

**VOLUME ONE
– POLICY MATTERS**

FINAL BURWOOD COUNCIL
STREET TREE MANAGEMENT STRATEGY



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**Prepared for
Burwood Council**

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EXECUTIVE SUMMARY

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The Burwood Council Street Tree Strategy provides a framework for the future management of street trees within the Burwood Local Government Area.

The plan was prepared after a study of key issues and community consultation between July 2002 and September 2003.

The Strategy has a five year span of influence after which time it should be subject to major review. Additionally, it is intended that the Action Plan be updated on an annual basis.

Structure Of The Document

The Burwood Street Tree Strategy is divided into two volumes:

Volume 1 is the body of the strategy. It includes background information and identifies the principal issues concerning Burwood Council's street trees, as follows:

- Street tree inventory (part 2 of the Strategy)
- Planning and development guidelines (part 2 of the Strategy)
- Practical approaches to problems (part 3 of the Strategy)
- Street tree planting opportunities (part 4 of the Strategy)
- Arboricultural maintenance (part 6 of the Strategy)

Combined, parts 2 to 7 provide a **Management Framework** in the form of issue specific strategies.

Volume 2 describes internal procedures for implementation of the Street Tree Strategy. It also collates the issue specific strategies into an **Action Plan**. The Action Plan outlines the means of achieving the Street

Tree Strategy, and is presented through a series of tables.

Date Of Adoption

The Strategy was adopted by Council on [insert date of adoption].

Objectives Of The Strategy

The Street Tree Strategy was prepared to achieve a series of objectives, which may be summarised as:

- (a) Rationalise street tree management within the Local Government Area
- (b) Maximise the beneficial aspects of trees in the streetscape
- (c) Minimise the risk of damage and cost associated with street trees
- (d) Extend community awareness of Council's street tree policies and practices

Structure revised

Updated

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1.0 INTRODUCTION

1.1 PRELIMINARIES

The Burwood Street Tree Strategy was adopted by Council on [insert date], following the public exhibition of the draft from [insert dates]. The strategy applies to all trees within on public road reserves in the Local Government Area of Burwood.

1.2 STRUCTURE OF THE DOCUMENT

The draft Strategy is divided into two volumes:

Volume 1: Policy Matters

- Background to the strategy
- Purpose of the strategy
- Objectives of the strategy
- Process for preparation of the strategy
- Review of statutory controls and policies
- Statutory planning background
- Burwood Council Street Tree Database
- Community consultations and their outcomes
- Issues arising and values
- Strategies for management

Volume 2: Internal procedures

- Species selection
- Tree Preservation
- Consultation and notification procedures
- Risk management / insurance issues
- Strategies for specific streets
- Action plan

Structure revised

1.3 BACKGROUND

Burwood Council has approximately 7,400 street trees within the local government area. Street trees constitute an important element of the rich cultural heritage of Burwood and a considerable asset to the community on many levels. They enhance our enjoyment of streets by making them more comfortable and pleasant, as well as providing a wide range of other benefits such as shade and habitat for wildlife. Conversely, street trees constitute a potential risk to the community and to property on a number of levels ranging from interference with underground or above ground services to risk to property and personal safety through such effects as limb drop or lifting of paved walking surfaces. Like other assets such as buildings or services, street trees require effective and coordinated management to maximise their benefits to the community and the environment against their risks, such as damage to property or personal injury.

Burwood council has undertaken to prepare this strategy for management of its street trees in order to protect this cultural asset and minimise the risks to property or personal safety caused by street trees. In August 2002, Council commissioned PSB (Pittendrigh Shinkfield Bruce) to prepare a Strategy for Burwood's Street Trees.

1.0 INTRODUCTION

1.4 PURPOSE OF THE STRATEGY

The purpose of the Street Tree Strategy is to provide a management framework that will lead to the effective and co-ordinated management of street trees in the local government area.

The aim of the Street Tree Strategy is to maximise the benefits of street trees, and minimise the risks associated with them (such as damage to property or personal injury).

The Strategy is not a static document, and will require an annual review of the Action Plan to ensure that it remains current. A major review of the document is considered necessary after a period of five years.

1.5 OBJECTIVES OF THE STRATEGY

Council identified the following objectives for the Street Tree Strategy, in their consultant brief:

“The consultancy will develop a strategic and transparent strategy for the management of Council’s street trees that will address the following primary objectives:

- minimise the risk of damage to property
- minimise the risk of personal injury resulting from affected public infrastructure
- minimise conflicts between utilities
- maximise the beneficial aspects of trees in the streetscape
- develop a consultative process for involving the public in the decision making process.

In addition, the consultancy must take account of the following needs:

- conserve and enhance the amenity and heritage of the area created by trees in the public domain
- minimise/reduce the risk to people, property and infrastructure from existing trees and those planted in the future
- Council’s legal responsibilities with regard to its trees
- provide a rational tree planting and replacement policy that addresses management, safety, cost and liability constraints
- extend community awareness of and support for a policy that addresses these issues strategically.”

1.6 PROCESS

(see Figure 1)

The Street Tree Strategy was prepared in consultation with Council officers, Councillors and members of the community. The Strategy was prepared in two stages between August 2002 and May 2003, by a process that involved background analysis, community comment and technical input. Tasks carried out included:

Stage 1: Review and Summary of Issues

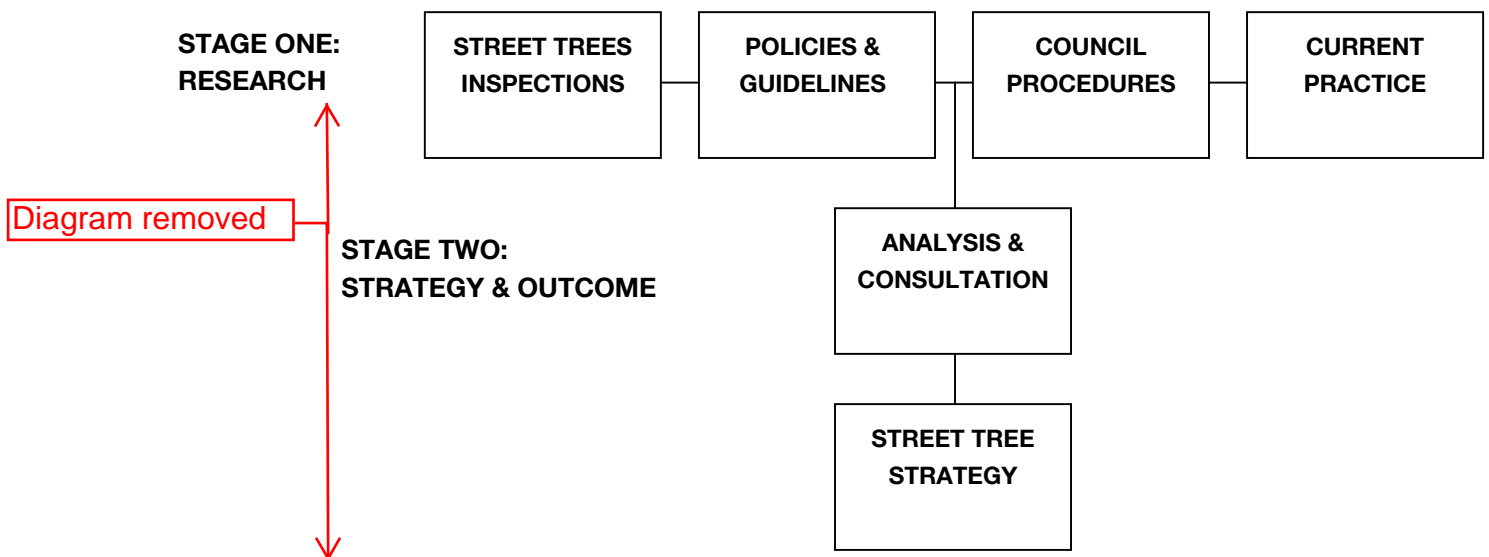
- Review of all Council information and documentation on street trees
- Field review of problems caused by street trees
- Review of legal advice
- Summary of the findings
- Preparation of an interim report to Council’s Project Management Team and feedback

1.0 INTRODUCTION

Stage 2: Consultations and Preparation of the Strategy

- Consultations with the community in the form of a mail back questionnaire included with Council's rates notice mail out and conducting of a public community workshop.
- Preparation of the draft Strategy in response to the requirements detailed in Council's brief including:
 - actions to reduce the existing risks and problems
 - a strategy for the management of the existing street trees, and planting of future street trees
 - a policy for Council to address third party claims
 - identification of appropriate amendments to Council's Tree Manual
 - a review of the Street Tree Master Plan
 - actions for short and long term tree maintenance, removal and replacement to maintain health and reduce hazards
 - a description of how the public will be informed about respective responsibilities and how third party claims will be assessed
 - procedures for the selection and planting of street trees and the minimisation of risks
 - specific strategies for street trees in a series of streets identified in Appendix A of the Brief

Figure 1: Project Process



2.0 REVIEW OF EXISTING CONTROLS/POLICIES

Burwood Council's street trees are currently subject to a variety of controls and policies. This section of the strategy provides an overview of these and explores opportunities to maximise the benefits and minimise the risks of street trees in Burwood through the provisions of the statutory framework and Council's policies and practices with regard to recording, selection, protection, maintenance and replacement of street trees.

2.1 STREET TREE INVENTORY

An inventory is an essential cornerstone of any asset management system, because it helps to quantify and describe what is being managed. The basic objective of a street tree inventory is to provide information on what trees are where, their overall size and condition, and what maintenance is required (Hitchmough 1994). In addition, inventories can be used to trigger corrective works and can help identify tree replacement requirements.

Burwood Council Street Tree and Maintenance Databases

Council has prepared an inventory of street trees within the local government area, which is referred to in the Strategy as the 'Burwood Council Street Tree Database'. Currently, maintenance records and descriptions of the street tree locations and dimensions are held in a second database, referred to as the 'Maintenance Database'. Each of these databases have been reviewed by the consultant team, and the summary of findings and relevant actions appear below.

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- The Burwood Council Street Tree Database was created using a hand held 'data logger' with a MapInfo graphic display
- The location of each street tree was determined with reference to an electronic map of the street, to give each tree a set of defining coordinates
- House numbers were not entered into the database
- A lap top computer loaded with MapInfo is required to locate a specific tree from the database in the field. This is a difficult way to access data - field staff would have to have ready access to lap tops and the ability, time and desire to use them
- Without street numbers, the accuracy of the data collected could not be fully assessed by PSB, but the data did appear to have some inaccuracies with regard to estimated tree heights
- Overall, not enough data is collected about each tree, for the database to be used as an effective tool
- The Maintenance Database collects different information to the Burwood Council Street Tree Database
- There should be one database that is consistently used by all team members concerned with any aspect of street tree maintenance
- The range of information collected by the Maintenance Database is consistent with our recommendations, although some changes are recommended, such as the type of pruning carried out (formative, hazard reduction etc.)

2.0 REVIEW OF EXISTING CONTROLS/POLICIES

2.2 STATUTORY FRAMEWORK

- The statutory framework that applies to street trees in Burwood is comprised of the following:
- Burwood Heritage Study (1989) and Council's Heritage Local Environmental Plans
- Tree Preservation Order
- Burwood Council Landscaping Code
- Burwood Precinct Urban Design Guidelines (Urban Design Advisory Centre 2001)
- Tree Safety Management Plan (Energy Australia 2002)

Updated

Burwood Heritage Study (1989) and Council's Heritage Local Environmental Plans

- Street trees within heritage conservation areas contribute to the character and setting of the streetscape, and also because they may be characterised as 'Significant Trees'. Burwood Council has three heritage Local Environmental Plans, these are Nos. 10 (Appian Way), 11 (Malvern Hill Estate) and 19 (Burwood Council Local Environmental Plan). The Local Environmental Plans (LEPs), and the Planning Scheme Ordinance have established a number of heritage conservation areas in Burwood Council, which apply to an estimated 20% of the streets in the local government area. Under the heritage LEPs, the impact of development proposals on the Conservation Area's heritage significance, which may include the streetscape, is required to be assessed, amongst other things.
- The definition of what a 'Significant tree' is varies between local government areas. 'Significant' suggests that something is outstanding, or especially meaningful. A tree deemed to be significant has some quality, attribute or characteristic that sets it above or apart from other trees. Generally, significant trees are trees that have been determined to have either environmental or historic values, because they are representative of the indigenous vegetation of the area, or are exotic vegetation associated with European settlement and historic sites. Street trees in Conservation Areas contribute to the "environmental heritage significance" of those areas. In this regard these trees may be considered to be 'Significant Trees'. The important aesthetic contribution that street trees in conservation areas and other significant trees make should be recognised in their management.

- Burwood Council is recommended to prepare a Register of Significant Trees. In the interim, street trees in conservation areas should be retained wherever possible. To help identify which trees are within Conservation Areas, Council's Planners and Tree Managers should have a reference map, which clearly indicates the extent of all heritage conservation areas in Burwood Council. This information should be captured in the Street Tree Database.

Removed

2.0 REVIEW OF EXISTING CONTROLS/POLICIES

- Resources should be devoted to retaining the existing species in Conservation Areas, where the species is considered to be appropriate in terms of its horticultural characteristics for the site. This could mean that:
 - Aerial Bundled Cabling is installed, to reduce the conflict between street trees and overhead wires
 - Root control barriers are installed
 - Street and pavement works are designed to ensure the appropriate allocation of space for tree root development
 - Major works to street trees in heritage conservation areas should be referred to Council's planning branch for development assessment advice.

Tree Preservation Order (1979)

- Burwood Council's Tree Preservation Order applies to all trees within the local government area, including street trees. Tree Preservation Orders protect trees by making it an offence to alter or remove a tree without Council's consent. As the Tree Preservation Order was prepared several years ago, it now contains out dated terminology (eg. 'lopping' and 'tree surgeon' are no longer accepted arboricultural terms). The document could be simplified, shortened (refer to North Sydney's Order, as an example) and revised. Revision of the Tree Preservation Order should be made under the provisions of clause 8 of the Environmental Planning and Assessment Model Provisions 1980, in force under the Environmental Planning and Assessment Act 1979. The revised Order is to include the current Australian Standard for the Pruning of Amenity Trees (AS 4373) and Occupational Health and Safety regulations.

Updated

Burwood Council Landscaping Code (not dated)

- The purpose of the Code is to "raise awareness about the important aesthetic and functional uses of site landscaping and to ensure that landscaping forms an integral component of the design process for new development in Burwood (p. 1)." The Code does not distinguish between landscaping on private sites, or in the public domain, or provide guidelines to developers about street trees. The Code is recommended to be revised, to provide developers with guidance on street tree planting, appropriate species and establishment maintenance.

Burwood Precinct Urban Design Guidelines (Urban Design Advisory Centre 2001)

- The Burwood Precinct Urban Design Guidelines provide controls, principles and criteria to achieve better residential design and improved residential amenity around Strathfield Station generally. Council has adopted the Guidelines as a draft report. Burwood Council will prepare Local Environmental Plans and Development Control Plans to meet the objectives of the Urban Design Guidelines.
- Street tree planting, where the opportunity exists, is supported and recommended by the Guidelines, but species are generally not mentioned. Details of street tree planting dimensions and the location of services are also not provided. The new Local Environmental Plans and Development Control Plans to support the objectives of the Urban Design Guidelines should accord with the Street Tree Strategy.

2.0 REVIEW OF EXISTING CONTROLS/POLICIES

Energy Australia's Tree Safety Management Plan (2002)

Energy Australia Tree Safety Management Plan provides guidelines on vegetation management under power lines for use by councils, public and private landowners and others. Advice on types of vegetation that are suitable and not suitable for planting near overhead is provided. Only low growing species are recommended for use under power lines (see part 3.2.2 of the Strategy).

The Tree Safety Management Plan also provides information on the Network Standard Vegetation Safety Clearances around streetlights, aerial bundled cabling, poles, and conductors and states the requirements for contractors, councils, other managers.

The Energy Australia list of 'unsuitable trees' contains species that can be directionally pruned, and that are suitable for planting under power lines, providing a commitment to such pruning is made. Council should assess the financial feasibility of installing aerial bundle cabling in areas where existing mature trees are causing interference so that existing streetscape character and amenity can be maintained. Council should also consider the financial viability of the installation of underground electrical networking in 'new' streets in development areas.

2.3 STRATEGIES

- Prepare a register of Significant Trees in Burwood Council, for scheduling in the Burwood Local Environmental Plan.
- Prepare and maintain a reference map, which clearly indicates the extent of all Heritage Conservation Areas in Burwood Council. The information from the reference map should be captured in the Street Tree Database.
- Revise the Tree Preservation Order under the provisions of clause 8 of the Environmental Planning and Assessment Model Provisions 1980, in force under the Environmental Planning and Assessment Act 1979. The existing Tree Preservation Order should be simplified, and shortened. Revision of the Tree Preservation Order is to include the current Australian Standard for the Pruning of Amenity Trees (AS 4373) and Occupational Health and Safety regulations.
- Revise the Landscaping Code, to provide developers with guidance on street tree planting (Appendix 1), appropriate species (Table 2) and establishment maintenance. Revise Council's Conditions of Development Consent so that they are in accordance with the Street Tree Strategy.
- New local environmental plans should accord with the Street Tree Strategy, and development control plans should seek to provide planting conditions that maximise the potential for medium to tall street trees.
- Prioritise the installation of aerial bundle cabling in the following areas:
- Heritage Conservation Areas where the existing mature trees are in conflict with the over head wires so that existing streetscape character and high level of amenity can be maintained, and
- Areas identified by Actions 3.4.7 and 3.4.8 for street trees removal and replacement.
- Prepare plain English versions of the following documents for the public:
 - Council's Tree Preservation Order

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3.0 CONSULTATIONS, ISSUES AND VALUES

3.1 COMMUNITY CONSULTATIONS AND THEIR OUTCOMES

Process

During the preparation of the Street Tree Strategy, the community was invited to comment on street tree management in Burwood Council by way of a mail out questionnaire and the opportunity to attend a Community Working Party meeting. The objective of consulting the community was to find out what was considered important about street trees within the local government area, and how they should be managed in the future. The feedback from the community is summarised below, and has been incorporated into some of the proposed recommendations in this Strategy. (Results of the consultations are provided in full at Appendix 1 NOT IN CURRENT APPENDIX). Council will also place the Draft Strategy on public exhibition, to provide a final opportunity for public comment, prior to its adoption.

Questionnaires about street tree management were distributed to 10,000 rateable properties within Burwood Council. A further 5,000 questionnaires were made available at Council run activities, and from Council's office.

Outcomes

Overall, 394 responses to the questionnaire were received, which equates to a response rate of about 3.1% (the typical response rate to questionnaires is about 3%). The highest response by street name was 3%, received from residents of Burwood Road and Wentworth Road, an arterial road and a sub arterial road, which indicates that an interest in street tree issues is shared across the local government area, and is not street specific.

3.2 ISSUES

The results of the questionnaire indicate that the majority of people in the local government area would agree that the main management issues for street trees are:

- that there are not enough street trees in Burwood
- tree species suitability
- replacement of street trees that have been removed
- safe enjoyment of street trees
- pruning of trees under powerlines

Issues mentioned by a marginal or less than significant number of the respondents were:

- after planting care and maintenance of street trees
- tree debris
- damage caused by street trees

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3.0 CONSULTATIONS, ISSUES AND VALUES

Other street tree management issues mentioned by the respondents were:

- lack of consistent species
- desire for a mixture of tree heights (small, medium and large)
- the hazard of branches overhanging footpaths
- vandalism of trees
- native species
- the relocation of services underground so that larger trees can be planted
- visibility – especially reduced by shrubs
- resident input into species selection
- replacement of large trees under powerlines with smaller trees

In addition to the questionnaire analysis, a Community Working Party meeting was held with interested residents, to explore the community's values, issues and concerns in relation to Burwood's street trees. The meeting was held on the evening of 10 October 2002, and eight residents attended.

The key issues discussed at the meeting were:

- overhead wires, and their impact on the appearance of street trees following power line clearance pruning
- species selection
- street tree replacement, following removal, and the identification of new street tree planting opportunities
- communication with the community about street tree works

The pruning of street trees away from above ground electricity wires was an issue of great interest. Engineering solutions to above ground wires, such as aerial bundled cables and the relocation of electricity wires to below ground, were discussed (see part 3.2.2 of the Strategy).

The members of the Working Party indicated that they aspired in the future towards trees that were efficiently managed, and were capable of providing shade and a visually appealing streetscape.

3.3 VALUES

The results of the questionnaire, as included in full at Appendix 1, indicate that the majority of people in the local government area would agree that street trees are important for the reason that they:

- add character to a street
- protect and enhance the environment
- provide important habitat for wildlife
- enhance the privacy of private property
- provide shade

3.0 CONSULTATIONS, ISSUES AND VALUES

A variety of other street trees values were mentioned by the respondents, including that street trees:

- instil 'a pride of place'
- screen and soften impact of development
- distract eye from ugliness of wires, poles, concrete
- are beautiful and precious
- add life to a street
- have colour, scent
- have a calming effect
- make one feel good
- provide contact with nature
- create a safer, better environment
- make it pleasurable to walk/drive through tree lined street
- increase the atmosphere of the area
- have potential to be used as part of comprehensive traffic calming strategy
- absorb dust and traffic noise

A low number of respondents (4%) indicated that street trees were not important. These respondents cited the following reasons:

- repair of damage caused by street trees is too costly to the ratepayer
- pruning under powerlines makes them ugly
- they are dangerous
- fallen leaves are messy and clog drains

4.0 STRATEGIES FOR MANAGEMENT

4.0 STRATEGIES FOR MANAGEMENT

Coming out of the investigations of Council's current policies and practices and the community consultation process, including the issues and values identified therein, a series of strategies for management of street trees in Burwood were formulated. These are described below.

4.1 COMPREHENSIVE STREET TREE DATABASE

Council's current street tree and maintenance databases should be amalgamated into a single database that is consistently used by all Council officers concerned with any aspect of street tree selection or maintenance.

Amalgamate the data from both databases into a single 'Burwood Council Street Tree Database' that is consistently used by all Council officers concerned with any aspect of street tree maintenance and management

Develop the Street Tree Database, using the recommended fields in Table 1 as a minimum guide, so that the data:

- can be used to determine maintenance responses
- can help identify New Tree Planting Opportunities
- can help identify more suitable replacement species, where tree replacement is required
- applies standard arboricultural terminology

Table 1 overleaf is recommended by Action 2.3.2 to form the basis of the Burwood Council Street Tree Database. The current Burwood Council Street Tree Database and the Maintenance Database already contain most of the data, with some minor revision. Additional fields may be added to the database, according to the requirements of Council's Street Tree Managers.

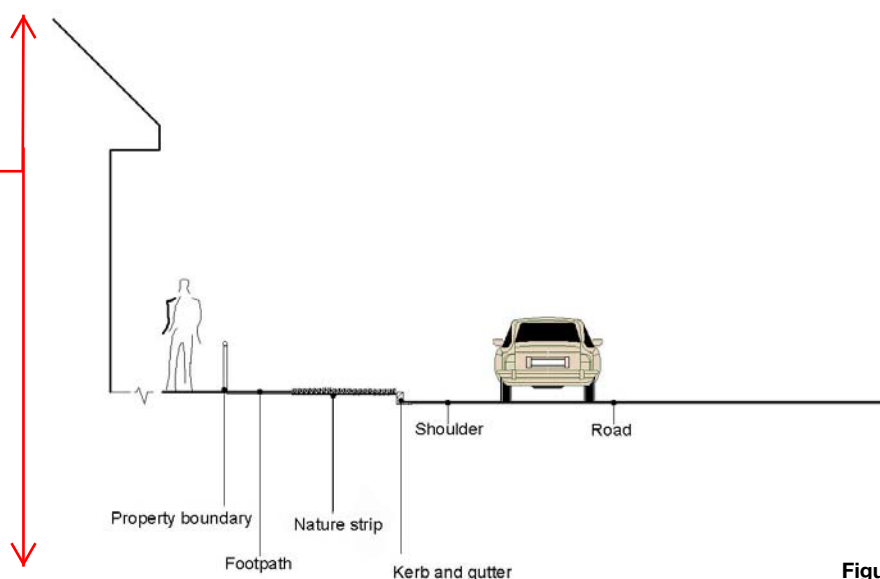


Figure 2: Typical Street Features Definitions

4.0 STRATEGIES FOR MANAGEMENT

Table 1: Recommended Burwood Council Street Tree Database

Field	Response
1. ID	(insert ID number, as appropriate)
2. Street Name 1	(insert principal street name, as appropriate)
3. Street Name 2	(insert secondary street name, as appropriate)
4. Property Number	(insert property number, as appropriate)
5. Suburb	(insert suburb, as appropriate)
6. Street Side Orientation	N, S, E, W
7. Tree Location (instead of 'where')	<ul style="list-style-type: none"> • Footpath <1600mm¹ • Footpath > or = 1600mm • Road shoulder • Nature strip
8. Tree Location Width (mm) ²	<ul style="list-style-type: none"> • Solid hardstand (saw cutting required) • Tree planting square <600 wide x 1000 long (see Figure 6) • Tree planting square >600 wide x 1000 long • Nature strip <1000 • Nature strip 1000 - 1500 • Nature strip 1500 – 3000 • Nature strip >3000
9. Above Ground Impacts on Tree	<ul style="list-style-type: none"> • Powerlines (6m) • Service wires (4m) • Building proximity • Signs and lights • ABC • Nil
10. Below Ground Impacts on Tree	<ul style="list-style-type: none"> • Surveyed • Not surveyed
11. Lateral Impacts on Tree (distance in metres)	(insert the distance in metres between the tree and adjacent structures, such as fences or pit covers)
12. Species	(insert the botanical name of the existing species, as appropriate or 'Nil' if no tree exists)
13. Remnant/Planted/Self Sown	<ul style="list-style-type: none"> • Indicate origin of tree if known.
14. Age	<ul style="list-style-type: none"> • Young (replaces 'New') • Semi-mature (replaces 'Young') • Mature • Over-mature⁵
15. Safe Useful Life Expectancy (SULE)	<ul style="list-style-type: none"> • SULE rating to be assessed independently and inserted here
16. Height (m)	(specify height in metres)
17. Spread (m)	(specify spread in metres)
18. Trunk diameter at 1.0m above ground (mm)	<ul style="list-style-type: none"> • 100, 200, 300, 400, 500, 600 or >600
19. Condition	<ul style="list-style-type: none"> • Good (does not require any action) • Fair • Poor • Over mature • Dead
20. Footpath Damage (mm)	<ul style="list-style-type: none"> • Nil • 0-10⁵ • 10-20⁵ • > 20⁵
21. Kerb Damage (mm)	<ul style="list-style-type: none"> • Nil • 0-10⁵ • 10-20⁵ • > 20⁵

Removed

4.0 STRATEGIES FOR MANAGEMENT

Field	Response
22. Heritage Significance	<ul style="list-style-type: none"> • Yes (within a heritage conservation area, a commemorative tree or is otherwise significant) <ul style="list-style-type: none"> - Aboriginal - Commemorative - Habitat - Historic - Memorial - Rare - Unique Form - Other • No
23. Planting Opportunity ^{2,3}	<ul style="list-style-type: none"> • This field is recommended, to clearly show whether an opportunity for tree planting exists: <ul style="list-style-type: none"> • Yes • No
24. Replacement species ^{2,4}	<ul style="list-style-type: none"> • Insert the botanical name of the replacement species
25. Root barrier	<ul style="list-style-type: none"> • Installed • Not installed
26. Recommendation ²	<ul style="list-style-type: none"> • Prune • Remove • Replace • Surface repair • Install root control barrier • Maintain root control barrier • Nil
27. Planting Date	<ul style="list-style-type: none"> • Date of planting
28. Removal Date	<ul style="list-style-type: none"> • Date of tree removal
29. Removal Reason	<ul style="list-style-type: none"> • Dead • Insurance • Customer request • Other (describe)
30. Stump Removal Date	<ul style="list-style-type: none"> • Date of stump removal
31. Prune Date	<ul style="list-style-type: none"> • Date of pruning works carried out
32. Inspection Date	<ul style="list-style-type: none"> • Date of visual tree inspection
33. Customer Service Request No.	<ul style="list-style-type: none"> • Record Customer Service Request No.
34. Comments	<ul style="list-style-type: none"> • Notes on works carried out on tree, issues associated with tree, or other matters pertaining to tree.

Removed

Removed

4.0 STRATEGIES FOR MANAGEMENT

TABLE 1 NOTES:

¹Footpaths <1600mm wide are not suitable for street tree planting squares

- ²Indicates an entirely new field

³Planting opportunity:

- A planting opportunity exists if the site satisfies the requirements identified in Table 2, there is enough room to accommodate a street tree, and there is no street tree present.
 - A planting opportunity also exists when trees are removed and the site satisfies the requirements identified in Table 2.
 - ⁴Replacement species should be determined by referring to Flow charts 1 and 2 and Table 2.
- Indicates a potential maintenance response trigger

Included in explanation table

Explanation and definitions of the terms used in Table 1:

Table 1 Field	Definition
1. ID	<ul style="list-style-type: none"> • To be determined by the Street Tree Surveyor
2. Street Name 1	
3. Street Name 2	
4. Property Number	
5. Suburb	
6. Street Side Orientation	<ul style="list-style-type: none"> • 'Street Side Orientation' is the side of the street that the tree is located. For instance, on a predominantly east – west street, such as Wyatt Avenue, street trees may be located on the north or south side of the street. The Tree Manager may elect to plant deciduous trees on the southern side of the street to maximise solar access in winter.
7. Tree Location	<ul style="list-style-type: none"> • To be determined by the Street Tree Surveyor. This field applies to both existing tree trees, and the future location of a street tree, if there is a 'Planting Opportunity'
8. Tree Location Width	
9. Above Ground Impacts	
10. Below Ground Impacts	<ul style="list-style-type: none"> • The purpose of this field is to indicate whether the below ground services have been surveyed in that location.
11. Lateral Impacts on Tree	<ul style="list-style-type: none"> • The purpose of this field is to identify the distance in metres between the tree and adjacent structures, such as fences or service pits
12. Species	<ul style="list-style-type: none"> • To be determined by the Street Tree Surveyor
13. Remnant/Planted/Self Sown	<ul style="list-style-type: none"> • Self explanatory; of use when negotiating cost sharing for line clearing operations
14. Age	<ul style="list-style-type: none"> • The age classes are defined as follows: • Young: < 5years • Semi-mature: a tree of intermediate height, before maturity • Mature: a tree of mature height for that species, and in 'good', 'fair' or 'average' condition • Over-mature: a tree that has reached the end of its safe lifespan and should be planned to be replaced
15. Safe Useful Life Expectancy (SULE) rating	<ul style="list-style-type: none"> • SULE ratings of all street trees in the Local Government Area are to be assessed independently as a separate exercise and information fed into this database.

4.0 STRATEGIES FOR MANAGEMENT

Table 1 Field	Definition
16. Height (m) 17. Spread (m) 18. Trunk DCH (mm)	<ul style="list-style-type: none"> To be determined by the Street Tree Surveyor
19. Condition	<ul style="list-style-type: none"> Good: a tree in good health, and does not require any further action. A healthy, vigorous tree, reasonably free of signs and symptoms of disease, with good structure and form typical of the species. Fair: a tree with something wrong in terms of its health or further action required. Tree with slight decline in vigour, small amount of twig dieback, minor structural defects that could easily be rectified. Poor: a tree that is approaching over-maturity or should be removed because it is found to be in very poor health. Tree in decline, epicormic growth, extensive dieback of medium to large branches, epicormics, and significant structural defects that cannot be mitigated. Over mature: a tree that has reached the end of its safe lifespan. Dead: a tree that is dead
20. Footpath Damage (mm) 21. Kerb Damage (mm)	<ul style="list-style-type: none"> To be determined by the Street Tree Surveyor
22. Heritage Significance	<ul style="list-style-type: none"> Yes (within a heritage conservation area or is otherwise significant – refer to eight listed criteria to assess significance) No (if not determined to be a significant tree)
23. Planting Opportunity	<ul style="list-style-type: none"> Yes: if the site satisfies the General Principles in part 4 of the Strategy, there is enough space to accommodate a street tree, and there is no street tree present. No: if the above statement is not the case
24. Replacement species	<ul style="list-style-type: none"> Replacement species should be determined by the Tree Manager, after having regard for the site conditions
25. Root barrier	<ul style="list-style-type: none"> Whether a root barrier had been installed or not, at the time of carrying out the survey
26. Recommendation	<ul style="list-style-type: none"> 'Prune' if the tree has a dead or dangerous limb (including low branches), is in conflict with a building or other structure, or requires sight line clearance 'Remove' if the tree has been classified as 'Over Mature' or 'Dead' or if the tree has been classified as 'Average', but the species is not suitable for its location and other risk management strategies would not be successful 'Replace' if a tree has been removed and the site has been assessed to be suitable for a street tree 'Surface repair' if a trip hazard is evident 'Install root control barrier', if the preliminary works outlined in part 3.3.3 of the Strategy have concluded that this action is recommended 'Maintain root control barrier' if tree roots have grown over the top of the barrier 'Nil' if no action is required

Removed

4.0 STRATEGIES FOR MANAGEMENT

Table 1 Field	Definition
27. Planting Date 28. Removal Date	<ul style="list-style-type: none"> Record date of works
29. Removal Reason	<ul style="list-style-type: none"> Record reason for tree removal
30. Stump Removal Date 31. Prune Date 32. Inspection Date	<ul style="list-style-type: none"> Record date of works or inspection
33. Customer Service Request No.	<ul style="list-style-type: none"> Record the Customer Service Request No.
34. Comments	<ul style="list-style-type: none"> Memo field to record notes on works carried out on tree, issues associated with tree, or other matters pertaining to tree.

4.2 STREET TREE SELECTION, MAINTENANCE AND MANAGEMENT

A number of issues were identified with respect to tree selection, maintenance and management through the process of review of Council records, consultation with Council officers and community comment.

The physical space above and below ground that is available for street trees to grow in is highly constrained. Above ground, tree development is limited by electricity wires, pedestrian pavements, kerbs, and roads. Below ground, the development of tree roots is constrained by a variety of services (gas, sewer, water, telephone, electricity), footings and property boundaries. Without proper planning and preventative measures, conflict between street trees and other urban elements may arise. The Strategy aims to provide practical approaches that seek to avoid or mitigate the problems caused by street trees in Burwood, both in the short and long term.

Site assessment and the review of Council records were used to discover the range of problems caused by street trees in the local government area. Community comment gathered during the preparation of the Strategy helped to prioritise the issues.

With regard to tree selection, maintenance and management, the key issues identified included:

- Species selection, to reduce damage caused by trees and tree roots to underground services, pavements, kerbs and third party property, and to take account of horticultural characteristics (such as vigour, fruit production, leaf drop, mature tree dimensions and growth habits of above and below ground parts)
- Power line clearance pruning, and the impact it has on the appearance of street trees
- Risk management, such as corrective pruning and root control
- Street tree removal and replacement, following removal
- Vandalism of young trees
- Strategies recommended to address each of these are outlined below.

4.0 STRATEGIES FOR MANAGEMENT

Examples removed

Illustration of Typical Street Tree Issues in Burwood Council



- This *Jacaranda mimosifolia* will ultimately cause problems with pavement uplift.
 - Roots can be seen on the surface and may become trip hazards.
 - This species is tall-growing and spreading and should not be pruned.
 - It requires a wider nature strip than this.
 - Flowers, when wet, are a slip hazard.
- The *Eucalyptus scoparia* in foreground has been pruned effectively, although it requires constant maintenance and may develop structural faults in the long term.
- These *Casuarina cunninghamiana* have been planted in groves.
 - Their mature size of 30m has not yet been reached and they will cause problems due to their large root systems.

4.0 STRATEGIES FOR MANAGEMENT

4.3 SPECIES SELECTION

Street trees have the potential to soften the impact of development and instil a sense of unity in the otherwise complex array of built elements that make up our streetscapes. Community comment on street tree selection indicated that a variety of tree heights and species were desired across the local government area, so that street trees can provide shade and visual diversity. Consistency of one or two species within individual streets was preferred. However, the community also identified that appropriate street tree species selection was a key management issue.

Appropriate species selection is undoubtedly the most cost effective way of reducing the potential for damage caused by trees in the built environment (Winstone no date). Decisions about future tree species selection must be informed by the lessons learnt from past tree plantings. Many of the existing problems caused by street trees in the local government area are the result of inappropriate species selection, particularly the conflict between mature tree dimensions and the built elements within their immediate environment. Street tree selection needs to be carried out in the context of location, horticultural characteristics and the availability of risk minimisation strategies.

Burwood Council has prepared a list of 'Recommendations for Plantings by Area Number and Street' (Section 3 of 'Street Trees In Burwood, September 2001'). Following the compilation of the Street Tree Database, it is recommended that the species in Council's current recommendations list be revisited to ensure that due regard is given to site conditions, horticultural suitability and existing streetscape character. Streetscape character will be particularly important in heritage conservation areas and other areas where street trees are established and have a positive aesthetic impact on their environment.

Site conditions criteria are to include:

- Width of planting opportunity (nature strip/tree planting square/road shoulder/median strip)
- Soil depth and type
- Relationship to compass points (shade/sun)
- Street/avenue/highway
- Slow traffic/fast traffic
- Underground services
- Overhead obstructions/constraints
- Location of crossings/traffic lights
- Associated building types (hotels, schools)
- Pedestrian and vehicle usage and need for visibility
- Access for street cleaning equipment and garbage collection vehicles
- Horticultural selection criteria are to include:
 - Habit of growth
 - Physical form
 - Visibility around trunk and canopy
 - Pollution tolerance
 - Drought tolerance
 - Growth rate/longevity
 - Weed potential for urban bushland and private property

4.0 STRATEGIES FOR MANAGEMENT

- Maintenance/creation of habitat and promotion of species diversity
- Tolerance of compacted soils (low aeration, poor drainage)
- The Burwood Council Street Tree Database at Table 1 has been designed to capture the essential aspects of the above criteria, so that decisions about street tree selection can be made by matching the site conditions with a suitable species on the Recommended Street Tree Schedule (at Table 2).
- The decision making process pertaining to street tree selection is indicated by Flow Charts 1 and 2. For any given combination of site conditions, there are a number of additional factors that Council's Tree Managers will take into consideration when selecting tree species. These factors include:
 - Identifying the species that have performed well in similar sites elsewhere in the street or local government area
 - Community feedback
 - Existing character of the street

Table 2: Street Tree Species Selection Schedule

NOTES

1. All trees located in high or moderate risk zones are to be planted with root control barriers.
2. Tree planting squares in footpaths < 1000mm x 1000mm are not suitable for street trees.
3. Nature strips <1000mm (between the kerb and foot path) are not suitable for street trees.
4. Trees are not to be located directly under electricity service lines to houses.
5. # Trees in this column are suitable for planting on the side of a street where there are no overhead powerlines.
6. It is assumed that prior to using this table, the location of underground services has been identified and a services diagram consulted in relation to street tree planting location.
7. *Aerial bundled cabling (ABC).
8. If an existing street tree planting is dominated by a tree species that is not listed below, Council may elect to continue to recommend the use of that species.
9. All of the tree species in the table are considered to be hardy in all soil types that occur in Burwood LGA. It is assumed that existing topsoils will be a minimum depth of 300mm, over clay subsoils to varying depths (minimum 600mm assumed). The species are tolerant of periods of drought stress, as well as poor drainage and low soil aeration levels. (Typical conditions for street trees).
10. Evergreen/deciduous parameters to be taken into account with regards to solar access to properties.
11. All trees are suitable for mass street planting. However, the species that make impressive 'avenues' have been separately nominated. Avenue trees may be species that are significantly more long-lived, or have visual characteristics that make them a more suitable choice for a heritage area.

Changed
to only
small
trees

Botanical Name	Common Name	Approx. Mature Height (M)	Evergreen Or Deciduous	Street / Avenue / Highway	Overhead Impacts				Tree Location		
					Use under power lines, with little or no pruning required	Able to be grown under power lines, with formative pruning	#No power-lines	Able to be grown under and pruned around ABC*	Concrete footpath with > 1000mm x 1000mm opening for tree	Minimum nature strip Grass or mulched planting strip (mm)	Road shoulder Suitable for planting in shoulder of road
Acacia binervia	Coastal Myall	10	Evergreen	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Acer buergeranum	Trident Maple	9	Deciduous	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Agonis flexuosa	Western Australian Peppermint Tree	9	Evergreen	Street Avenue	No	No	Yes	Yes	No	1500 - 3000	No
Albizia julibrissin	Silk Tree	6	Deciduous	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Backhousia citriodora	Sweet Verbena Tree	6	Evergreen	Street Avenue	No	Yes	Yes	Yes	Yes	<1500	No
Banksia integrifolia	Coastal Banksia	12	Evergreen	Street	No	Yes	Yes	Yes	Yes	1500 - 3000	No
Bauhinia variegata	Orchid Tree	6	Evergreen	Street	No	Yes	Yes	Yes	No	<1500	No
Buckinghamia celsissima	Ivory Curl Tree	6	Evergreen	Street	No	Yes	Yes	Yes	No	<1500	No
Butia capitata	Jelly Palm	8	Evergreen	Street Avenue	No	No	Yes	No	No	1500 - 3000	No
Callistemon citrinus	Lemon-scented Bottlebrush	4	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	1500 - 3000	No
Callistemon salignus	White Bottle Brush	9	Evergreen	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Callistemon viminalis 'Hannah Ray'	Weeping Bottle Brush	6	Evergreen	Street	Yes	Yes	Yes	Yes	No	<1500	No
Callistemon viminalis 'Kings Park'	Bottle Brush	6	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Chamaecyparis obtusa 'Crippsii'	Golden Hinoki Cypress	8	Evergreen	Street	No	No	Yes	No	No	1500 - 3000	No
Elaeocarpus reticulatus	Blueberry Ash	10	Evergreen	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Eucalyptus maculata	Spotted Gum	20	Evergreen	Avenue Highway	No	No	Yes	No	No	>3000	Yes
Eucalyptus microcorys	Tallow Wood	20	Evergreen	Avenue	No	No	Yes	No	No	>3000	Yes

Botanical Name	Common Name	Approx. Mature Height (M)	Evergreen Or Deciduous	Street / Avenue / Highway	Overhead Impacts				Tree Location		
					Use under power lines, with little or no pruning required	Able to be grown under power lines, with formative pruning	#No power-lines	Able to be grown under and pruned around ABC*	Concrete footpath with > 1000mm x 1000mm opening for tree	Minimum nature strip Grass or mulched planting strip (mm)	Road shoulder Suitable for planting in shoulder of road
Eucalyptus sideroxylon	Mugga Iron Bark	15	Evergreen	Street Avenue	No	No	Yes	No	No	>3000	Yes
Fraxinus excelsior 'Aurea'	Golden European Ash	9	Deciduous	Street Avenue	No	No	Yes	Yes	No	1500 - 3000	Yes
Fraxinus 'Griffithii'	Evergreen Ash	6	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Gordonia axillaris	Fried Egg Plant	5	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Grevillea 'Honey Gem'	Honey Gem	4	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Grevillea 'Moonlight'	Moonlight	4	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Jacaranda mimosifolia	Jacaranda	12	Deciduous	Street	No	No	Yes	No	No	>3000	Yes
Jacksonia scoparia	Jackson's Bush	4	Evergreen	Street	Yes	Yes	Yes	Yes	No	<1500	No
Koelreuteria paniculata	Golden Rain Tree	9	Deciduous	Street	No	Yes	Yes	Yes	No	1500 - 3000	Yes
Lagerstroemia indica	Crepe Myrtle	6	Deciduous	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Leptospermum petersonii	Lemon-Scented Tea Tree	6	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Livistona australis	Cabbage Tree Palm	10	Evergreen	Street Avenue	No	No	Yes	No	No	<1500	No
Lophostemon confertus	Brush Box	>20	Evergreen	Street Avenue Highway	No	No	Yes	Yes	No	>3000	Yes
Magnolia grandiflora 'Little Gem'	Dwarf Bull Bay Magnolia	6	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Magnolia x soulangiana	Saucer Magnolia	6	Deciduous	Street	Yes	Yes	Yes	Yes	No	1500 - 3000	No
Melaleuca 'Revolution Gold'	'Revolution Gold' Melaleuca	6	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Melaleuca armillaris	Bracelet Honey Myrtle	4	Evergreen	Street	Yes	Yes	Yes	Yes	No	1500 - 3000	No

Botanical Name	Common Name	Approx. Mature Height (M)	Evergreen Or Deciduous	Street / Avenue / Highway	Overhead Impacts				Tree Location		
					Use under power lines, with little or no pruning required	Able to be grown under power lines, with formative pruning	#No power-lines	Able to be grown under and pruned around ABC*	Concrete footpath with > 1000mm x 1000mm opening for tree	Minimum nature strip Grass or mulched planting strip (mm)	Road shoulder Suitable for planting in shoulder of road
Melaleuca bracteata 'Revolution Green'	'Revolution Green' Melaleuca	6	Evergreen	Street	Yes	Yes	Yes	Yes	Yes	<1500	No
Photina x fraseri	Chinese Hawthorn	6	Evergreen	Street	Yes	Yes	Yes	Yes	No	<1500	No
Pistacia chinensis	Chinese Pistachio	9	Deciduous	Street Avenue	No	Yes	Yes	Yes	Yes	<1500	No
Pittosporum rhombifolium	Queensland Pittosporum	9	Evergreen	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Platanus digitalis	Plane Tree	20	Deciduous	Avenue Highway	No	No	Yes	Yes	No	>3000	Yes
Platanus x hybrida	London Plane	>20	Deciduous	Avenue Highway	No	No	Yes	Yes	No	>3000	Yes
Pyrus calleryana	Callery Pear	12	Deciduous	Street Avenue	No	No	Yes	Yes	Yes	>3000	No
Quercus palustris	Pin Oak	15	Deciduous	Street Avenue Highway	No	No	Yes	Yes	No	>3000	No
Robinia pseudoacacia 'Frisia'	Golden Honey Locust	10	Deciduous	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Stenocarpus sinuatus	Queensland Firewheel Tree	9	Evergreen	Street	No	Yes	Yes	Yes	No	1500 - 3000	No
Tibouchina 'Alstonville'	Lasiandra	6	Evergreen	Street	No	Yes	Yes	Yes	Yes	<1500	No
Tristaniopsis laurina	Water Gum	9	Evergreen	Street	No	Yes	Yes	Yes	Yes	1500 - 3000	No
Xanthostemon chrysanthus	Golden Penda	9	Evergreen	Street	No	Yes	Yes	Yes	No	1500 - 3000	No

4.0 STRATEGIES FOR MANAGEMENT

ILLUSTRATION OF TABLE 2 RECOMMENDATIONS

- Under powerlines, small trees or medium trees that can be formatively pruned



Callistemon viminalis (to 6m)



Melaleuca bracteata (to 6m)

- Larger species on the side of the street that does not have powerlines



Eucalyptus maculata (to 20m)

Examples removed



4.0 STRATEGIES FOR MANAGEMENT

Examples removed



Callistemon viminalis (to 6m)

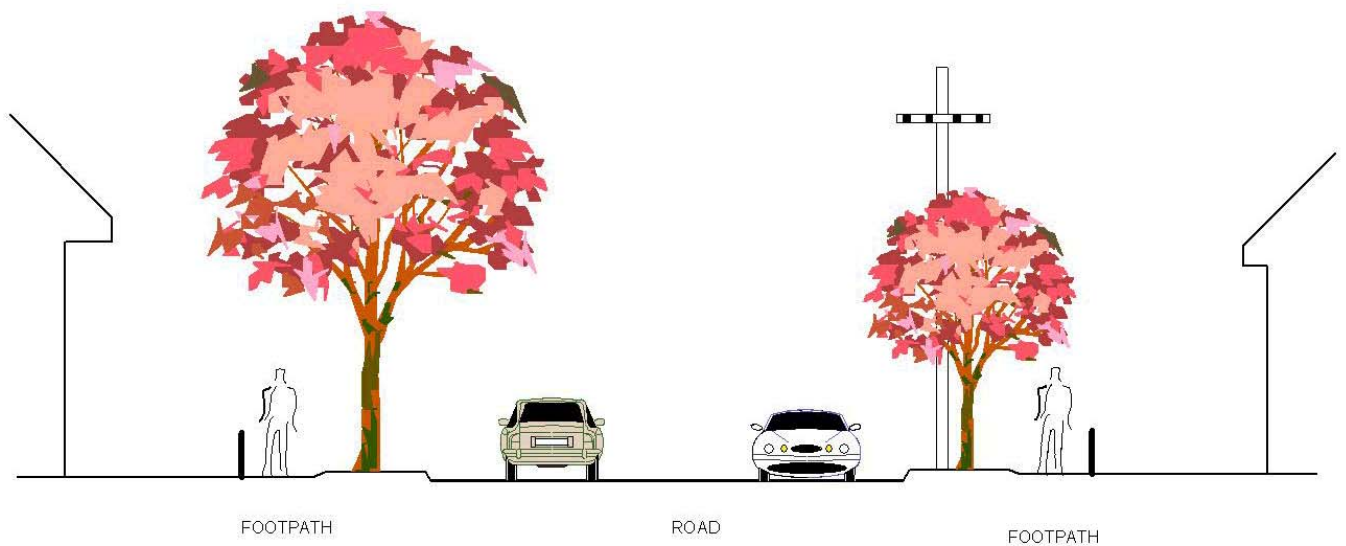


Koelreuteria (to 10m)

4.0 STRATEGIES FOR MANAGEMENT

INDICATIVE STREET SECTIONS

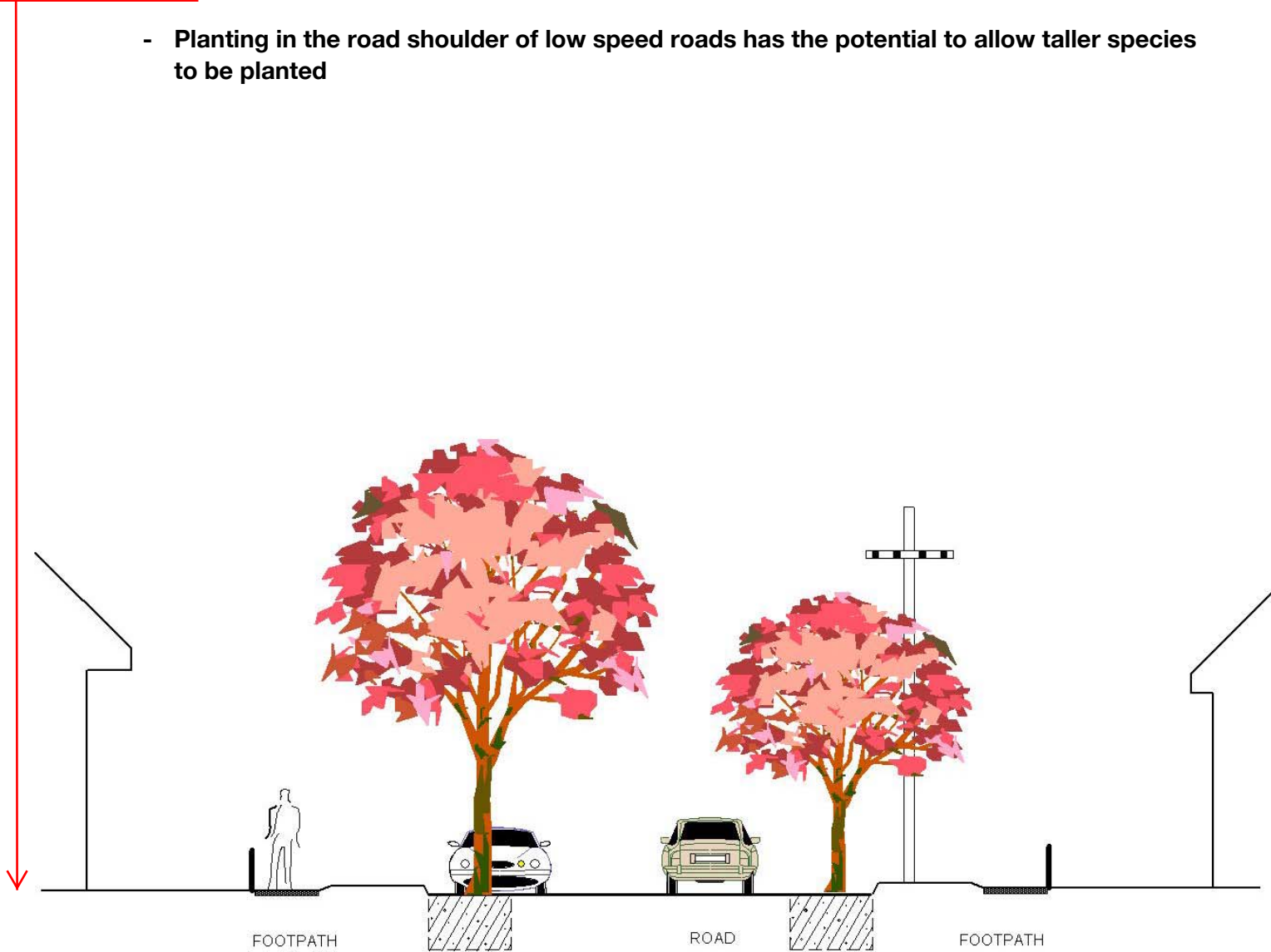
- A tall species and a smaller species can be planted in the same street, if site conditions permit



4.0 STRATEGIES FOR MANAGEMENT

Diagram removed

- Planting in the road shoulder of low speed roads has the potential to allow taller species to be planted



4.0 STRATEGIES FOR MANAGEMENT

4.4 POWER LINE CLEARANCE PRUNING

The conflict between street trees and overhead power lines is perhaps one of the greatest limitations on street tree planting and development. In NSW, energy suppliers are responsible for the pruning of street trees around power lines. Qualified personnel are contracted by the energy suppliers to carry out the pruning, because the pruning or removal of trees near power lines can be extremely dangerous. Pruning works within three metres of power lines should only ever be carried out by suitably qualified personnel and in accordance with the WorkCover Code of Practice for the Amenity Tree Industry (Energy Australia 2002).

The pruning is performed in accordance with the network standards for vegetation safety clearances. In Burwood's residential streets, the vegetation safety clearances are (ibid.):

- 1.5m from low voltage overhead mains
- 0.5m from low voltage overhead aerial bundled cables (ABC)

The safety clearances have been determined to maximise the reliability of electricity supplies and to help prevent injury to people and damage to property (ibid.). However, clearance pruning can result in street trees having an unnatural appearance, particularly if the pruning results in a pronounced "V" shaped canopy.

Strategies to reduce or eliminate the conflict between street trees and power lines are:

- tree height selection
- directional pruning (species suitable for formative pruning)
- 'pseudo street trees'
- engineering solutions

Tree Height Selection

An effective way of minimising the conflict between tree canopies and overhead obstructions, such as power lines, is to select only those species that do not grow taller than the height of the power lines, which are commonly between 6.0 to 8.0m tall. This strategy is advocated by Energy Australia's 'Tree Safety Management Plan' (2002b). While this strategy addresses the functional aspects of tree management, it comes at the expense of the benefits of tree height and scale. Limiting tree size to small trees across the municipality would not be an aesthetically satisfactory solution, but it is a useful strategy for narrow streets. Tree height selection should be used as one of a range of strategies within the local government area to achieve visual diversity.

A parallel approach is to select species that have been modified through propagation or grafting onto dwarfing rootstocks, to allow otherwise prohibitively large species to be planted in the streetscape (Hitchmough 1994, p. 282). In practice, the development of dwarfing rootstocks has been restricted to the orchard industry (Andreasens Nursery 2002, pers. comm. 21 October). The nursery industry has produced several varieties of trees that are propagated onto a 'standard', which results in a round headed small tree suitable for use in small spaces (Fleming's Nurseries 2002). As above, this strategy would be suitable for very restricted spaces, and could complement a range of other strategies within the local government area.

4.0 STRATEGIES FOR MANAGEMENT

Directional Pruning

Some medium sized trees (7.0m – 15.0m) can be trained around overhead power lines to achieve aesthetically acceptable results. This strategy requires correct species selection and formative pruning when the tree is young. The aesthetic result of directional pruning is most successful when the safety clearances between the lines and the tree are minimal (see Engineering Solutions below). Table 2 provides a list of species that can be grown near powerlines, with pruning.

'Pseudo Street Trees'

A 'pseudo street tree' is a tree that grows next to but not in the road reserve or nature strip, but that forms part of the streetscape (Draper 1997, p. 6). Such trees may be in the front garden of a private residence, in a park or school adjacent to the street or along the perimeter boundary of commercial premises. The benefit of pseudo street trees is that they typically have more space to develop, and are less likely to conflict with overhead power lines and trafficable areas. As a result, some of the species of trees that are not suitable for use in the road reserve may be planted, thereby enhancing the impact of the trees in the street. For a planting of pseudo street trees to be successful, information to the community should be made available about suitable planting locations, species selection and maintenance (op. cit, p. 10).

Some streets may not even offer planting opportunities for pseudo street trees. The planting of soft wooded perennials may apply under these circumstances. This strategy would be limited to Council resources and priorities for planting, and be subject to a maintenance agreement between Council and the local community.

Engineering Solutions

The impact on the appearance of street trees from electricity wire clearance pruning is not satisfactory in the eyes of the community. To address this impact, longer-term solutions are required. The engineering solutions that are available include:

- replacement of overhead wires with Aerial Bundled Cable
- replacement of overhead wires with underground cables
- relocating below ground services to provide more space for street tree planting in road shoulders or nature strips, including the use of structural soils

Energy Australia, in partnership with local councils, introduced a subsidy scheme for Aerial Bundled Cable (ABC) in 1991 (Energy Australia 2002, pers. comm., 5 July). ABC allows reduced safety clearances compared with overhead wires, which benefits the appearance of street trees without compromising safety. ABC is an economically feasible short-term solution, which allows many of the visual and functional problems posed by overhead wires to be largely eliminated without the impacts caused by the cutting of roots during the installation of underground cables adjacent to existing street trees. Several Councils in Sydney have installed ABC in select streets with very positive results. Burwood Council also plans to install ABC in some locations, following the adoption of this Strategy.

4.0 STRATEGIES FOR MANAGEMENT

Underground electricity is installed in all new urban residential developments. Most new high voltage wires are also placed underground, and in some commercial areas, overhead wires are placed underground in conjunction with building developments (Energy Australia 2002). The Local Government Association unanimously supported the relocation of above ground wires to below ground within the Sydney Basin at its annual conference in 2001, and the State Government has also voiced its support for the proposal (Wainwright 2001).

Removed The relocation of above ground electricity wires to below ground has been estimated at \$56,000 to \$80,000 per span by Energy Australia (or \$7,000 to \$10,000 per customer), compared with approximately \$4,000 per span for ABC (Energy Australia 2002). The high cost of replacing above ground wires with below ground cables has meant that very few councils in Australia have carried out this work.

Removed In Victoria, councils carry out their own safety clearance works around power lines. This has meant that Victorian councils have control over the management of their street trees, within the parameters of the agreed codes and management plans with the Office of the Chief Electrical Inspector. Above ground wires have been relocated below ground in parts of Melbourne City Council, although funding for this work is restricted those areas which are high profile by virtue of their heritage and/or tourist values (Shears, I 2002, pers. comm., 17 October). The benefit to the health and vitality of the streetscape from the relocation of above ground power lines is enormous, but the attainment of this solution will require sustained funding support.

A final engineering solution is the design of roads and footpaths to provide more space for street tree planting in road shoulders or nature strips. The use of common trenches for below ground services, and achieving compaction rates of 95% in service easements will reduce the incidence of damage to services. The installation of structural soils should also be given consideration, at the time of carrying out major road works.

Pruning

Pruning is an effective way of eliminating a number of the risks mentioned above that are a result of potentially hazardous branches, including:

- low branches near footpaths and roads
- dead branches or other limbs that are otherwise poorly attached (structural defects)
- storm damage
- branches within the safety clearance zones of electricity wires
- canopy thinning prior to root pruning works
- sight line clearances for signs, traffic lights and street lights

Pruning should be prioritised such that the trees with the highest hazards are attended to first, followed by those with the second highest hazards and so on across the local government area.

4.0 STRATEGIES FOR MANAGEMENT

4.5 ROOT CONTROL

One of the most important measures that will prevent or at least mitigate problems caused by roots is careful street tree selection (see part 3.2.1 of the Strategy). Other strategies include (after Harris 1992, p. 504):

- root control barriers at the time of planting
- retrospective root pruning and installation of root control barriers
- underpinning of foundations
- water tight flexible service lines
- compaction rates of 95% around service easements
- planting street trees as far from below ground services as possible (see Figure 3)

Root Control Barriers at the Time of Planting

The installation of root control barriers at the time of planting is recommended to be carried out. As a minimum action, it is recommended that trees planted in high or moderate risk zones are to have root control barriers installed. Trees send out roots in all directions, to exploit as much of the soil as possible (Nicoll, 2002). Soil near the surface is usually best suited to root growth, and most tree roots are usually found here. Tree roots can not grow in compacted soil, such as heavy clay subsoils or heavily trafficked topsoils. Root control barriers aim to direct the growth of tree roots down and away from the surface of the soil, to avoid conflict with trafficable surfaces and other surface elements. For this strategy to be successful, the soil at depth must contain enough oxygen and moisture to sustain the roots.

There are many types of root control barriers available, and a distinction should be made between the root control barrier with vertical ribs and the root control barrier that is flat (Quambusch 1996, p. 19). Studies have shown that the flat root control barrier can create root girdling, and result in tree instability (ibid.).

Root control barriers are best installed at the time of planting (see Appendix 2). There are two principal applications of root barriers: surround and linear. The surround application is more economical where the distance between street trees is greater than 7 metres. The linear application of root barrier is more economical when planting groups of trees near each other, or when there is a maximum of two hardscapes that need protection (ibid.). The linear application is commonly used in root pruning applications, or new tree plantings in nature strips.

Root pruning of existing trees and the installation of root control barriers is an appropriate risk management strategy in some circumstances. A clear benefit of this strategy is that the tree, which might otherwise have been removed, can remain.

4.0 STRATEGIES FOR MANAGEMENT

Root investigation is required, prior to the installation of root control barriers adjacent to existing trees. A suitable method of investigation is root mapping, using a controlled water blasting technique. Root mapping can be used to determine the size and direction of root growth, as well as clarifying whether the tree's roots are the true cause of damage to the target. The root map is analysed by an experienced Arborist, who can determine whether root pruning would be an appropriate and effective course of action, and what distance the roots should be pruned from the trunk of the tree. Root pruning may impair the anchorage of the tree to some extent, and for this reason it will not be suitable in all circumstances. Prior to carrying out root pruning, the Arborist may recommend that canopy thinning be carried out to reduce wind resistance. Due to the cost involved with the installation of root control barriers to existing trees, this risk management strategy would need to be prioritised across the local government area. A description of the root mapping procedure is provided at part 6.4 of the Strategy.

Underpinning of Foundations

Tree roots can cause damage to the footings of buildings and fences by expanding and physically disrupting them, and as a consequence of removing water from the soil thereby causing these structures to settle (Fakes 1992, p. 27). The subsoils in the Burwood Council local government area are classified as 'moderately reactive' (Chapman et al. 1989, p.30). Older houses in Burwood typically have a clay foundation and brick footings. Clay foundations are the cause of major problems for houses, because they shrink and swell. 'Reactive' clays shrink and swell to such an extent that movement can damage houses (Walsh 1988).

To minimise the changes in moisture content of clays, the CSIRO (ibid.) recommends:

- adequate site drainage
- locating gardens and trees away from houses
- adequate but moderate garden watering
- repairing plumbing leaks
- In addition, the compaction of soils to 95% close to the house, will deter roots from growing there.
- Trees and shrubs require water for survival. In late summer or in times of drought, moderate watering of gardens is advisable, to prevent vegetation from drying out the soil and causing it to shrink. Removal of large trees creates the opposite problem. As soil moisture is gradually restored, clays swell and may lift shallow footings.

Many assumptions are made about damage caused by tree roots, without proper and conclusive investigation (see root mapping, mentioned in Root Control Barriers above). If after investigation tree roots are found to have caused damage to buildings and fences, there are strategies that can be used to remedy the situation.

Tree removal is a possible course of action, but it is not desirable for two reasons. Firstly, the community has clearly expressed that street trees are important and that more rather than less street trees are required in the local government area. Secondly, tree removal may reverse the water levels in the soil, causing them to expand and lift shallow footings. This is especially apparent if the tree is older than the building (Cameron 1985). Other strategies are to underpin the footing with an engineered concrete pad, or to protect the footing by installing a root control barrier or compacting the soil to 95% near the house.

4.0 STRATEGIES FOR MANAGEMENT

4.6 STREET TREE REMOVAL AND REPLACEMENT

Street tree removal is an inevitable and a necessary management strategy when a tree:

- has reached or is approaching over maturity
- poses a high risk of damage or personal injury to the community, which all other strategies have failed to eliminate or mitigate within the capacity of Council's resources

The commonly used urban trees of south-eastern Australia can have useful lifespans of between 50 to 150 years, although street trees are generally less long lived because of their harsh environments (Hitchmough 1994, p. 269). Few professionals, let alone the public, have ever witnessed the wholesale aging and death of large numbers of trees in the streets and parks around them, because most of us are still living with our first crop of planted trees (ibid.). Since we have not faced the end of our street trees' lifecycle before, the removal of over mature trees that are not yet dead often draws strong community opposition. Community opinion is also generally divided about the removal of trees that have been found to cause damage. As a result, decisions about street tree removal and replacement are some of the most difficult for the Tree Manager to make.

So why do street trees need to be removed from time to time? Street trees need to be removed when the cost to maintain them is increasing, while the aesthetic returns from their appearance is in decline. Why are the aesthetic returns from street trees important? The results of the street tree questionnaire demonstrated that street trees are valued for the positive aesthetic contribution that they make to the streetscape, amongst other things. In order to promote this value, the aesthetic appearance of street trees should be maximised.

Urban landscape managers have found that the aesthetic returns from trees increases as they age, until a plateau is reached. After this, the returns fall away as the tree naturally reaches over maturity (op. cit., p. 270). Inversely, the cost of maintaining trees is high while they establish, but then declines as they mature. When they reach over maturity, trees require increased arboricultural monitoring and corrective works to maintain them in a safe, attractive condition (ibid.). There is a cross over point after which time the aesthetic returns from a tree decrease but the management cost increases. Trees that have passed the cross over point should logically be replaced. Of course, some over mature trees can be retained in the landscape for periods of ten years or more with additional management. However, the opportunity to establish a new crop of trees during this time is lost. This tree replacement argument can also be applied to street trees that are not suited to their location, if the implementation of risk management strategies, such as root control barriers, would not be successful.

Tree replacement planning forms part of the process illustrated by Flow Chart 2. As illustrated in Flow Chart 2, tree replacement planning should address the entire project, including community consultation, and all aspects of the removal and replacement works. If tree replacement is proposed, it should occur as soon as is practical after the removal works, if not before if the site circumstances permit.

4.0 STRATEGIES FOR MANAGEMENT

Revised

Sometimes emergency tree removal is necessary. Unfortunately, the short lead in time under these circumstances means that advanced notification of works will not always be possible. In this case, information to residents should be distributed as soon as is practical after the works to explain what has happened, and what steps will be taken by Council to replace the tree.

When planning multiple tree replacement works, the community should be advised in advance, and given the opportunity to comment on the street tree replacement proposals. Providing residents with the opportunity to participate in the planting and basic maintenance of the new trees in their street can help to foster a sense of community contribution and interest in the successful establishment of the new trees. Phasing a tree removal and replacement program over time will help to reduce the trauma of mature tree loss, and promote a variety of age classes in the tree population. Examples of approaches to tree removal and replacement include:

- blocks (blocks should be a minimum of 20m long, to reduce competition between the new trees and the existing mature trees)
- one side of a street at a time
- at the time of replacing the electricity wires with ABC or below ground cables (see part 3.2.2 of the Strategy)

It should be noted that the removal of every second or third tree has been trialed in the past without success. It has been found that new trees struggle to compete for light, nutrients and water with the existing trees, which leads to trees that do not fulfil their aesthetic potential in maturity.

The Community Working Party convened to discuss street tree management indicated that better communication about tree removal and replacement between the community and Council was required (see part 1.6 of the Strategy). As indicated above, there are a number of ways that trees can be removed and replaced, and the right method for any given area will be the one that is supported by the community and is appropriate to the budget.

Vandalism

Vandalism of street trees in their early stages of growth increases the cost of tree replacement programs. Owing to the number of street trees in Council's care, prompt replacement of vandalised trees is not always possible. The selection of semi-mature stock and the use of hardwood tree stakes or tree guards at the time of planting are techniques used to avoid the vandalism of trees. No tree guards will stop vandalism from occurring entirely.

Although smaller stock has a lower replacement cost, the limbs and trunks of small trees are easy to damage by vandals. The recommended minimum size of replacement stock is 25 litres. Larger stock should be used in highly visible areas, such as around shopping centres or stations. The recommended planting technique for replacement street trees is illustrated at Appendix 2. Promoting community participation in the planting of street trees is likely to result in increased community interest in the young trees and may help kerb damage by vandals.

4.0 STRATEGIES FOR MANAGEMENT

4.7 STRATEGIES SUMMARISED

General

- Plant street trees according to the method illustrated at Appendix 2.
- Council should consider adopting a policy to retain those areas that afford the opportunity for large tree plantings in the municipality (such as wide nature strips or other open space areas).

Species Selection

- Revise Burwood Council's list of 'Recommendations for Plantings by Area Number and Street' following the completion of the Street Tree Database, and according to the 'Street Tree Species Selection Schedule' (Table 2) to ensure that Council's list has due regard for site conditions, tree selection criteria and existing streetscape character.

Power Line Clearance Pruning

- Prepare a long term plan that seeks to reduce the conflict between street trees and overhead power lines as well as achieving a range of tree heights across the municipality through a combination of the following strategies:
- Small trees (< 6.0m) in locations that permit street tree planting, but are highly constrained
- Install ABC in select streets and the use of medium (6.0m – 15.0m) to tall species (>15.0m) that can be formatively pruned
- Identify tree planting opportunities on public and private land for 'pseudo street trees'
- Investigate funding sources for the relocation of above ground powerlines to below ground in established residential areas

Risk Management

- Prepare written risk management procedures, in accordance with this document and the inclusions of the statewide "Best Practice Manual for Trees and Tree Root Management" (Version 2, May 2003). These strategies will explain the positive steps that Council will take to avoid or mitigate the risks posed by street trees, and how works will be prioritised.
- The Safe Useful Life Expectancy (SULE rating) of all trees in the age class of 'mature' will be assessed.
- Carry out removal and replacement planning for all trees with a short SULE rating (SULE rating of 5 years or less). The planning process should address the entire project, including community consultation, and all aspects of the removal and replacement works. Special consideration should be made to preserve Significant Trees (see part 7.1.2 of the Strategy).
- Carry out removal and replacement planning for all trees that are not suitable for their location (according to Table 2), and for which risk minimisation strategies will not be successful. The planning process should address the entire project, including community consultation, and all aspects of the removal and replacement works. Special consideration should be made to preserve Significant Trees (see part 7.1.2 of the Strategy).

4.0 STRATEGIES FOR MANAGEMENT

- Review Council's current Standard Conditions of Development Consent, and add new conditions to address the following matters: -
- Developers shall install street trees according to Council's Planting and Root Control Barrier Specification (Appendix 2), prior to the release of the Occupation Certificate or Linen Plan (as appropriate)
- At the time of development or redevelopment of a site, Developers shall pressure test all internal service lines to the main, and provide Council with evidence to demonstrate that the service lines are satisfactory in this regard, prior to the release of the Occupation Certificate or Linen Plan (as appropriate)

5.0 STREET TREE PLANTING OPPORTUNITIES

5.1 INTRODUCTION

In recent years, the rate of tree removal within Burwood Council has exceeded the rate of tree replacement, which has created a backlog of trees to be replaced.

Results of the community consultation indicate that street tree replacement following removal is a priority matter, followed by the planting of more street trees generally. It should be clearly recognised by Council and the community that not all street trees should be replaced following their removal, because they may have been inappropriately sited in the first instance. However, every endeavour should be made to retain or increase the net number of street trees, rather than have the total number of trees slowly removed from the urban environment.

5.2 COMMENTARY

- A definitive reference list of street tree replacement species is required to be developed and used in combination with the database, as a tool for the selection of new street tree species.
- Although historically certain street tree species have been found by Council to be unsuitable because of roots and other problems, these species may have other horticultural and streetscape character merit. Some of these species should be reconsidered with the use of appropriate root barriers.
- Street tree planting opportunities exist in two main situations: firstly, following the removal of a dead or otherwise unsuitable street tree; and secondly, in locations that satisfy the street tree planting criteria. The guiding principals that follow can be used to determine whether additional street tree planting opportunities exist in a given street.

Guiding Principles for Street Tree Planting

Retain established patterns of street tree planting, for example:

- single fronted dwellings with one street tree in front of each dwelling, or
- single fronted dwellings with small street trees in front of every second dwelling, or
- double fronted dwellings with one street tree in front of each dwelling, or two street trees in front of each dwelling

Do not recommend a 'Planting Opportunity' if the site conditions, such as a building or other element, would overly interfere with the natural or safe development of the street tree.

Existing patterns of street tree planting are determined by observation. Some of the existing patterns may be clearly indicated by Council's MapInfo system, whereas other streets may require site inspections to clarify the location of the existing trees.

5.0 STREET TREE PLANTING OPPORTUNITIES

5.3 STRATEGIES

- Identify existing and new street tree planting opportunities.
- Prepare a prioritised Street Tree Planting Program, with achievable annual targets. Priority should be given to the replacement of trees that have been removed in the past, over new street tree planting opportunities. Nurseries specialising in semi-mature stock may be contracted to provide and deliver to Council the trees for each year's planting program.
- Include the following street tree planting provisions (as applicable) at the time of planning major engineering works, so that the available space for street trees in the road shoulder or nature strip is maximised:
 - Common services trenches
 - Design of service easements or conduits so as to exclude tree roots
 - Installation of structural soils and permeable pavements
 - Siting new below ground services a minimum of 4m away from street trees
 - Relocation of above ground services to below ground

6.0 ARBORICULTURAL MAINTENANCE PROGRAMS

6.1 INTRODUCTION

Street trees, unlike trees in parks and other open space areas, are typically in the vicinity of pedestrian pathways, streets and private property. As a result, street trees should be inspected at regular intervals by an arborist. The extent of the inspection will vary, given available resources, but some form of inspection should occur annually. The inspection procedure should be standardised, systematic and established in writing (Kane et al. 2001).

Each part of the tree must be inspected for risks, including the crown, main stem, branches and roots, and the inspection method should be consistent across the population of street trees in the local government area. A systematic priority rating system should be used to develop a risk management strategy for Council's street trees. Accordingly, the trees that pose the greatest risk would be attended to prior to the trees that have lower risks.

Appropriately qualified tree managers within Council could carry out the inspections if resource levels would permit this, or Council may elect to contract the work to consulting arborists. The results of the arboricultural inspections should be collected in Council's Street Tree Database, and used to generate priority work programs with the objective of risk minimisation.

Updated

The Local Government Tree Resources Association encourages the use of a Hazard Rating Process based on the Safe Useful Life Expectancy (SULE) of trees, developed by the International Society of Arboriculture (Statewide no date, p. 25). SULE is a system designed to classify trees into a number of categories so that information regarding tree retention can be concisely communicated in a non-technical manner. A tree's SULE rating is the life expectancy of the tree in years. The rating is determined by firstly considering a tree's age, health, condition, safety and location (to give safe life expectancy), then by economics (ie. cost of retaining trees at an excessive management cost is generally not acceptable), effects on better trees, and sustained amenity.

Removed

It is recommended that Council assess the SULE of all trees in the 'mature' age category. Younger trees will have comparatively longer SULE ratings, and over mature trees will have a SULE rating of 5 years or less. Trees with a short SULE (that is, less than 5 years) should be the subject of tree removal and replacement planning.

6.2 COMMENTARY

Burwood Council has prepared three key horticultural guidelines for street tree maintenance:

- Burwood Municipal Council Street Tree Manual (amended since 1992)
- Street Trees Management Plan (1999)
- Street Trees in Burwood (2001)

The horticultural advice and recommendations provided by Burwood Council's internal guidelines is consistent with accepted horticultural practice, but additional information is required to ensure that the documents are comprehensive. Maintenance procedures should be established in writing, with hazard reduction procedures prepared first (such as crown lifting, and dead wooding).

6.0 ARBORICULTURAL MAINTENANCE PROGRAMS

The nature of the maintenance carried out on a young tree differs to that required for established trees.

Maintenance of Young Trees

It is best to plant street trees in the cooler months, particularly at the end of summer. However, providing watering is carried out, street trees may be successfully established at any time during the year.

Following the planting of young street trees, weed control, watering and formative pruning is required. If a root control barrier is installed, the top edge of the barrier should be scraped annually using a spade or other implement, to sever any roots that have grown over the top of the barrier.

Watering should be regular but relatively infrequent, depending on the weather conditions (Fakes no date). Deep watering is made easier by the installation of slotted drainage pipe to the side of the rootball at the time of planting. Residents may be encouraged to assist with the watering of newly planted street trees, particularly if planted in the warmer months of the year. Adequate drainage from the planting hole should be provided if possible, to avoid the encouragement of organisms that cause root rot, such as Phytophthora. However, drainage in planting holes is typically very poor, and it important to select species that can tolerate these conditions (the species in Table 2 have been selected on this basis).

Pruning may be necessary to gradually lift the canopy above the height of pedestrians and traffic, or to train branches around overhead wires. Pruning or training of young trees must be gradual, otherwise other problems will occur (ibid.).

Regular inspection of street trees for vandalism, whilst in the course of other duties, is a final task to be carried out during the establishment of young street trees.

Maintenance of Established Trees

Pruning is the main maintenance task to be carried out on established trees. The location of the street tree will determine the extent and nature of pruning required, particularly if it is below or in the vicinity of powerlines.

Root pruning to avoid or rectify damage is another aspect of maintaining mature trees. Decisions about root pruning should only be made by a qualified and experienced arborist, to avoid tree destabilisation or an unacceptable decline in the tree's health and vigour. Further information about root inspection is provided in Part 6.4.1 of the Strategy.

6.3 STRATEGIES

Carry out an annual inspection of all of the street trees in the local government area, to identify hazards and maintenance works. The inspection procedure should be standardised, systematic and established in writing.

Collect the results of the arboricultural inspection in Council's Street Tree Database, and generate a rolling program of strategic maintenance works, which would include recommendations on tree planting, replacement and pruning.

6.0 ARBORICULTURAL MAINTENANCE PROGRAMS

Revise Burwood Council's internal street tree management guidelines, so that they are consistent with AS 4373 – 1996 Pruning of Amenity Trees and Occupational Health and Safety requirements, and address all aspects of maintenance:

- Pruning
- Planting
- Watering
- Removal
- Fertilisation
- Weed prevention

Removed

Identify staff training requirements and implement a program of staff development. This program should encourage the membership of professional arboricultural organisations, so that Council may remain current with developments in tree care and maintenance.