



Urban Forest Technical Manual

A tool to assist the Ryde community to understand the requirements for the protection of trees within the City of Ryde.

 City of Ryde

Lifestyle and opportunity
@ your doorstep

ADOPTED 21 August 2012



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DOCUMENT CONTROL

ISSUE NAME	ISSUE DATE	PURPOSE
DRAFT 9	20 February 2012	Council Report
FOR PUBLIC EXHIBITION	8 March 2012	For Public Exhibition
FOR ADOPTION	15 June 2012	For Adoption
ADOPTED	21 August 2012	Adopted by Council, 21 August 2012



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1. Introduction

Individually and collectively, trees have environmental, economic and social benefits. These benefits include amenity, visual quality, enhanced streetscape, native fauna habitat, soil conservation, enhanced microclimatic conditions, solar access control and improved air quality. Collectively, all the individual trees form the Urban Forest canopy of the City of Ryde. This Urban Forest is a combination of street trees, park trees (including bushland) and trees on private property.

This Technical Manual is a tool to assist the community to understand the requirements of the City of Ryde Development Control Plan 2010 Part 9.6 (Tree Preservation). It contains:

- Details of the technical requirements for the assessment and protection of trees on development sites
- Guidance on how to calculate the DBH and TPZ of a tree
- Qualification and reporting specifications for arborists to support submissions to the City of Ryde
- Qualification requirements and standards applicable to persons carrying out work on trees
- Details of pruning requirements and
- Guidance and specifications in relation to replacement tree planting.



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2. Trees on development sites

2.1 Introduction

This section applies to all development sites upon which trees are located. It applies to Development Applications under all Parts of Development Control Plan 2010 (DCP 2010) and not only to Development Applications under Part 9.6 (Tree Preservation).

The protection of trees on development sites must be planned and managed. Developments should be designed to avoid or minimise potential conflict between trees and proposed structures. The future growth of trees (both above and below ground) must be considered when proposing to construct a structure close to a tree.

The provisions of Australian Standard 4970 – 2009 *Protection of trees on development sites* and the provisions set out in this Technical Manual shall be complied with in all development within the City of Ryde.

All Development Applications relating to land upon which trees are located shall:

- Include a determination of the retention value of all trees on the land
- Design for the retention of the trees categorised as having high or medium retention values
- Specify construction techniques which avoid or minimise the adverse impact of the development on trees to be retained
- Include details of the species and location of proposed replacement planting.

2.2 Determining tree retention values

Tree retention values shall be used to guide site analysis, site planning and development design. The retention value of a tree is an estimation of the overall significance of the tree in the landscape. Because this estimation of retention values is subjective, the retention value of each tree on a site shall be calculated using a consistent qualitative method using appropriate industry methods, eg SULE, Tree AZ, STARS or SRIV.

An arborist shall determine the retention value of a tree if any development is proposed within the Tree Protection Zone of that tree. This includes:

- trees on land upon which development is proposed
- trees on adjoining land
- street trees.

Refer to Section 3 for instructions on how to calculate a Tree Protection Zone. Refer to Section 4 for qualification requirements for arborists.

The retention value of each tree shall be calculated in accordance with the following three step process:

Step 1: Assess the sustainability of the tree in its location. This is determined by considering the vitality, structural condition, age/longevity of the tree and suitability of the tree to the site.



Step 2: Assess the landscape significance of the tree. This is calculated by considering the amenity, heritage and environmental value of each tree.

Step 3: Consider sustainability and landscape significance together to determine the retention value.

Trees shall be categorised as having a high, medium, low or very low retention value. The City of Ryde considers trees with a high retention value as a priority for retention on a site and trees with a medium retention value should be considered for retention. Both must be considered as constraints on development. Trees given a low or very low retention value can usually be removed and are therefore not considered to be a constraint on development.

2.3 Design for the retention of trees

All developments should be designed to enable the preservation and the long term ongoing viability of trees categorised as having a high or medium retention value. Alternative design options shall be considered prior to recommending tree removal including (but not limited to) the following:

- altering the building footprint ;
- altering the development layout; and/or
- altering hard surface design and the extent of hard surfacing, and using permeable materials.

2.4 Tree sensitive construction techniques

Construction techniques which avoid or minimise the adverse impact of the development on trees should be used in all developments within the City of Ryde. These include (but are not limited to):

- Pier and beam footings;
- Localised pier footings;
- Suspended slabs;
- Cantilevered building sections;
- Screw piles; and
- Contiguous piling.

2.5 Replacement planting

If trees on the development site cannot be retained, the City of Ryde shall require replacement trees to be planted. Section 6 below applies to all replacement planting.

2.6 Tree protection measures

Tree protection on all development sites within the City of Ryde must comply with Australian Standard 4970 - 2009 *Protection of trees on development sites*. The Tree Protection Zone shall be calculated in accordance with section 3 and not be less than that area. All tree protection measures must be in place prior to the commencement of construction works (including demolition, excavation or earthworks) and before any machinery or materials are taken onto the site.

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All tree protection measures must be maintained in good condition during the construction works and kept in place until the completion of works or as otherwise advised by the Project Arborist. All tree protection measures shall then be removed.

Details of requirements relating to Project Arborists are set out in section 4.

The following tree protection measures are mandatory on all development sites within the City:

1. Each Tree Protection Zone shall:
 - a. be enclosed by a 1.8m high fully supported chainmesh protective fencing. The fencing shall be secure and fastened to prevent movement. The fencing shall have a lockable opening for access. Roots greater than 40mm in diameter shall not be pruned, damaged or destroyed during the installation or maintenance of the fencing. The fencing shall not be moved, altered or removed without the approval of the Project Arborist;
 - b. have a minimum of two signs that include the words "Tree Protection Zone – Keep Out". Each sign shall be a minimum size of 600mm x 500mm and the name and contact details of the Project Arborist. Signs shall be attached facing outwards in prominent positions at 10 metre intervals or closer where the fence changes direction. The signs shall be visible within the site;
 - c. be kept free of weeds and, except where the existing surface is grass, grass. Weeds shall be removed by hand; and
 - d. unless the existing surface is grass, have mulch installed and maintained to a depth of 75mm.
2. Where the Project Arborist determines that tree protection fencing cannot be installed, the tree protection fencing needs to be removed temporarily, access within or through the Tree Protection Zone is necessary or where work will be carried out within the Tree Protection Zone (as approved and supervised by the Project Arborist):
 - a. the stem and branches of trees to be retained shall be protected, as follows:
 - two layers of carpet underlay (or other padding approved by the Project Arborist) shall be installed around the stem and branches. Stem protection shall cover the stem from ground level; and
 - hardwood or treated pine timbers (100mm x 50mm) the same length as the stem or branch shall be positioned over the padding and next to each other around the stem or branch, secured together with galvanised wire or strapping. Boards shall not be nailed or screwed into the stem or branch. No part of the protection shall be secured to the tree.
 - b. The ground surface within the Tree Protection Zone shall be protected by placing geotextile fabric on the ground surface, covering this with a layer of mulch to a depth of 75mm and then placing boarding (scaffolding board, plywood sheeting or similar material) on top. The geotextile fabric and mulch shall be kept clear of tree stems by at least 50mm.



3. The following activities shall not be carried out within any Tree Protection Zone:
 - a. disposal of chemicals and liquids (including concrete and mortar slurry, solvents, paint, fuel or oil);
 - b. stockpiling, storage or mixing of materials;
 - c. refuelling, parking, storing, washing and repairing tools, equipment, machinery and vehicles;
 - d. disposal of building materials and waste;
4. The following activities shall not be carried out within any Tree Protection Zone unless under the supervision of the Project Arborist:
 - a. increasing or decreasing soil levels (including cut and fill);
 - b. soil cultivation, excavation or trenching;
 - c. placing offices or sheds;
 - d. erection of scaffolding or hoardings; and/or
 - e. any other act that may adversely affect the vitality or structural condition of the tree.
5. All work undertaken within or above a Tree Protection Zone shall be supervised by the Project Arborist.
6. Excavation within the Tree Protection Zone of any tree to be retained shall:
 - a. be undertaken using non-destructive methods (eg. an Airspade or by hand) to ensure no roots greater than 40mm in diameter are damaged, pruned or removed. All care shall be taken to preserve and avoid damaging roots;
 - b. not occur within the Structural Root Zone.
7. The City of Ryde shall only give approval for minor pruning works. All pruning works shall be specified by the Project Arborist. All pruning shall be carried out in accordance with section 5 and by an arborist qualified in accordance with section 4.
8. Written approval from the City of Ryde shall be obtained prior to removing or pruning any street tree. All street trees not approved for removal shall be protected in accordance with the tree protection measures set out above.

The City of Ryde may include additional tree protection requirements as conditions of Development Application approval.

2.7 Arboricultural reports

If any part of the proposed development will encroach into the Tree Protection Zone of any Tree on the site, on adjoining land or any street tree, the City of Ryde may require an arboricultural report to be submitted as part of the Development Application process. The City of Ryde Planning and Environment team shall specify the type of arboricultural report required and any issues they wish to be addressed in the report. The requirements for arboricultural reports are set out in section 4.

Effects of development on Trees

All parts of a tree may be damaged by development, as follows:

1. **Crown damage:** Leaf area can be lost through pruning or from mechanical damage caused by construction machinery. Poor pruning techniques can cause wounds that are susceptible to infection by wood decay organisms. Damage to foliage reduces the level of photosynthesis, production of sugars, and consequently the tree's ability to withstand stress and respond to wounds.
2. **Trunk damage:** Mechanical damage from construction machinery causes wounds which lead to decay. Damage may also interfere with the transport of water, sugar and nutrients throughout the tree reducing the tree's ability to function normally.
3. **Root damage:** The roots of a tree can be 4 to 7 times larger than the crown area and most roots are found in the top of the soil. Roots can be damaged or severed, the soil compacted, root space lost, soil levels changed (eg. by stripping the soil surface, excavation and cut and fill), soil hydrology altered and surfaces sealed. Damage to roots may lead to a loss of tree stability, reduction in water and nutrient uptake adversely affecting tree vitality, and decay as a result of wounding.

Trees take years to grow but can be injured or killed in a very short time. **It is usually not possible to repair trees stressed or injured through construction damage.** The ability of all trees to tolerate construction impacts depends on a number of factors:

1. **Tree age, health and vigour.** Healthy, vigorous trees are better able than non- vigorous trees to tolerate adverse impacts because they have more energy reserves to recover from injury. In general, mature and over-mature trees are less able to tolerate construction impacts and adapt to environmental changes than young or semi-mature trees.
2. **Tree species.** Some species of tree are more tolerant of site changes than others.
3. **The cumulative impact of construction throughout the construction process.** Mature trees on a site may have already been affected by past construction activities (eg. excavation, compaction and fill when the original building work was carried out).

Trees may respond to construction impacts in a variety of ways. Common symptoms of tree stress from construction injury are slower growth, smaller leaves and poor foliage colour, thin foliage, wilting, twig and branch dieback, decay at wounds caused by mechanical damage, attack by stress-related pests such as borers and tree death.



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3. Tree Protection Zones

3.1 Introduction

The Tree Protection Zone of a tree is a distance from the stem set aside for the protection of a tree's crown and roots to provide for the viability and stability of the tree. It is an estimate of the area required to protect a tree from adverse construction impacts. No construction activity or changes to soil levels should occur within this area. Because a tree's crown and roots do not always grow in a perfect circle around the stem, it is a hypothetical estimation of the area to be protected. The actual location of tree roots can only be determined by carrying out root investigation via excavation by a qualified arborist (refer to section 4).

3.2 When does the Tree Protection Zone need to be calculated?

The Tree Protection Zone of a Tree must be calculated:

- before soil levels are altered (eg. by excavation or fill) close to a Tree to determine if the works are within the Tree Protection Zone. If it is, a Tree Permit must be obtained for the works before they commence.
- before a Development Application is submitted to determine if any development is proposed within the Tree Protection Zone of any:
 - tree on land upon which development is proposed,
 - tree on adjoining land, or
 - street tree.

3.3 Tree Protection

The Tree Protection Zone is a minimum area set aside for protection of a tree. The Tree Protection Zone shall not be less than this area. Section 2 specifies activities that are prohibited within Tree Protection Zones and tree protection measures. These requirements are mandatory for all development within the City. The City of Ryde may specify in the Tree Permit or Development Application approval additional prohibited activities and tree protection measures. All tree protection measures must be installed before any works are commenced (including demolition, excavation and earthworks) and before any machinery or materials are taken on to the site.

3.4 Encroachment into a Tree Protection Zone

Encroachment (eg. excavation, trenching or fill) of the Tree Protection Zone should be avoided however the City of Ryde recognises that this is sometimes unavoidable. Encroachments of less than 10% of the area of the Tree Protection Zone area are generally considered minor and may be compensated for elsewhere and contiguous with the Tree Protection Zone. Such encroachments must be determined by the Project Arborist who should consider the factors listed in clause 3.3.4 of AS 4970-2009 *Protection of trees on development sites*. If the encroachment is outside the Structural Root Zone of the tree, the City of Ryde will generally not require detailed root



investigation to be carried out.

Encroachment into the Tree Protection Zone greater than 10% into the Tree Protection Zone is generally considered to be major. If this, or an encroachment into the Structural Root Zone will occur, advice shall be sought from the Project Arborist who must determine if the tree will remain viable. The area lost to the encroachment must be compensated for elsewhere and contiguous with the Tree Protection Zone. The Project Arborist shall determine whether detailed root investigation is required (refer to section 4 for Project Arborist qualification requirements and responsibilities).

Depending on the site constraints and the tree's tolerance for root loss, the development may need to be changed to satisfy the requirements of **AS 4970-2009 Protection of trees on development sites**. Tree sensitive design and construction options can reduce the impact of encroachment and may be conditioned as part of a Development Application approval or Tree Permit.

3.5 How to calculate a Tree Protection Zone

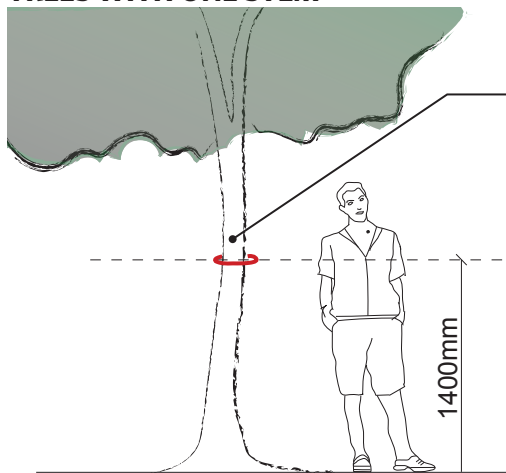
Figures 3.1 and 3.2 illustrate how to calculate the Tree Protection Zone.

If you are unsure whether you have calculated the Tree Protection Zone correctly, you can use Tree Protection Zone Calculator on the City of Ryde website at www.ryde.nsw.gov.au If you input your measurements into the calculator it will calculate the Tree Protection Zone for you.

Figure 3.1 Calculating a Tree Protection Zone (TPZ)

STEP 1 Calculating the circumference of a tree stem

TREES WITH ONE STEM

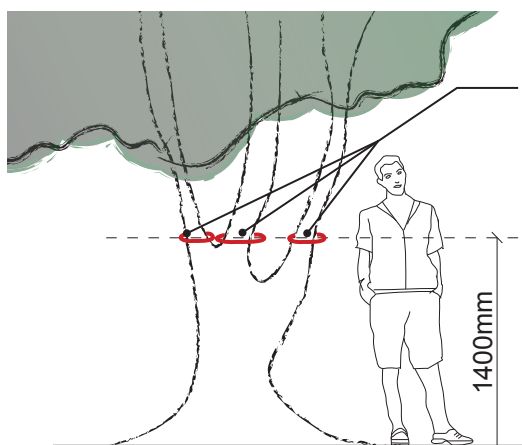


For a single trunk tree, measure the trunk at chest height.
Circumference at chest height

The circumference of a tree stem is the length around it.
The circumference can be calculated by wrapping a flexible tape measure around the stem tightly. The tape should be wrapped around the stem at 1.4 metres above ground level.

TREES WITH MORE THAN ONE STEM

Where a tree has more than one stem, a measurement should be taken on each stem at 1.4 metres above ground level. The formula for calculating the TPZ of trees with multiple stems is complex. Because of this, you should input your measurements into the TPZ Calculator on the City of Ryde website and it will calculate the TPZ for you. The TPZ Calculator can be viewed at www.ryde.nsw.gov.au.



For a multi trunk tree, measure each trunk at chest height
Circumference at chest height

Plan View: Measure the circumference of the tree trunk at 1400mm above ground level (at breast height) with a tape measure

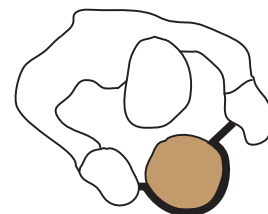




Figure 3.2 Calculating a Tree Protection Zone (TPZ)

STEP 2 - Using the circumference measurement to calculate the TPZ

1. Calculate the DBH (Diameter at Breast Height)

Divide the circumference (as calculated in Step 1) by 3.14

2. Calculate the TPZ

Multiply the DBH figure by 12.
This measurement should be calculated in metres.

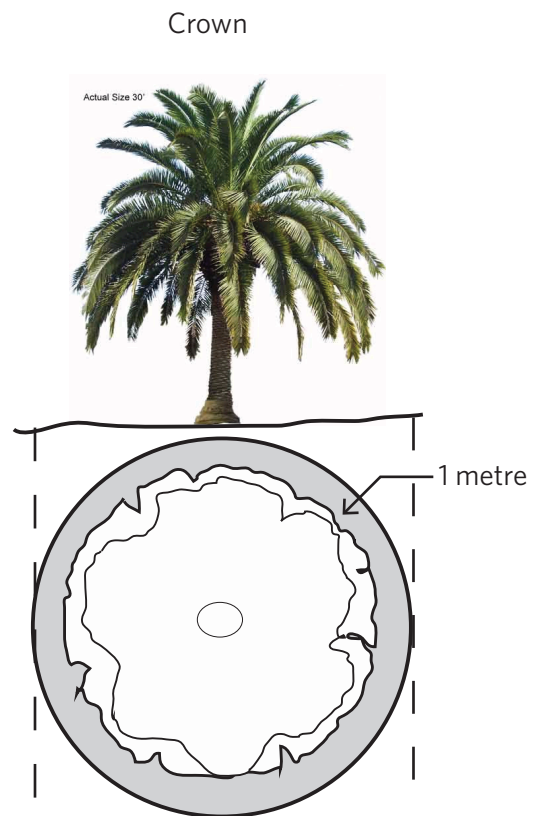
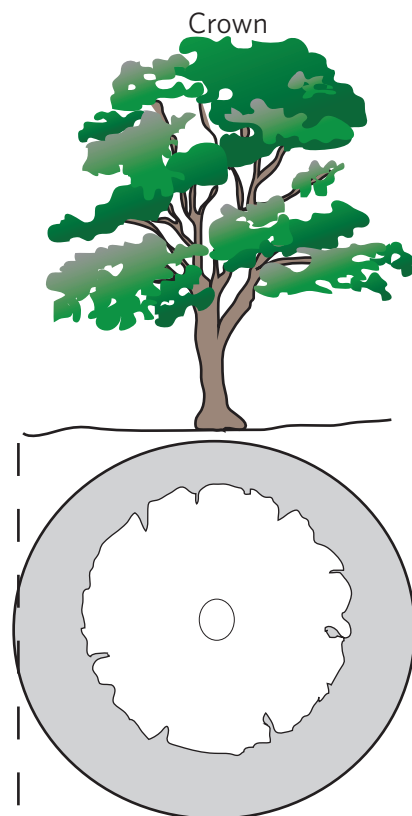
3. Measure the TPZ

The TPZ of a tree is then measured by laying a tape measure on the ground and measuring the TPZ distance radially from

the stem to form a circle around the tree stem. This circle is the TPZ, as shown in the examples below.

NOTE: A TPZ should not be less than 2 metres or more than 15 metres from the tree stem.

NOTE: You do not need to calculate the TPZ of palms, cycads and tree ferns. For these plants, the TPZ should not be less than 1 metre outside the crown.



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4. Arborists

4.1 Qualifications

Tree work is technical and inherently dangerous. Therefore it is important that appropriately qualified people are hired to carry out this work. Table 4.1 sets out the qualification requirements for arborists within the City of Ryde.

Table 4.1 Arborist Qualification Requirements

TASK / ACTIVITY	MINIMUM QUALIFICATIONS
Assess and carry out tree pruning	Australian Qualification Framework level 3 or equivalent in Horticulture (Arboriculture). Registered as a member of either: <ul style="list-style-type: none">• Tree Contractors Association Australia• Arboriculture Australia
All tree assessment and report preparation including: <ul style="list-style-type: none">• Tree health and condition assessment• Tree retention value assessment• Arboricultural impact assessment• Tree protection plan• Root mapping• Testing with a sonic tomograph• Testing with resistance drilling technology	Australian Qualification Framework level 5 or equivalent in Horticulture (Arboriculture).
Project Arborist in relation to all development	Australian Qualification Framework level 5 or equivalent in Horticulture (Arboriculture).



4.2 Suitably qualified arborists

Qualified and industry approved arborists can be found by contacting the following organisations:

- **Tree Contractors Association Australia**
Web: <http://www.tcaa.com.au> Telephone: 1300 660 379
- **Institute for Australian Consulting Arboriculturists**
Web: <http://www.iaca.org.au>
Telephone 1300853 288
- **Arboriculture Australia**
Web: <http://arboriculture.org.au> Telephone: 1300 664 374

Before you employ an arborist you should check that they are qualified to carry out the work (in accordance with Table 4.1) and insured to carry out the type of work proposed.

Note: You must obtain a Tree Permit or Development Application approval before you carry out all non exempt Tree Works within the City of Ryde. If you employ a person or company to carry out Tree Works without prior approval you will be in breach of section 126 of the *Environmental Planning and Assessment Act (1979)* for which pecuniary penalties apply. The City of Ryde may issue penalty infringement notices.

4.3 Arboricultural Reports

Reports prepared by an arborist who does not hold the qualifications specified in Table 4.1 or reports that do not include the minimum information as specified in this Section will not be accepted.

When preparing an arboricultural report, the arborist must not act as an advocate for their client but instead has an overriding duty to assist the City of Ryde in making an impartial decision. All arboricultural reports must provide an objective, balanced assessment of the tree and must reflect the arborist's expert opinion.

The City of Ryde shall consider the level of detail and relevance of the information contained within an arboricultural report. The City of Ryde may:

- require further investigation to be carried out, for example aerial inspection or testing via a sonic tomograph or resistograph.
- disagree with the findings and/or recommendations in the report, and the report may form the basis for refusing an application for tree removal.

Pages 21-25 set out the minimum content requirements for all arboricultural reports. Reports submitted that do not comply with these requirements shall not be accepted.

The City of Ryde may require plans to be submitted in both hard copy and AutoCAD dwg. format.

4.4 Project Arborist

A Project Arborist is an arborist appointed by a property owner or development applicant to monitor the vitality and condition throughout the construction process of all trees being retained on the land, and any trees on adjoining land and street trees where the development encroaches into



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the Tree Protection Zone of those trees. Project Arborists must have the qualifications set out in Table 4.1.

Throughout the construction process, the Project Arborist shall be responsible for:

- inspecting and assessing the trees
- supervising any work within the Tree Protection Zone of the trees
- specifying and supervising pruning works
- preparing reports required by the City of Ryde
- specifying and monitoring compliance with tree protection measures
- specifying and certifying remediation works
- providing written statements of compliance (certification) at specific milestones throughout the construction process in accordance with AS 4970 - 2009 *Protection of trees on development sites*.

The property owner or development applicant should employ the Project Arborist at the initial design stage of the development and prior to the commencement of any construction works (including demolition, excavation or earthworks). The same Project Arborist should be retained throughout the construction process to ensure a consistent approach in the protection and preservation of the trees.

The City of Ryde shall include monitoring and reporting requirements as conditions at development application approval and construction certificate stages.

The City of Ryde shall require the Project Arborist to be involved at pre-determined stages of the development process, as listed in Table 4.2. Reports prepared by the Project Arborist during the development process shall include (as a minimum) the following:

- details of the vitality and structural condition of all trees being retained and their growing environment
- details of any works undertaken within the Tree Protection Zone of each tree
- documentary evidence of compliance with tree protection measures (eg. photographs)
- details of proposed remedial works and the time frame for these works to be completed if:
 - the vitality or structural condition of the tree or the growing environment has been adversely affected
 - the tree has been damaged in any way
 - any tree protection measures are non-compliant
- Confirmation (certification) that remedial works specified in previous reports have been completed.
- Any other information reasonably required by the City of Ryde in relation to the health and structural condition of trees being retained. Copies of monitoring documentation may be required.



Table 4.2 Development Stages

STAGE OF THE PROJECT	ROLE OF PROJECT ARBORIST
Pre-construction	<ul style="list-style-type: none"> ▪ Tree removal and pruning – the Project Arborist shall: <ul style="list-style-type: none"> ▪ mark all trees for pruning, retention, removal or transplanting on site and check these correspond with those shown on the relevant construction plans; ▪ specify all pruning works; and ▪ certify all tree pruning, removal and transplanting works on the completion of these works. ▪ Tree protection – the Project Arborist shall certify that all tree protection measures are installed in compliance with the Tree Protection Plan and specification.
Construction	<p>The Project Arborist shall submit reports to the City of Ryde regularly throughout the construction process. The number and timing of reports required will vary according to the size of site and size and complexity of the development. Report requirements shall be specified by the City of Ryde in the Development Application approval and construction certificate documentation. The following milestones are typical triggers for the preparation of reports:</p> <ul style="list-style-type: none"> ▪ Completion of site establishment ▪ Installation of services ▪ Installation of footings and slabs ▪ Erection of scaffolding ▪ Works within the Tree Protection Zone of any tree on the site or on adjoining land or any street tree ▪ Completion of building works ▪ Practical completion of all construction and landscape works.
Post-construction	<p>Completion of the defects liability period. The Project Arborist shall:</p> <ul style="list-style-type: none"> ▪ certify that all tree protection measures throughout the construction and landscaping works have complied with all plans, specifications and reports prepared by the Project Arborist and conditions specified in Development Application approval or Tree Permit. ▪ If any tree protection measures have not been complied with, provide details of the non-compliance and the impact on the trees. ▪ assess the vitality and structural condition and growing environment of all trees on the site, and trees on adjoining land and street trees where any work has occurred within the Tree Protection Zone of those trees, ▪ make recommendations for any necessary remedial works and certify that all remedial works have been completed.

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Minimum content for Arboricultural Reports

MANDATORY REPORT REQUIREMENTS

All arboricultural reports submitted to the City of Ryde must include the following information:

- The name, business address and telephone number of the arborist and/or business who inspected the tree(s) and prepared the report.
- The qualifications and industry experience of the arborist who prepared the report.
- Disclosure by the arborist of any pecuniary or non pecuniary interests in the site or development.
- The name of the person or business who commissioned the report.
- The address of the site where the tree(s) affected by the proposed development are located.
- The date(s) when the tree inspection was undertaken.
- The purpose of the report.
- Methodology used in the inspection.
- A survey plan of the site, to scale (with scale shown), accurately showing:
 - The lot boundaries
 - The location of the all trees on the site with an individual number given to each tree
 - A brief description of any other vegetation on the site
 - Trees on adjoining properties 5 metres or less from the site boundaries.
 - A table showing, for each tree surveyed:
 - a. the full botanical name (genus and species) and common name
 - b. age class
 - c. estimation of the height
 - d. DBH - trunk diameter at 1.4 metres above ground level
 - e. an estimation of canopy spread to the four cardinal points.
- The arborist's observations and findings:
 - A description of the health, condition and structure of each tree, addressing root system, the stem, branches and foliage.
 - Supporting evidence (eg. photographs and laboratory results).
- A discussion of the observations made and data collected. This should include a discussion of all management options available (eg. tree pruning, site or design modification) to avoid the removal of the tree.



Minimum content for Arboricultural Reports

- The estimated useful life expectancy and an analysis of the landscape amenity and significance of each tree to the site and locality.
- The retention value of each tree using appropriate industry methods (eg, SULE, Tree AZ, Stars or SRIV).
- Recommendations: These must be based on the observations made and any test results. Recommendations made to support a specific development outcome will not be considered. An explanation of why options are recommended or not recommended must be included.
- Sources of references referred to in the report. References not used in the report should not be included.

Root Mapping

Roots must be located and exposed using minimally destructive techniques (eg. hand digging or Air-spade) or non-destructive techniques (eg. sonic tomograph). Machinery or tools such as mattocks and crow bars must not be used.

In addition to the mandatory report requirements, the report must contain the following information:

- a plan showing the location of all excavation lines including points of reference and orientation details
- a section plan of the excavation showing all material found within the excavated area
- photographs (including points of reference and orientation details)
- a schedule of findings for each individual excavation line including details of:
 - total linear distance of the excavated line
 - number of roots found
 - linear distance along the excavation that roots are located
 - depth at which roots were located
 - condition of the roots
 - diameter of the roots.

Tree Hazard Assessments

A tree hazard assessment may be required when an applicant considers a tree to be potentially hazardous.

In addition to the mandatory report requirements, the report must contain the following information:

- a description of any identified hazards (eg. the extent of decay or basal cavity)

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Minimum content for Arboricultural Reports

- details of the hazard rating system used
- the hazard rating under that system
- recommendations for hazard abatement. These must be based on the observations made. An explanation of why options are recommended or not recommended must be included.

Resistograph Reports

In addition to the mandatory report requirements, the report must contain the following information:

- The reason why the resistograph assessment is being carried out (eg, testing for decay associated with a wound)
- The type of defect being tested for
- Drill depth and resonance setting
- The type or model of resistograph used
- The location of the drill test readings on the tree in relation to the defect
- The failure criteria applicable to the defect
- Photographs of the defect
- A clear copy of the resistograph charts resulting from the test, with the wood quality indicated on the charts by colour coding
- Plotted diagram of the decay
- Assessment as to whether the defect passes or fails the applicable failure criteria (including details of calculations made)
- Recommendations and the reasons for the recommendations.

Arboricultural Impact Assessment Reports

Where development is being carried out on a site upon which trees are located or within the Tree Protection zone of a tree on adjoining land or a street tree, an Arboricultural Impact Assessment report may be required by the City of Ryde as part of the Development Application process.

In addition to the mandatory report requirements, the report shall contain the following information:

- Retention values for all trees.
- In accordance with ***Australian Standard 4970-2009 Protection of trees on development sites***, for each tree on the site, and for each tree on adjoining land and street tree where the development will occur within the Tree Protection Zone of those trees:
 - stem diameter measured above the root buttress
 - recommended Tree Protection Zone (TPZ) and Structural Root Zone (SRZ)



Minimum content for Arboricultural Reports

- percentage of encroachment into each TPZ and details of any encroachment into any SRZ
- proposed method used to excavate within the TPZ and SRZ.

Note: This information shall be clearly presented in table form.

- An accurate and comprehensive assessment of the likely impact of the proposed development on each tree including:
 - Details of the proposed development including but not limited to alterations to existing buildings, services, drainage and driveways, and proposed building footprints
 - Details of above and below ground constraints on trees to be retained
 - Details of any modifications to existing soil levels on the site (for example, cut, fill and excavation)
 - The location of proposed sediment controls on the site
 - The impact of proposed landscape modifications.
- Recommendations as to design modifications and construction methods to minimize the adverse impact on trees that should be retained.
- Recommendations on protection measures to ensure the protection of the trees to be retained.
- Details of any pruning required for construction works and the proposed development, and a pruning specification setting out the:
 - pruning type (classification) in accordance with AS 4373 – 2007 Pruning of amenity trees
 - number of branches to be pruned
 - branch orientation
 - branch diameter, and
 - approximate percentage of live canopy to be removed

Note: All pruning shall be carried out in accordance with section 5.

- A Tree Protection Plan (to scale, with scale shown) showing the TPZ and location and type of tree protection measures that will be erected or installed around each tree. This plan must include all trees being retained on the site, and trees on adjoining land and street trees if development will occur within the TPZ of these trees. The Plan shall include details of proposed protection measures throughout the entire development and construction process (including during the demolition and excavation stages).
- A Tree Removal Plan showing all trees on site and clearly marking all trees proposed to be removed.

Minimum content for Arboricultural Reports

- A Landscape Plan showing:
 - All trees that are proposed to be retained and transplanted on the site
 - For all replacement tree plantings proposed
 - a replacement plant schedule (showing the botanical and common names the expected mature height of the tree with the City of Ryde)
 - tree stock specification in accordance with section 6.
 - locations of proposed plantings.
- A post-construction tree establishment and maintenance programme. The City of Ryde requires a 52 week establishment and maintenance period and this period shall commence at practical completion.



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5. Pruning

5.1 Introduction

Tree pruning should result in healthy, structurally sound and aesthetically pleasing trees. One of the key objectives when pruning a tree is to create and maintain a strong structure with a functional and pleasing form. This can be achieved by undertaking pruning regularly throughout the life of the tree. Pruning can guide the form of a tree and correct defects such as poor structure.

There should always be a good reason to prune a tree because pruning causes wounds which the tree has to respond to. Frequent and indiscriminate pruning will stress the tree and consequently adversely affect its health.

5.2 General requirements

All pruning works within the City of Ryde must be carried out:

- by an arborist with a minimum qualification of AQF level 3 (refer to Table 4.1 in section 4)
- in accordance with Australian Standard 4373 – 2007 *Pruning of amenity trees*
- in accordance with the *Workcover Code of Practice - Amenity Tree Industry 1998*
- in accordance with this Technical Manual.

5.3 Pre pruning assessment

Prior to any pruning works being carried out, the tree must be assessed by a person competent in arboricultural assessment (Table 4.1 in Section 4). This must include:

- an assessment of the tree's species, age, health, growth habit, structural condition, stability and growing environment
- an assessment of existing habitat and potential habitat value of the tree or section of the tree being considered for pruning.

Note: Tree with hollows or other potential habitat may need to be assessed by an ecologist or wildlife specialist.

- an assessment of the risk of disease spreading from the tree to other trees and the need for disinfecting pruning tools between trees
- consideration of the reason for pruning the tree
- an assessment of the likely effect of any root pruning
- consideration of the impact of the pruning on the health, structure, amenity and stability of the tree.

The arborist must:

- Determine whether pruning is required or not having regard to the criteria set out above.
- Recommend the pruning works only if the tree will not be adversely affected by the pruning.



5.4 Pruning practices

Trees must be pruned to maintain their natural habit. The arborist must aim to remove the smallest possible amount of living tissue when pruning. Lopping, topping, lion's tailing, flush cutting, wound painting and wound filling must not be specified or undertaken within the City of Ryde. Tree pruning should not:

- result in the premature death of the tree
- create a hazard
- be excessive or indiscriminate
- result in the overall crown shape becoming unbalanced or the tree unstable.

All pruning tools must be sharp to ensure clean cuts will be made. Equipment that will wound, penetrate or bruise bark and conductive tissues (including spurs, spikes, hooks, chained platforms and lowering systems) must not be used on or in sections of trees to be retained. When pruning palms all pruning tools must be disinfected in between trees to avoid the spread of disease.

Roots to be pruned shall be located and exposed using minimally destructive techniques (eg. hand digging or by Air-spade) or non-destructive techniques (eg. sonic tomograph).

5.5 Pruning specifications

The City of Ryde's Urban Forest team or the Project Arborist shall specify the type (pruning class) and amount of pruning which may be carried out before any pruning work commences. All pruning shall be undertaken in accordance with these specifications and the provisions of this Section 5.

AS 4373 - 2007 *Pruning of amenity trees* sets out a number of pruning classes. Pruning may maintain or modify the crown of a tree. Crown maintenance does not reduce the volume of the crown and retains the structure and size of the tree. Crown modification changes the form and habit of the tree. The class specified by the Urban Forest team or Project Arborist will depend on the reason for pruning a tree. The specification shall include:

- For deadwooding, the minimum diameter and location of the branches to be removed (refer to the Note below)
- For crown thinning, the percentage of the crown to be removed, and maximum diameter and location of branches to be removed
- For selective pruning, the specific branches to be removed
- For formative pruning of young trees, the specific branches to be removed
- For reduction pruning, the extent of the crown or limb reduction
- For crown lifting, the clearances to be achieved, and the maximum diameter and location of the branches to be removed
- For remedial (restorative) pruning, specific details of pruning and number of pruning stages
- For pruning palms, specific parts (fronds and/or fruit) to be removed.

Note: Written consent (by way of a Tree Permit or Development Application approval) is not



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required to remove dead branches, provided the work is carried out:

- by a qualified arborist (in accordance with Table 4.1 in Section 4)
- in accordance with:
 - Australian Standard 4373 -2007 *Pruning of Amenity Trees*
 - NSW WorkCover *Code of Practice: Amenity Tree Industry 1998*.

However, prior written approval to remove deadwood from a Tree must be obtained if the Tree:

- is or forms part of a heritage item; or
- is within one of the five heritage conservation areas within the City of Ryde.



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6. Replacement planting

6.1 Introduction

DCP Part 9.6 (Tree Preservation) aims to preserve the urban forest within the City of Ryde. An urban forest has environmental, social and economic functions and benefits. The environmental function largely depends on the amount of canopy cover. In addition many of the benefits of individual trees are directly related to size. When a large mature tree is removed from a site it will take a significant amount of time and resources to regain those benefits and replace the canopy cover. A small replacement tree does not have the same function or benefits as an existing large mature tree.

Effective management of trees as a natural resource and as part of the urban infrastructure of the City of Ryde depends, amongst other things, upon the long term retention of existing trees. However the City of Ryde recognises that trees need to be removed in some situations. In order to maintain the urban forest within the City of Ryde, the Urban Forest team may require replacement of any tree removed.

The success of the replacement tree will depend upon:

- Selecting an appropriate tree species and a suitable planting location (refer to section 6.2)
- Purchasing a good quality tree to buy (refer to section 6.3)
- Correctly planting the tree to give it the best conditions in which to grow (refer to section 6.4)
- Maintaining the tree during the period in which it establishes (Refer to section 6.5).

6.2 Replacement planting as a condition of tree removal

The City of Ryde may require replacement planting as a condition of a Tree Permit or Development Application approval. The Tree Permit or Development Application approval may specify in relation to the replacement tree:

- the minimum height at planting or minimum container size
- the minimum height at maturity
- whether the tree is native or exotic
- the genus and species (refer to the Note below)

Note: Within Urban Bushland areas, specific native trees may be specified.

6.3 Selecting the right tree for the right place

When selecting a tree, the following factors should be considered:

- The mature size and habit of the tree. Large trees should not be planted in very small spaces where they may conflict with buildings and service infrastructure (eg solar panels or sewerage pipes). The height and spread of trees can only be controlled by frequent and ongoing maintenance which may be costly.



- Desirable features of the tree, eg. weeping habit, flowering, bird attracting, drought tolerant, evergreen or deciduous, native or exotic. The City of Ryde considers both native and exotic trees to be valuable natural assets and does not advocate the planting of native trees only. In many urban situations, native trees do not grow as well as exotic species.
- The specific benefits to be achieved or problems to be avoided. Eg, planting a deciduous tree on the northern side of a dwelling house will provide shade to that part of the house in summer and allow light through in winter. Conversely planting a potentially large, evergreen tree to the north of solar panels will cause overshadowing which will adversely affect energy collection.

The mature size of a tree and what it looks like (habit/shape) will vary depending on where it has been planted (soil and climate conditions) and how much care it has received. However, in general, a good way of finding out how big a tree will grow and what it will look like when mature is to look at mature specimens within the City of Ryde. For example in parks, nearby gardens and street trees.

Trees listed in Table 6.1 are considered undesirable and should not be planted within the City.

Table 6.1 Undesirable Tree Species

BOTANICAL NAME	COMMON NAME
<i>Ailanthus altissima</i>	Tree of Heaven
<i>Alnus jorulensis</i>	Evergreen Alder
<i>Arecastrum romanzoffianum</i> (syn. <i>Syagrus romanzoffianum</i>)	Cocos Palm
<i>Bambusa spp.</i>	Rhizomatous Bamboo
<i>Cinnamomum camphora</i>	Camphor Laurel
<i>Erythrina x sykesii</i>	Indian Coral Tree
<i>Erythrina crista-galli</i>	Cockscomb Coral Tree
<i>Ficus benjamina</i>	Weeping Fig
<i>Ficus elastica</i>	Rubber Tree
<i>Lagunaria patersonii</i>	Norfolk Island Hibiscus
<i>Ligustrum lucidum</i>	Broad Leaf Privet
<i>Ligustrum sinense</i>	Narrow Leaf Privet
<i>Nerium oleander</i>	Oleander
<i>Olea europaea africana</i>	African Olive
<i>Populus spp</i>	Poplars
<i>Salix spp.</i>	Willows
<i>Schefflera actinophylla</i>	Umbrella Tree
<i>Tamarix aphylla</i>	Athel Tree
<i>Toxicodendron spp.</i>	Rhus Tree



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6.4 Choosing good quality plants

Choosing good quality stock is as important as choosing suitable species, planting location, correct planting and maintenance of the tree. The selection of a good quality plant is essential for the long term success of the tree. In particular, a well developed and well formed root system is critical to the long term health and viability of a tree.

Poor plant selection can cause early death, poor growth, poor vitality and poor form. Most root defects cannot be corrected. A tree with above ground defects will need remedial care. Eg, poor form will need to be corrected by formative pruning by an arborist whilst the tree is young or establishing. It is not economical in the long term to buy cheap plants if they are of poor quality.

The City of Ryde recommends that tree stock planted within the City should comply with the NATSPEC document Specifying Trees - A guide to assessment of tree quality by Ross Clark (2003).

The following guidelines are intended to help residents identify good quality stock at the plant nursery/garden centre. They are based on the NATSPEC document.

Tree stock should be assessed for overall balance between the size of the roots below ground and the crown above ground, and for both above ground and below ground characteristics, as follows and as shown in Figure 6.1:

- Balance between the size of the tree above the ground and the size of the rootball/container: In general, large trees in small containers are likely to have root defects and will need a high level of maintenance (eg frequent watering) when planted. A tree with a moderately sized crown in proportion to the root system is likely to grow more vigorously when planted than a tree with a large crown.
- Above ground:
 - Does the tree look healthy?
 - Is the tree free from pests and disease?
 - Is the tree free from wounds or injury? Are there any recent pruning wounds? Select plants with no or very few wounds. All pruning wounds should be cleanly cut.
 - Is the tree self supporting? A tree should be able to stand up without being staked. If the stem of the tree bends when the stake is removed, the tree is not self supporting and should be rejected.
 - Does the stem of the tree taper? The circumference of the stem at the base of the tree should be larger than the circumference higher up the stem. This shows that the stem is strong. Often trees that have been staked do not have stem taper.
 - Does the tree have a intact (unpruned) central stem?
 - Is the crown of the tree symmetrical? Are there branches on all sides of the stem?
 - Are all branches smaller in diameter than the stem? The diameter of each branch should be no more than half the diameter of the stem.



- Are the junctions between the stem and branches convex (similar to a wide “U” shape)? Structural problems may occur on some trees if the space between the stem and branches forms a very narrow fork (similar to a narrow “V” shape).
- Is the stem of the tree approximately in the middle of the container?
- Below ground (these characteristics can only be seen if the plant is taken out of the container):
 - Root growth should be symmetrical and roots should grow downwards.
 - The outside of the rootball should be free of circling or large, sharply bent roots.
 - There should be sufficient roots in the pot so that when the tree is removed from the pot, the root mass will keep its shape. On shaking or handling the rootball outside of the pot most (at least 90%) of the soil should remain around the roots.
 - The root crown (the uppermost roots emerging from the stem) should be at the surface of the rootball/potting mix.

The Urban Forest team, arborists and your local plant nursery/garden centre will be able to explain these characteristics to you and give you advice on how to select good quality trees.

6.5 Tree planting

Correctly planting a tree is a very simple process but an important one. Correctly handling the tree when planting, preparing the planting hole and caring for a tree after it has been planted will ensure the survival and optimal growth of the tree.

The best time to plant a tree is during autumn when the soil is still warm and the roots of the tree have time to grow before winter. Trees take up water through their roots. In general, trees require more water when they actively start to grow in spring and during hot summer months. Planting in autumn gives the tree more time to grow new roots and for roots to start growing into the surrounding soil before the increased demand for water starts. However container grown trees can be planted at any time of the year if they are properly cared for after planting.

Handling a tree

Trees should be kept in a sheltered and shady spot before being planted to keep them from wilting. Care should be taken not to damage trees when moving them. If the tree must be lifted by its stem, the stem should be wrapped with soft padding (eg. carpet underlay or rubber) and only the padded part of the stem handled. If the tree is large, a soft sling should be placed under the rootball rather than lifting the tree by its stem.

Watering

The tree should be well watered a number of times during the planting process:

- prior to planting, whilst the tree is still in the container. The soil in the container should be moist when you plant the tree.
- immediately after planting by watering within the watering berm (see below). This will ensure



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the rootball of the plant receives the water and not the surrounding soil (refer to the Note below and Figure 6.2).

- after laying mulch or, if mulch isn't immediately placed around the newly planted tree, both before and after laying the mulch.

The soil should be thoroughly wetted. It is better to give the plant a few long, thorough applications of water rather than a small amount of water frequently.

Note: When the tree is first planted all of its roots are contained inside the potting mix from the container. This is the tree's rootball at this time. The tree will not have any roots in the surrounding soil and therefore there is no need to water the surrounding soil at the time of planting.

Digging the planting hole

Before digging the planting hole, the location of underground services should be ascertained to avoid injury, and interruption or damage to services. The City of Ryde recommends contacting Dial Before you Dig on 1100 before you carry out any excavation works. All excavation within 300mm of services should be carried out by hand.

Tree roots need oxygen and generally most fine absorbing roots of trees are to be found in the top 200-300mm of soil. The planting hole should be dug to a depth slightly less than the height of the rootball in the container so that when the tree is placed in the hole the top of the rootball sits up to 20mm above the top of the hole. This is because the weight of the tree will make the tree settle down in the hole over time and eventually the top of the rootball will be level with the top of the surrounding soil.

Root trimming

Root pruning may increase fine root growth within the root ball. Shaving or trimming off the very outermost edge (up to 20mm) of the rootball of a container grown tree will stimulate root division and growth. An increased root system will allow the tree to absorb more water and nutrients, and consequently the tree may establish more quickly. Root trimming can be done when the tree has been placed in the planting hole prior to backfilling.

Backfilling the hole

Backfill the planting hole in layers, gently tamp down the soil in each layer and lightly water to remove any air pockets. Fill the hole with soil and construct a berm (see below). There should be no soil placed over the top of the rootball because this buries the existing tree roots impacting on the tree's ability to absorb oxygen. Placing soil over the rootball up to the trunk may also cause collar rot.

Constructing a berm

Form a mounded edge of soil approximately 60mm high on top of the rootball just inside the outermost edge of the rootball. This makes a shallow basin around the stem which prevents water run off to lower ground and allows the water to soak into the soil. The tree should be watered within this area until the tree is established.



Staking

Good quality trees should not require staking.

Mulching

Applying organic mulch over the surface of the soil after planting is beneficial because it:

- adds organic matter (and nutrients) to the soil
- protects the soil surface
- reduces water run-off
- insulates the soil from temperature extremes and
- inhibits weed growth.

Mulch should be placed at an approximate maximum depth of approximately 50mm. If mulch is too deep it can have negative effects such as reducing the amount of surface water reaching the soil and roots. Mulch should be kept well clear of the tree trunk. Mulching up to the trunk may cause collar rot.

6.5 Care after planting

Trees may take up to two years to successfully establish. Care during this period will lead to healthy and vigorously growing trees. The following maintenance practices should be regularly carried out during the establishment period:

- Watering: Water both the rootball and the surrounding soil thoroughly
- Weeding: Remove weeds close to the tree (weeds compete with the tree for water and nutrients)
- Fertilising: To maintain healthy growth in accordance with the fertiliser manufacturer's application instructions
- Pest and disease control: inspect to monitor and protect the tree from pests and diseases
- Mulching: Replenish water to keep the mulch depth to approximately 50mm deep.

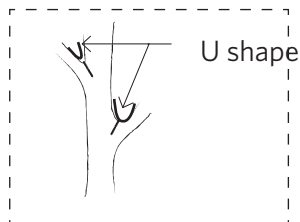
Figure 6.1 Choosing a good quality tree what to look for above ground

When buying a tree, look for a balance between the size of the container (the root ball) and the size of the crown.

The tree should :

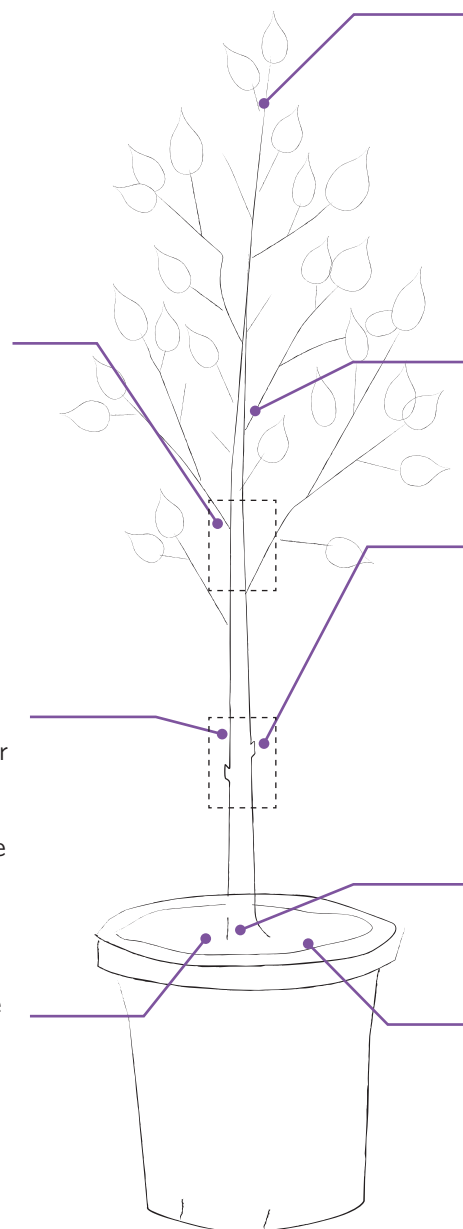
- be able to support itself without a stake
- have few, if any, pruning wounds
- be free from injury, pests and disease

The join between the stem and the branches should be in a wide "U" shape (as shown below)



The tree should be free from wounds or injury. The diameter of any pruning wound should be less than half the diameter of the stem immediately above the wound

The stem of the tree should be in the middle of the container



The tree should have one central stem which has not been pruned

There should be branches on all sides of the tree

The diameter of each branch should be smaller than the stem where they join

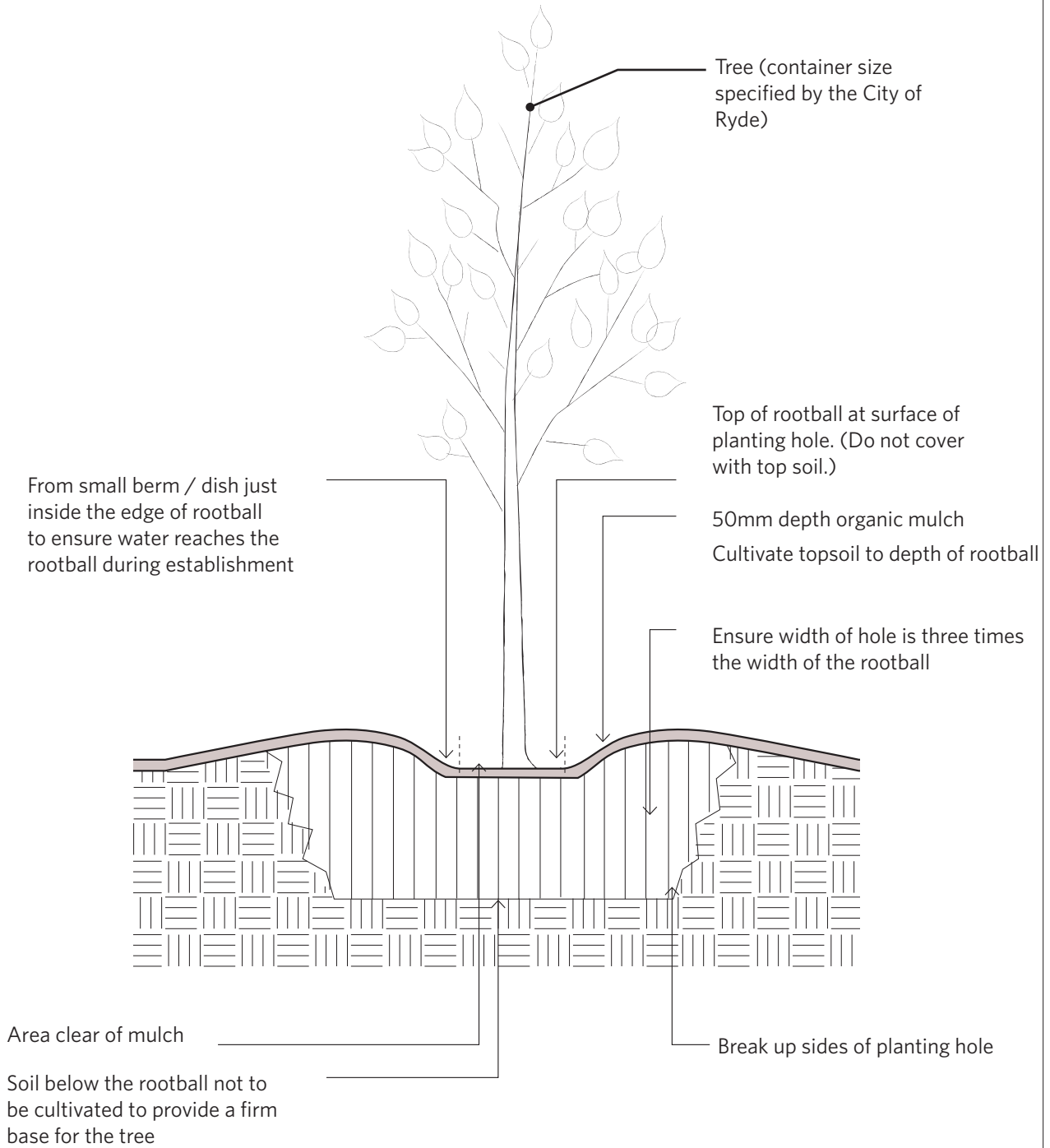
All pruning wounds should be cleanly cut at the branch collar

The circumference of the stem should be largest at the base and get increasingly smaller up the stem

The uppermost roots emerging from the stem should be at the surface of the potting mix.



Figure 6.2 Typical Tree Planting Detail



7. References

Australian Standards:

AS 4373 - 2007- Pruning of amenity trees

AS 4970 - 2009 - Protection of trees on development sites

Tree supply standards:

Clark, R 2003, Specifying Trees - A guide to assessment of tree quality, 2nd edn, Sydney NSW

Codes of practice:

NSW WorkCover Code of Practice: Amenity Tree Industry 1998.

City of Ryde documents:

City of Ryde Local Environment Plan 2010

City of Ryde Development Control Plan 2010

Other references:

City of Newcastle 2010, The Newcastle Urban Forest Technical Manual, The City of Newcastle Council, Newcastle NSW

Harris, RW Clark, JR & Matheny, NP 2004, Arboriculture Integrated Management of Landscape Trees, Shrubs and Vines, 4th edn, Prentice Hall, New Jersey USA



8. Glossary

Branch collar means a swelling around the base of a branch containing defensive chemicals formed by overlapping stem and branch tissue.

Crown means the portion of the tree consisting of branches and leaves and any part of the stem from which branches arise.

Crown lifting means the removal of the lower branches of a tree.

Crown thinning means the selective removal of branches that does not alter the overall size of the tree.

DBH means diameter at breast height at 1.4m above ground level.

Deadwooding means the removal of dead branches from a tree.

Exotic means a plant introduced or not originating from Australia.

Flush cut means a cut that damages or removes the branch collar or removes the branch and stem tissue and is inconsistent with branch attachment as indicated by the branch bark ridge.

Formative pruning means the pruning of young or establishing trees with the aim of directing growth and/or developing a sound structure.

Lion's tailing means the practice of removing branches from the interior of the crown leaving most of the foliage at the ends of branches. This may lead to structural hazards.

Lopping means the cutting branches or stems between branch unions or internodes.

Native means all plant species indigenous to Australia including all plant species locally indigenous to the City of Ryde.

Project Arborist means an arborist qualified in accordance with section 4.1 who is retained by a property owner or development applicant to carry out the responsibilities set out in section 4.4.

Reduction pruning means the removal of ends of branches to lower internal lateral branches or stems in order to reduce the height and/or spread of the tree.

Remedial (restorative) pruning means the removal of damaged, diseased or lopped branches back to undamaged tissue in order to induce the production of shoots from latent or adventitious buds, from which a new crown will be established.

Stem means the part of the tree which supports branches, leaves, flowers and fruit and is also called "the trunk".

Structural Root Zone (SRZ) means an area around the base of a tree required for the tree to be stable. The tree's woody roots and soil cohesion in this area are necessary to hold the tree upright. It is a radial distance from the stem calculated in accordance with **AS 4970 -2009 Protection of trees on development sites**.

Topping means reducing the height of a tree by lopping.



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Tree Protection Zone (TPZ) means an area above and below ground calculated in accordance with AS 4970 -2009 *Protection of trees on development sites*. It is a radial distance from the stem set aside for the protection of a tree's roots and crown to provide for the viability and stability of the tree.

Urban Bushland means land designated as Urban Bushland within the City as shown on maps and in documents commissioned by the City of Ryde from time to time.