance, where a soil nutrient deficiency is affecting the performance of a tree, or where pest or disease is present. The tree should not be fertilised while stressed with application occurring once the stressor has been managed.

Benefits gained from the increase in stored resources may aid the tree to overcome the stress caused by future disturbances. Nutrient requirements should be based on a soil test by a registered soil laboratory.

10.4.3.4 Weed management

The use of chemicals to control weeds can be detrimental to trees, with many large tree species highly susceptible to even small amounts of chemical. Laboratory testing has shown that weed chemicals stay active when absorbed by mulch. It is vital to tree health to minimise the use of weed chemicals within the root zone or on mulch beds wherever possible.

During establishment maintenance ensure the tree planting pit and adjacent mulch areas are free of weeds for the entire period. Weed management should be undertaken by hand with inspection frequency to be increased where required to minimise weed establishment.

Where chemicals are used to manage weeds in large continuous mulch beds, or where the weeds have established, then the application must occur using only hand wands with hoods over the nozzle. The spray must not fan beyond the footprint of the weed. Broad spraying is not permitted.

10.4.3.5 Pest and disease management

Generally, insect populations can threaten tree health to the point of mortality. Notify Council of any pests and diseases found. Treatment of pests is generally undertaken by a licensed pest control operator.

There are a range of maintenance activities that can increase the risk of pest and disease attack in trees including:

- compaction of the soil within the dripline or root zone of the tree
- imported fill that may contain disease or pests
- roto-tilling, trenching or removing soil from the tree root area
- excessive or regular watering on or near the tree trunk
- planting water loving understory plants within the dripline
- use contaminated mulch, soil or plant stock.

The likelihood of pest and disease problems can be reduced by:

- using mulch that is free of weed species, harmful or foreign matter in accordance with *AS 4454-2012 Compost, soil conditioners and mulches*
- placing mulch well clear of plant stems
- regular watering to maintain field capacity
- use of certified growing media
- using certified plant material. Request certificate from Nursery supplier to certify disease free stock
- avoiding compaction
- avoiding chemical use
- aerating compacted soil.

Note: Refer to section 11.0 for common pests and diseases in the Newcastle LGA and **Appendix 1**.

11.0 Biosecurity

There is a risk to the tree population within any urban forest from a range of pests and diseases. It is critical that appropriate measures are put in place to ensure that any pest or disease is not introduced or spread within the Newcastle LGA.

Any tree maintenance activities (including propagation, planting, mulching, pruning or removal works) are to ensure that the requirements of **Appendix 1: Disease and Insect Pest Management Protocols Newcastle LGA** are included in all documentation and implemented.

12.0 Callaghan campus

This section is based on the Landscape Management Implementation Plan Callaghan Campus, 3 September 2012 (LMP). For the purpose of Section 5.03 Tree and Vegetation Management of the Newcastle DCP 2012 compensatory works for vegetation removal at the Callaghan Campus is to be undertaken in accordance with this section. Vegetation pruning is to be undertaken in accordance with AS 4373 and **Appendix 5** *Tree Pruning Specification* form.

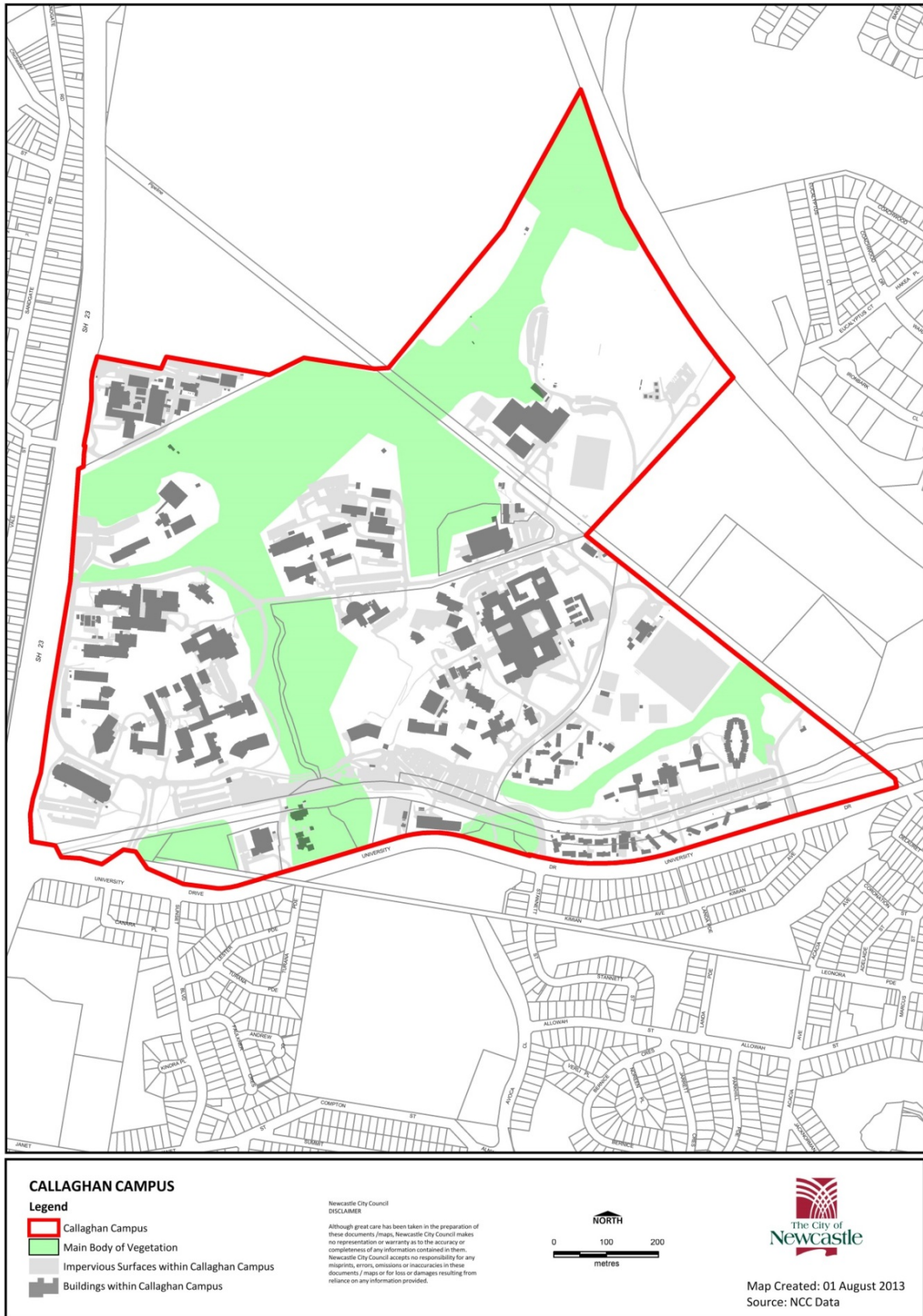
Vegetation works are to be categorised based on the category of impact the activity will have on the environment. **Table 9** is to be used to determine the category of impact an activity will have.

Once the category of impact is known, compensatory works can then be determined based on works listed in **Table 10**. Compensatory works are to be undertaken in a management zone identified in the Landscape Management Implementation Plan Callaghan Campus. The management zone where compensatory works will be undertaken is to be nominated in the development application.

It is advised that the mitigation measures in **Table 9** are undertaken to reduce the impact of the activity.

Compensatory works will be placed as a condition of consent. Council will keep a register of regeneration works which have been conditioned on developments.

Map 1: Callaghan Campus





Step 1 - Determine the category of impact the activity will have

Applicants are required to complete the below table, answering each question until a category of works is established.

Table 9 - Determine the category of impact the activity will have

| <p>This section does not apply to development which will have a 'significant impact' under section 5A of the <i>Environmental Planning and Assessment Act 1979</i>, or development which is significant under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i>. Provisions of relevant State and Commonwealth legislation apply in these cases.</p> | | |
|---|---|---|
| Question | Sub-questions | Mitigation measure |
| <p>1. Will the activity impact on a vegetation community that forms part of a vulnerable, endangered, or critically endangered ecological community (ie. threatened vegetation) or threatened flora population or species?</p> <p>If yes →</p> <p>If no ↓</p> | <p><i>If yes to any of the below questions the activity is categorised as 'threatened vegetation-moderate impact'. If you answer no to ALL questions below, the activity is categorised as 'threatened vegetation – minor impact'.</i></p> <ol style="list-style-type: none"> 1. Does the threatened vegetation being removed account for 10% or more of the combined canopy, midstorey and understorey on the development site? 2. Does the threatened flora habitat being removed account for 10% or more of the extent or estimated population size or threatened species or population present within the area to be impacted by the development (including construction phase)? 3. Will any remaining vegetation become isolated from the main body of vegetation? 4. Is there potential that the threatened vegetation would be used by one or more threatened fauna species for shelter, breeding or foraging? | <ul style="list-style-type: none"> ▪ Seek an alternative location and/or modify the activity to minimise impacts. ▪ Minimise loss of fauna during clearing activities. ▪ Community liaison where appropriate. ▪ On going bush regeneration. |

| Question | Sub-questions | Mitigation measure |
|--|--|---|
| <p>2. Will the activity impact on remnant native vegetation?</p> <p>If yes →</p> <p>If no ↓</p> | <p><i>If yes to any of the below questions the activity is categorised as 'remnant native vegetation – moderate impact'. If you answer no to ALL questions below, the activity is categorised as 'remnant native vegetation – minor impact'.</i></p> <ol style="list-style-type: none"> 1. Does the threatened vegetation being removed account for 20% or more of the combined canopy, midstorey and understorey on the development site? 2. Will any remaining native vegetation become isolated from the main body of vegetation? 3. Is there potential that the area would be used by one or more threatened fauna species for shelter, breeding or foraging? | <ul style="list-style-type: none"> ▪ Seek an alternative location and/or modify the activity to minimise impacts. ▪ Ongoing bush regeneration/weed control. ▪ Minimise loss of fauna during clearing activities |
| <p>3. Will the activity result in the removal or pruning of native trees?</p> <p>If yes →</p> <p>If no ↓</p> | <p>NOTE: Tree pruning is categorised as 'native tree removal – minor impact'.</p> <p><i>If you answer yes to any of the below questions the activity is categorised as 'native tree removal – moderate impact'. If you answer no to all questions below, the activity is categorised as 'native tree removal – minor impact'.</i></p> <p>Tree Removal Questions:</p> <ol style="list-style-type: none"> 1. Is there a hollow present? 2. Is the locally native tree removal likely to generate neighbour or community complaints? | <ul style="list-style-type: none"> ▪ Limit tree removal to that required. ▪ Minimise loss of fauna during clearing activities. ▪ Notification when impacting immediate neighbour (i.e. loss of amenity). ▪ Community liaison where appropriate. |
| <p>4. Will the activity result in the pruning or removal of exotic vegetation or weeds?</p> <p>If yes →</p> <p>If no ↓</p> | <p><i>If yes to any of the below questions the activity is categorised as 'exotic vegetation and weeds - moderate impact'. If you answer no to ALL questions below the activity is categorised as 'exotic vegetation and weeds – minor impact'.</i></p> <ol style="list-style-type: none"> 1. Is there potential that the area would be used by one or more threatened fauna species for shelter or breeding? | <ul style="list-style-type: none"> ▪ Ongoing weed maintenance. ▪ Minimise loss of fauna during clearing activities. |

| Question | Sub-questions | Mitigation measure |
|--|--|--|
| <p>5. Will the activity impact on vegetation fringing or within a watercourse, lake, wetland, or other body of water?</p> <p>If yes </p> <p>If no </p> | <p><i>If yes to any of the below questions the activity is categorised as 'water course vegetation – moderate impact'. If you answer no to ALL questions below, the activity is categorised as 'watercourse vegetation – minor impact'.</i></p> <ol style="list-style-type: none"> 1. Is there potential that the area would be used by one or more species, populations or ecological communities listed under the NSW Fisheries Management Act and/or Threatened Species Conservation Act 1995? 2. Is there potential that the area would be used by one or more threatened fauna species for shelter, or breeding? 3. Will the activity cause alterations to hydrological regimes? | <ul style="list-style-type: none"> ▪ Sediment and erosion controls, ie. runoff and bank stability. ▪ Stormwater runoff controls. ▪ Ongoing weed control/ bush regeneration. ▪ Community liaison where appropriate. |
| <p>6. Will the activity impact on a cleared area with no flora or fauna values?</p> | <p>The activity is categorised as 'cleared areas'.</p> | |

Step 2: Compensatory works which are to be undertaken for vegetation removal

Once the category of impact is known (as determined from **Table 9**) compensatory works can be undertaken as outlined in **Table 10**.

Table 10 - Compensatory works which are to be undertaken for vegetation pruning and removal

| Category of impact | Compensatory works to be undertaken |
|---|---|
| Threatened vegetation - minor impact | <ul style="list-style-type: none"> Undertake bush regeneration of the disturbed area using locally native species and targeted weed removal for a minimum of 2 years, in accordance with the Action Plan. <p>AND</p> <ul style="list-style-type: none"> Bush regeneration of an area at least 20% the size of the disturbed area in an identified bushland management zone within the main body of vegetation. Regeneration should be located (where possible) to provide a buffer effect and use relevant species from the threatened vegetation affected. |
| Threatened vegetation - moderate impact | <ul style="list-style-type: none"> Undertake bush regeneration of the disturbed area using locally native species and targeted weed removal for a minimum of 2 years, in accordance with the Action Plan. <p>AND</p> <ul style="list-style-type: none"> Bush regeneration of an area at least 50% the size of the disturbed area in an identified bushland management zone within the main body of vegetation. Regeneration should be located (where possible) to provide a buffer effect and use relevant species from the threatened vegetation affected. <p>AND</p> <ul style="list-style-type: none"> If the tree contained hollows, then install three or more nest boxes in adjacent trees (or nearby areas) or on posts for each tree hollow removed. |
| Remnant native vegetation - minor impact | <ul style="list-style-type: none"> Undertake bush regeneration over the disturbed area using locally native species and targeted weed removal for a minimum of 2 years, in accordance with the Action Plan. |
| Remnant native vegetation - moderate impact | <ul style="list-style-type: none"> Undertake bush regeneration over the disturbed area using locally native species and targeted weed removal for a minimum of 2 years, in accordance with the Action Plan. <p>AND</p> <ul style="list-style-type: none"> If the tree contained hollows, then install three or more nest boxes in adjacent trees (or nearby areas) or on posts for each tree hollow removed. |
| Native tree removal – minor impact | <p>Tree Removal</p> <ul style="list-style-type: none"> Undertake bush regeneration over the disturbed area using locally native species and targeted weed removal for a minimum of 2 years, in accordance with the Action Plan. <p>Pruning</p> <ul style="list-style-type: none"> No offset is required for minor pruning of foliage if it does not affect the continued health of the locally native tree (ie. pruning is not of the trunk or primary branches of the tree). <p>Note: Pruning is to be undertaken in accordance with AS 4373 and Appendix 5 Tree Pruning Specification form.</p> |

| Category of impact | Compensatory works to be undertaken |
|---|--|
| Native tree removal - moderate impact | <ul style="list-style-type: none"> • Undertake bush regeneration over the disturbed area using locally native species and targeted weed removal for a minimum of 2 years, in accordance with the Action Plan. <p>AND</p> <ul style="list-style-type: none"> • If the tree contained hollows, then install three or more nest boxes for each tree hollow removed in adjacent trees (or nearby areas) or on posts. |
| Exotic vegetation and weeds - minor impact | <ul style="list-style-type: none"> • Revegetate the area where exotic vegetation or weed infestation has been (if the site is identified in the LMP as a suitable regeneration site), using appropriate locally native species as per the Landscape Management Implementation Plan (LMP). |
| Exotic vegetation and weeds - moderate impact | <ul style="list-style-type: none"> • Revegetate the area where exotic vegetation or weed infestation has been (if the site is identified in the LMP as a suitable regeneration site), using locally native species as per LMP. <p>AND</p> <ul style="list-style-type: none"> • If the area is more than 200m², then weed removal should be staged to allow an area to be revegetated. |
| Water course vegetation - minor impact | <ul style="list-style-type: none"> • Undertake bush regeneration of the disturbed area using locally native species and targeted weed removal for a minimum of two years, in accordance with the Action Plan. |
| Water course vegetation - moderate impact | <ul style="list-style-type: none"> • Undertake bush regeneration of the disturbed area using locally native species and targeted weed removal for a minimum of two years, in accordance with the Action Plan. <p>OR</p> <ul style="list-style-type: none"> • If not practical in the same area, use a nearby area on the same watercourse for the above regeneration activities, this can either be on or off the corridor. |
| Cleared areas | <ul style="list-style-type: none"> • Cleared areas with fauna habitat values are not addressed by this strategy and will be considered on a case by case basis. |

Glossary

Action Plan: for the purpose of the University of Newcastle Callaghan Campus the term refers to the Action Plans in Section 9.3 of the Landscape Management Implementation Plan Callaghan Campus dated 3 September 2012.

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.

Bushland Management zone: for the purpose of the University of Newcastle Callaghan Campus the term refers to the Bushland Management zone map in Section 9 of the Landscape Management Implementation Plan Callaghan Campus 3 September 2012.

Bush Regeneration: the rehabilitation of bush from a invasive plant species or otherwise degraded plant community to a healthy community composed of native and indigenous species.

Canopy cover: refers to the total area contained within the vertical projection of the periphery of tree crowns (or other overstorey). 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: means Newcastle City Council.

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

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.

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

Dead tree: where the biological function of the tree has ceased, no leaves are present and visible evidence of trunk, root plate and canopy desiccation.

Development Control Plan (DCP): has the same meaning as in the *Environmental Planning and Assessment Act, 1979*.

Note: The term is defined as a development control plan made, or taken to have been made, under Division 6 of Part 3 and in force.

Development site: includes all areas within which the development will occur and can extend across several lots or development blocks.

Disturbed area: the area which will be impacted by a development, including construction, demolition and use.

Dying tree: demonstrates reduced growth rates, sparse foliage and reduced response to damage or stress over subsequent growing seasons.

Exotic: any flora or fauna species which is not native or 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.

Indigenous: any tree, shrub, fern, creeper, vine, palm or plant that is native to the Lower Hunter Region, and includes the flower and any part thereof.

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

Injuring: 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.

Lopping: an unacceptable practice as defined in the Australian Standard AS4373 – 2007.

Main body of vegetation: is the area shown on Map 1 - Callaghan campus

Manual: the technical manual/s that support Newcastle Development Control Plan 2012.

Native: any tree, shrub, fern, creeper, vine, palm or plant that is native to Australia but not indigenous, and includes the flower and any part thereof.

Native Vegetation: has the same meaning as in the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*. As such native vegetation is any of the following types of plants native to New South Wales:

- (a) trees (including any sapling or shrub or any scrub)
- (b) understorey plants,
- (c) groundcover (begin any type of herbaceous vegetation),
- (d) plants occurring in a wetland.

Native Vegetation Community: plant communities, comprising primarily native species, the composition and structure of which reflects the interactions between plant species, between plants and fauna and with the environment. Native vegetation communities include canopy trees (where present), understorey, and ground cover. Regrowth and newly colonising stands of native species are included as part of the native vegetation community.

LEP: the Newcastle Local Environmental Plan (LEP) 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.

Park Tree: a public tree located in a park managed by Council. These are generally mown areas but may have some pockets of trees with understory.

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 (eg. underground water/sewer pipes, electrical cables etc.) and structural elements on private land. Structural elements include driveways, and walls which are retaining devices only.

Pruning: is the selective removal of branches in accordance with the requirements and classifications within AS4373-2007 Pruning of amenity trees.

Public Tree: tree/shrub species located on any land managed by Council.

Remnant: native vegetation community within the boundaries of the Newcastle University Callaghan Campus.

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 within the tree protection zone, or paving within the drip-line of the tree.

Riparian zone: refers to a riparian corridor as defined by Department of Primary Industries - Office of Water - i.e. a riparian corridor that forms the transition between land and river or watercourse.

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.

Shrub: a woody perennial plant that is generally smaller than a tree species at maturity and has many main stems or trunks.

Stormwater: the runoff from rainfall events.

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

Street tree: public trees and shrubs within the road reserve. These have been surveyed and mapped by Council.

Street tree vacancy site: sites identified by Council for future tree planting. The sites have been identified from analysis of the Local Government Area based on criteria in the Tree Asset Management System (TAMS). The information on locations of street tree vacancy sites is available on request from Council.

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.

Solar: suitable access to sunlight for human wellbeing.

Topping: an unacceptable practice as defined in the Australian Standard AS4373 – 2007.

Tree Private land: a long lived woody perennial plant greater than 3m height (or will be at maturity), with one or relatively few main stems or trunks.

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

Tree Protection Zone (TPZ): is a determined area of ground under a 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 LGA, and 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 2012 by providing technical information for the design, implementation and management of tree planting in the local area.

Undesirable Species: tree species listed in Appendix 1 of this Technical Manual that are unsuitable for replanting due to negative characteristics.

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 encroaching on an area mulched for trees.

Appendices

Appendices are provided as separate documents on Council's website.

www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Development-control-plans