



104 DERBY STREET, PENRITH

ARBORICULTURAL IMPACT ASSESSMENT

PREPARED FOR:

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Executive Summary

This report was commissioned by Sol Qurashi to accompany their Residential Development Application within the Penrith City Council area at 104 Derby Street, Penrith. The aim of this report is to provide an assessment of the impacts of the proposed development on fourteen trees.

This report collates and presents information collected by Andrew Morrison on the 07/05/13. The data collected is located at **7. Tree Survey Table** (page 12) also see **8. Tree Survey Table Notes** (page 14) for notes relating to tree survey table.

Generally the site's vegetation was observed to have a mixed native and exotic tree canopy, with a mixed native and exotic shrub midstorey and an exotic turf groundcover layer. The existing surveyed trees are shown at **9. Tree Location Plan** (page 18).

The proposed development will involve the extension and alteration of a single detached residence with associated driveways, carparking, gardens, turf, paths, paving and retaining walls. This will involve the demolition of existing structures and regrading site levels through excavation, cutting and filling of soil on site. The extent of site works is also illustrated at **9. Tree Location Plan** (page 18).

- 3 trees will be unaffected by the development (Tree No.'s, 3, 9 & 11).
- 3 trees are located adjacent to the proposed development and the proposed construction will provide a minor encroachment (less than 10% of the TPZ area) within the TPZ (Tree No.'s 4, 8 & 14).
- 2 trees are located adjacent to the proposed development and the proposed construction will provide a major encroachment (greater than 10% of the TPZ area) within the TPZ (Tree No.'s 10 & 12).
- 6 trees are located within the car park or driveway footprint (Tree No.'s 1, 2, 5, 6, 7 & 13).

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the proposed construction on those trees proposed to be retained. This report specifically recommends:

- The removal of Tree No.'s 1, 2, 5, 6, 7 & 13 if the development is approved as there is an unavoidable major encroachment into the tree protection zone.
- The removal of Tree No. 4 as it is causing damage to nearby existing driveway and is likely to continue to cause damage to proposed foundations. This tree species is unsuitable for the location it has been planted into.
- The immediate removal of Tree No. 9 as it is a known weedy species.
- The immediate removal of Tree No. 8 is in poor health and condition and is unlikely to improve.
- The replacement planting of 2 locally native or deciduous canopy trees shall be installed in 25L pot size to offset the loss of trees on site.
- The retention of Tree No.'s 3 & 11. The construction will not impact this tree.
- The retention of Tree No. 14. The construction will provide a minor encroachment into the tree protection zone.

- The retention of Tree No.'s 10 & 12. The construction will provide a major but tolerable encroachment into the tree protection zone.
- Hand excavation is required for all works located within the TPZ of all retained trees. These works shall be supervised by the project arborist.
- An AQF Project Arborist shall be engaged to certify the tree protection works in accordance with the hold points provided at **6.3. Hold Points** (page 11).
- For additional tree protection notes see **10. General Tree Protection Notes** (page 20).

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1. Introduction

This report was commissioned by Sol Qurashi to accompany their Residential Development Application within the Penrith City Council area at 104 Derby Street, Penrith. The aim of this report is to provide an assessment of the impacts of the proposed development on fourteen trees.

This report collates and presents information collected by Andrew Morrison on the 07/05/13. The data collected is located at **7. Tree Survey Table** (page 12) also see **8. Tree Survey Table Notes** (page 14) for notes relating to tree survey table.

2. Methodology

2.1. Limitations

Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible. However Adrian Swain - Consulting Arborist can neither guarantee nor be responsible for the accuracy of information provided by others. Unless stated otherwise:

- Information contained in this report covers only the tree/s examined and reflects the health and structure of the tree at the time of inspection. The documented, observations, results, recommendations and conclusions given may vary after the site visit due to environmental conditions. Liability will not be accepted for damage to person or property as a result of natural processes, unforeseeable actions or occurrences.
- Observations recorded for trees located within adjacent properties have been made without entering that property. As a result measurements for these trees are estimated. Similarly these trees were not subject to a complete visual inspection and defects or abnormalities may be present but not recorded.
- The inspection was limited to visual examination from the base of the subject tree without dissection, excavation, probing or coring (unless specifically noted otherwise).
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree may not arise in the future.

2.2. Site Inspection

A visual inspection of the tree/s was performed from ground level, data collected includes:

- Genus, Species, Common Name;
- Height, Width, DBH (Diameter at Breast Height), DRB (Diameter above Root Buttress);
- Age and Health;
- Amenity and Ecological Value;
- Crown Form and Condition;
- Visible Defects or Evidence of Wounding.

2.3. Measurement

- Tree locations are supplied on the client supplied survey plan or triangulated using a measuring tape.
- Diameter at breast height (DBH) and Diameter above Root Buttress (DRB) are measured using a diameter tape.
- Height is measured using a clinometer.
- Canopy width is estimated using a measured stride paced out on site.
- Structural Root Zone (SRZ) and Tree Protection Zone (TPZ) radii are measured (in accordance with AS 4970-2009) from the centre of the trunk.
- Development impact/setback is measured from the centre of the trunk to the face of the structure in Auto CAD using the perpendicular distance function. Generally this is measured without detailed foundation design.

2.4. Recording Data

Data collected is collated in the tree survey table located at **7. Tree Survey Table** (page 12). The tree survey table contains abbreviations for terms describing the trees characteristics; explanatory notes pertaining to these are located at **8. Tree Survey Table Notes** (page 14).

The physical data for tree locations, crown width and DRB is schematically described in **9. Tree Location Plan** (page 18).

2.5. Reference Documents

The report was written in coordination with:

- Architectural Site Plan prepared by Building Design and Draft Revision 09/05/2013.
- Survey Plan prepared by John K. Wicks and Associates, dated 28/02/2013.
- Drainage Plan prepared by EZE Hydraulic Engineers Revision 05/05/2013.
- Landscape Plan prepared by Ecodesign Revision A 15/05/13.
- The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009)

2.6. Council Tree Preservation Order

The Penrith City Council tree preservation order defines a tree as being a perennial plant with self-supporting stem which:

- a. Has a girth of 30cm or more, measured at a distance of 40cm above the ground; and
- b. Has a height in excess of 3m.

2.7. Determining a tree's significance

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. When determining a tree's significance within the landscape context, the following questions are asked of each tree. Significance may be expressed in increments of High, Medium or Low. For a High rating the majority (≥ 4) of the answers will be yes; for a Medium rating half ($=3$) of the answers will be yes; and for the Low rating the minority of answers will be yes (≤ 2).

1. Is the tree a locally native remnant; an endangered species; a part of an endangered ecological community; or does the tree provide critical habitat for an endangered species?
2. Is the tree of botanical interest; listed as a heritage item under the Federal State or Local Regulations?
3. Is the tree visually prominent in the locality?
4. Is the tree well structured?
5. Is the tree in good health and does it display signs of good vigour?
6. Is the tree typically formed for the species?
7. Is the tree located in a position that will accommodate future growth?

3. Observations

3.1. Site Description

The site is a single block located at 104 Derby Street, Penrith. It currently contains a detached dwelling house with associated shed, carport, driveway, paths and turf areas. The site has a general northerly aspect.

3.2. Soil Landscape Map

The soils in this area are from the Luddenham Group ³. They are generally shallow <100mm dark podzolic soils or massive earthy clays on crests, moderately deep red podzolic soils on upper slopes, moderately deep yellow podzolic soils and prairie soils on lower slopes and drainage lines.

Generally the landscape is characterised by undulating to rolling hills on Wianamatta group shales often associated with Minchinbury sandstone. There is local relief of 50-80m and slopes gradients of 5-20% across narrow ridges, hillcrests and valleys ³.

These soils are limited by high soil erosion hazard, localised impermeable highly plastic subsoil, and moderate reactivity. The critical soil characteristics of this soil type for trees growing on this site include erosion hazard.

3.3. Native Vegetation Map

The Shale Plains Woodland ecological community ^{12, 13} is generally dominated by *Eucalyptus moluccana* and *E. tereticornis* with *E. crebra*, *E. eugenioides* and *Corymbia maculata* occurring less frequently. These species often form a separate small tree stratum, occasionally including other species such as *Exocarpus cupressiformis*, *Acacia parramattensis* subsp. *parramattensis* and *Acacia decurrens*.

A shrub stratum is usually present and dominated by *Bursaria spinosa*. Common ground stratum species include *Dichondra repens*, *Aristida vagans*, *Microlaena stipoides* var. *stipoides*, *Themeda australis*, *Brunoniella australis*, *Desmodium varians*, *Opercularia diphylla*, *Wahlenbergia gracilis* and *Dichelachne micrantha*. ^{12, 13}

Shale Plains Woodland is the most widely distributed community on the Cumberland Plain however it is listed as endangered under the Threatened Species Conservation

Act 1995 12, 13. There appears to be no species representative of this vegetation community located on this site.

3.4. Summary of site inspection data

Generally the site's vegetation was observed to have a mixed native and exotic tree canopy, with a mixed native and exotic shrub midstorey and an exotic turf groundcover layer. The existing surveyed trees are shown at **9. Tree Location Plan** (page 18).

3.5. Summary of Proposed Development

The proposed development will involve the extension and alteration of a single detached residence with associated driveways, carparking, gardens, turf, paths, paving and retaining walls. This will involve the demolition of existing structures and regrading site levels through excavation, cutting and filling of soil on site. The extent of site works is also illustrated at **9. Tree Location Plan** (page 18).

3.6. Summary of tree impacts

- 3 trees will be unaffected by the development (Tree No.'s, 3, 9 & 11).
- 3 trees are located adjacent to the proposed development and the proposed construction will provide a minor encroachment (less than 10% of the TPZ area) within the TPZ (Tree No.'s 4, 8 & 14).
- 2 trees are located adjacent to the proposed development and the proposed construction will provide a major encroachment (greater than 10% of the TPZ area) within the TPZ (Tree No.'s 10 & 12).
- 6 trees are located within the car park or driveway footprint (Tree No.'s 1, 2, 5, 6, 7 & 13).

4. Discussion

4.1. Trees with a Minor TPZ Encroachment

The proposed construction encroaches within the TPZ by 10% or less.

- Tree 4 is located 2.2m from proposed house footing providing a 6.9% encroachment within the TPZ. This tree is considered to be of medium significance however it is a species which presents challenges to nearby structures.

Cracking was found present in the nearby concrete driveway in the adjacent property (102 Derby Street). The crack radiated from the base of the tree indicating its roots were the likely cause of the cracking. This is expected to increase as the tree matures.

The root system of this species is widely recognized to be vigorous, with the potential to cause damage to nearby footings. It should be removed and a suitable replacement tree be planted in an appropriate location on the property.

- Tree 14 is located 3.75m from proposed OSD providing a 4.2% encroachment within the TPZ. It is located in the road reserve. This tree is considered to be of medium significance and suitable for retention.

If retained an area equivalent to the encroachment is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Similarly excavation works required to be undertaken within the TPZ should be performed by hand under the supervision of the project arborist.

- Tree 8 is located 1.07m from the proposed carpark providing a 6.4% encroachment within the TPZ. This tree is considered to be of low significance, in poor health and structural condition and should not be considered a constraint on the development.

4.2. Trees with a Major TPZ Encroachment

The proposed construction encroaches within the TPZ by more than 10%.

- Trees 10 and 12 are located 2.8m and 1.31m from the proposed car park, providing a 10.2% and 10.5% encroachment within the TPZ. These trees are considered to be of medium significance and suitable for retention.

The landscape plans indicate these trees for retention with no changed levels outside the car park footprint. The degree of impact is considered to be low to moderate and is sustainable by these trees with no modification to the architectural or landscape plans provided.

An area equivalent to the *encroachment* is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

4.3. Trees within the development footprint

- Tree 5 is located within the proposed carpark. This tree is considered to be of medium significance and suitable for retention. However this tree cannot be retained if the development is approved in its current form.
- Trees 1, 2, 6, 7 & 13 are located within the proposed driveway or carpark. These trees are considered to be of low significance and should not be considered a constraint on the development.

4.4. Other Tree Comments

- Trees 3 & 11 are located in a position that will allow their retention without impact from the proposed development.
- Tree 9 is a known weed species. This tree should be considered for immediate removal irrespective of the proposed development application.

5. Recommendations

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the proposed construction on those trees proposed to be retained. This report specifically recommends:

- The removal of Tree No.'s 1, 2, 5, 6, 7 & 13 if the development is approved as there is an unavoidable major encroachment into the tree protection zone.
- The removal of Tree No. 4 as it is causing damage to nearby existing driveway and is likely to continue to cause damage to proposed foundations. This tree species is unsuitable for the location it has been planted into.
- The immediate removal of Tree No. 9 as it is a known weedy species.
- The immediate removal of Tree No. 8 is in poor health and condition and is unlikely to improve.
- The replacement planting of 2 locally native or deciduous canopy trees shall be installed in 25L pot size to offset the loss of trees on site.
- The retention of Tree No.'s 3 & 11. The construction will not impact this tree.
- The retention of Tree No. 14. The construction will provide a minor encroachment into the tree protection zone.
- The retention of Tree No.'s 10 & 12. The construction will provide a major but tolerable encroachment into the tree protection zone.
- Hand excavation is required for all works located within the TPZ of all retained trees. These works shall be supervised by the project arborist.
- An AQF Project Arborist shall be engaged to certify the tree protection works in accordance with the hold points provided at **6.3. Hold Points** (page 11).
- For additional tree protection notes see **10. General Tree Protection Notes** (page 20).

6. Tree Management

6.1. Tree Management Objectives

The general tree management objectives include:

- Appointment of a Project Arborist who has a minimum Level 5 AQF Arboriculture qualification and experience in managing trees on construction sites.
- Installation of additional root, trunk and branch protection as required to protect retained trees where minor encroachments within the TPZ are anticipated.
- The installation of a Tree Protection Fence to enclose and protect the TPZ.
- Monitoring, inspection and certification of tree protection as per the below hold points.

6.2. Management Objective Priorities

The prioritisation of the above objectives is integral for the successful management of site trees:

1. Protection of the TPZ of retained trees;
2. Protection of the trunk and branches of retained trees;

3. Reduction of stress related to construction impacts;
4. The ongoing viability of retained trees after practical completion.

6.3. Hold Points, Inspection and Certification

To ensure this plan is implemented hold points (**HP**) have been specified in the schedule of works (below). Once each stage is reached the work will be inspected and certified by the Project Arborist and the next stage may commence.

Alterations to this schedule may be required due to necessity however this shall be through consultation with the Project Arborist only.

6.4. Schedule of Works and Responsibilities

Hold Point	Task	Responsibility	Certification	Timing of Inspection
1	Indicate clearly (with spray paint on trunks) trees approved for removal only	Principal Contractor	Project Arborist	Prior to demolition and site establishment.
2	Install TPF and additional root, trunk and/or branch protection	Principal Contractor	Project Arborist	Prior to demolition and site establishment.
3	Supervise all excavation works proposed within the TPZ	Principal Contractor	Project Arborist	As required prior to the works proceeding adjacent to tree
4	Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Monthly during construction period
5	Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Following the removal of tree protection measures from HP 1
6	Final Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Prior to issue of occupation certificate.

7. Tree Survey Table

NO#	Genus	Species	Common Name	Height	Spread	Trunk		Dia 2	Dia 3	DBH	SRZ	TPZ	Age	Health	Crown	Signifi-			Development Selfback and Encroachment	Comments	
						Trunk Dia 1	Trunk Dia 2									Am	Eco	Form			Defects
1	Acer	negundo	Box Elder	5	5	280		280	290	1948	3360	M	F	F-P	L	L	L	CD.U.M	Within proposed driveway	Previously topped and pollard at 1.5m	
2	Castilemon	vinidialis	Weeping Bottlebrush	7	5	230	100	251	320	2051	3012	QM	P	F	L	L	M	CD.U.V	Within proposed driveway	Very sparse canopy with heavy dieback and epicormic growth. Overcrowding with surrounding smaller Castilemon sp. And Ligustrum sp.	
3	Pittosporum	undulatum	Sweet Pittosporum	6	4	140	100	173	400	2252	2076	SM	AV	AV	M	M	H	CD.U	No impact 2.2m from proposed roofing on south east corner of veranda providing a minor (6.9%) encroachment within the TPZ	Competes with surrounding Camellia sp. and tree 4	
4	Ficus	benjamina	Weeping Fig	7	7	390		390	390	2228	4680	SM	G	G	M	M	M	CD.S.M	Within proposed carpark	Has grown through plastic pot into ground. Multi trunked from 0.75m above grade included co-dominant stems at 2m. Jasmine climber on trunk to 5m. Crown skew to north	
5	Castilemon	salignus	White Bottlebrush	10	6	430		430	500	2474	5160	M	F	F-P	M	M	M	D.U	Within proposed carpark	Suppressed specimen showing low vigour	
6	Jacaranda	minosifolia	Jacaranda	7	3	60	90	124	210	1718	2000	SM	F	F	L	L	L	CD.S.U.M	Within proposed carpark	Certified leader dead from 5m	
7	Cupressus	laurata	Australian Cypress	10	3	260		260	260	1879	3120	QM	F-P	F	L	L	L	CD.B	Within proposed carpark		
8	Acer	buergerianum syn A. trifidum	Trident Maple	5	2	120		120	140	1500	2000	SM	P	P	L	L	L	S.U.U	1.07m from proposed carpark, providing a minor (6.4%) encroachment within TPZ and SRZ	5m Ulmus parvifolia 0.7m to south, not on survey. DBH 80mm diameter. Over crowded with numerous other trees and shrubs	
9	Olea	europaea subsp. africana	Wild olive	7	3	80		80	90	1500	2000	J	AV	AV	L	L	W	S.U.U	No impact	Recognized weedy species	
10	Ulmus	parvifolia	Chinese Elm	10	14	250	280	376	470	2410	4512	M	F	F	M	M	L	CD.S	2.8m from proposed carpark, major (10.2%) encroachment within TPZ	Previously topped at 2m x 2 scaffolds. 1 dead scaffold with decay	
11	Castilemon	salignus	White Bottlebrush	11	6	220	160	140	306	600	2670	3672	M	AV	AV	M	M	M	CD.U.M	No impact	Deadwood to 120mm diameter, crown skew to north. 3 trunks from 1m
12	Ulmus	parvifolia	Chinese Elm	7	7	190		190	240	1817	2280	SM	AV-G	AV-G	M	M	L	CD.B	1.3m from proposed carpark, major (10.5%) encroachment within TPZ and SRZ		
13	Jacaranda	minosifolia	Jacaranda	5	5	160		160	200	1683	2000	SM	P	F	L	L	L	CD.B	Within proposed carpark	Stunted and growth showing little vigour. Competition from nearby Murray sp.	
14	Lophoslemon	confertus	Brush Box	10	9	400		400	450	2366	4800	M	G	G	M-H	H	M	D.B	3.75m from proposed OSB retaining wall, providing a minor (4.2%) encroachment within TPZ	Located on road reserve	

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No impact
Minor encroachment
Major encroachment
Within development footprint

8. Tree Survey Table Notes

8.1. Genus, Species and Common Name

The botanical and common name of each tree is identified and recorded. Occasionally the exact species name is unknown; sp. is recorded to indicate this.

8.2. Height, Spread, Trunk Dia, DBH and DRB

- The tree's height and spread is recorded in metres.
- The tree **DBH** is recorded in millimetres. DBH is an abbreviation of Diameter (of the trunk) measured at Breast Height (or 1.2m from the base of the trunk). If more than one trunk is present the DBH is calculated in accordance with AS4970-2009 Protection of Trees on Development Sites.
- If the tree has multiple trunks multiple trunks each trunk DBH (**Trunk Dia**) will be recorded individually.
- The tree **DRB** is recorded in millimetres. DRB is an abbreviation of Diameter (of the trunk) measured above the Root Buttress. It is required to calculate the SRZ in accordance with AS4970-2009 Protection of Trees on Development Sites when there is major encroachment within the TPZ, ie. greater than 10% is encroached upon or if there is an encroachment within the SRZ.

8.3. Age

The age class of each tree is estimated as either:

- **J** – Juvenile, a young sapling, easily replaced from nursery stock.
- **SM** - Semi Mature, a tree that has not grown to mature size.
- **M** - Mature, a tree that has reached mature size and will slowly increase in size over time.
- **OM** - Over Mature, a tree that has been mature for a long period and is beginning to display signs of decline, e.g. large dead branches.
- **S** - Senescent, an over mature tree that is now in decline.

8.4. Health and Vigour

The trees health and vigour is recorded as a measurement of:

- **G** - Good the tree does not appear stressed with no excessive dieback, insect infestation, decay, dead wood or epicormic shoots.
- **Avg** - Average Health the tree appears stressed and have some crown dieback, and/or a few epicormic shoots, and/or some dead wood in the crown and some new growth at branch tips. These trees may benefit from remediation of the growing environment to reduce stress and return it to good health.
- **F** - Fair the tree may have areas of crown dieback, and/or epicormic shoots, and/or areas of decay, and/or reduced new growth at branch tips. These trees have been stressed for a short period of time, remediation of the growing environment may improve the trees health.
- **P** - Poor the tree may have large areas of crown dieback, and/or many epicormic shoots, and/or reduced new growth at branch tips. These trees have been stressed for a long time, remediation of the growing environment would not return the tree to good health.

- **D** – Dead the tree is dead

8.5. Crown Condition

The crown condition of each tree is assessed and recorded as either:

- **G** - Good Condition: the tree appears to have no visible indication of inherent structural defects.
- **Avg** - Average Condition: the tree has minor structural defects which may be corrected with remedial works or pruning, allowing the tree to return to Good Condition.
- **F** - Fair Condition: the tree has visible structural defects such as (but not limited to) dead branches, and/or an unbalanced crown, and/or leaning trunk and/or areas of decay. These trees do not demonstrate the typical form of their species, or have been damaged or have begun to deteriorate. Remedial works or pruning may return the tree to Average Condition.
- **P** - Poor Condition: the tree has significant structural defects such as (but not limited to) very large dead branches, and/or extremely unbalanced crown, and/or subsiding trunk and/or large areas of decay. These trees do not demonstrate the typical form of their species, or have been severely damaged or have deteriorated significantly. Remedial pruning would not return the tree to Fair Condition.

8.6. Significance

Measured as High, Medium or Low, see **0. The Penrith City Council** tree preservation order defines a tree as being a perennial plant with self-supporting stem which:

Has a girth of 30cm or more, measured at a distance of 40cm above the ground; and

- c. Has a height in excess of 3m.

Determining a tree's significance (page 6).

8.7. Amenity Value

Amenity value is a subjective measurement based on the tree's contribution to the landscape, it may be based on the tree's visual form, however it also includes non visual attributes such as provision of shade for a seat, screening of poor views or for privacy, or if it has historical significance. The amenity value is recorded as:

- **H** - High, the trees form is an excellent example of its species and it makes a great specimen and/or it has other attributes such screening, or is historical significance. These trees are visually prominent and valuable to the community or public domain.
- **M** - Medium, the tree may have an altered form and/or it has attributes that provides amenity to local residents only.
- **L** – Low, the tree is not a good specimen and it does not provide substantial benefit to local residents or the community.

8.8. Ecological Value

Ecological value is a measurement of the trees contribution to the environment. It is determined by the trees area of origin, its potential to provide habitat to native fauna

and its potential to become an environmental pest. The ecological value is recorded as:

- **H** - High, the tree is locally native or remnant and/or it has habitat value for native fauna.
- **M** - Medium the tree is native but not locally native.
- **L** - Low, the tree is not native and/or it may be a listed nuisance or weed species.
- **Ha** – Habitat, is the tree valued by fauna for food (ie. foliage fruit or sap) or shelter (ie. nesting, roosting, dray or hollow).

8.9. Form

The form, structure or shape of each tree is assessed and recorded as either one or a combination of several of the below terms; **(U)** Upright, **(B)** Broad, **(C)** Conical, **(Sh)** Shrub, **(CS)** Crown Shy (also referenced is the adjacent dominant tree canopy ie. **T4**), **(V)** Vase, **(D)** Dome, **(P)** Palm, **(S)** Spreading, **(L)** Leaning or **(BM)** Basal Multi Trunked.

Crown form may also be assessed in accordance with the relationship with the neighbouring tree and recorded as either: **S** - Suppressed, the crown is located beneath another larger crown and is leaning away (Crown Shy); **CD** - Codominant, the crown is adjacent to another crown of similar size, their crown areas may appear joined; **D** - Dominant, the crown is above other lower crowns; **E** - Emergent, the crown emerges from a lower canopy formed by other dominant or codominant crowns.

8.10. Defects

The presence of one or a combination of several defects is recorded **(W)** Wound, **(D)** Decay, **(F)** Fungus, **(B)** Bulge, **(FB)** Fibre Buckling, **(C)** Cracks, **(S)** Split, **(H)** Hollow, **(DB)** Die Back, **(E)** Epicormic shoots, **(DW)** Dead Wood, **(I)** Inclusion, **(CA)** Cavities, **(PF)** Previous Failure, **(R)** Root Damage, **(P)** Pruning wound, **(PD)** Pests and diseases, **(ST)** Storm Damage.

8.11. SRZ (Structural Root Zone)

The SRZ is a radial area extending outwards from the centre of the trunk. This area contains the majority of the structural woody roots. This area is responsible primarily for stability. Root damage or root loss within this zone greatly increases the opportunity for decay fungi to ingress into the heartwood, causing internal decay in addition to destabilising the tree's structural integrity. The SRZ is calculated as follows (This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites):

$$\text{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

8.12. TPZ (Tree Protection Zone)

The TPZ is a circular area with a radius measured by multiplying the DBH by twelve (12), or a circular area the size of the tree's drip line whichever is greater. This area contains the majority of the essential structural and feeder roots responsible for stability, gaseous exchange and water and nutrient uptake. Excavation, back filling, compaction or other disturbance should not occur in this area.

The TPZ is used to identify the minimum area required for the safe retention of a given tree. This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites. An incursion to 10% within the TPZ is potentially acceptable if no other option is available. A major encroachment (in excess of 10%) is required to be clearly justified by the project Arborist and compensated for elsewhere. Justification methodology may vary depending on site or the individual tree's health, vigour and ability to withstand disturbance and may require root investigation.

8.13. Development Setback / Impact

The successful retention of trees on construction sites is dependent on the adequate allocation and management of the space above, below and around trees to be retained.

The trunk and canopy of trees to be retained must be protected to ensure the trunk and branches are not damaged during construction. The removal of bark and / or branches allows the potential ingress of micro organisms which may cause decay. Similarly the removal of bark restricts the tree's ability to distribute water, mineral ions and glucose.

It is essential to prevent the disturbance of the soil beneath the drip line of each tree, because this is the area where oxygen, water and mineral ions are absorbed by tree roots. Oxygen, water and mineral ions are essential for healthy plant growth. If soil becomes compacted, the ability of roots to function correctly is greatly reduced. Similarly the removal or damage of roots will reduce the ability of roots to function correctly. Woody roots provide stability for the tree and they also transport nutrients to the leaves.

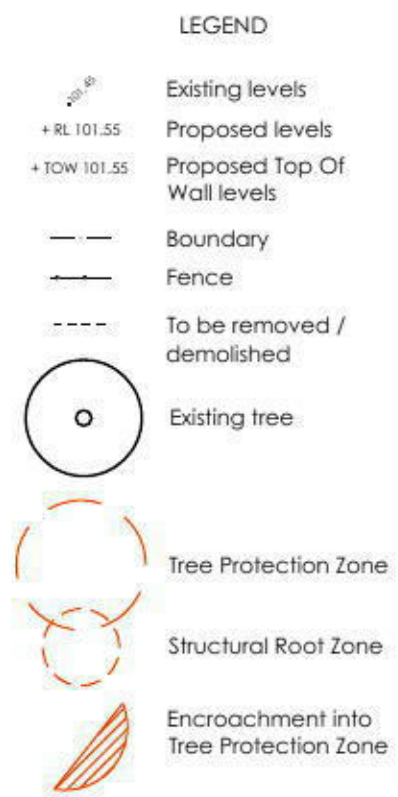
The potential implications of removing or damaging roots are threefold:

1. The risk of whole tree failure is increased, as tree roots anchor and stabilise the tree. Woody roots are developed to assist in the support of the tree in prevailing wind, with these roots removed wind throw may occur, which would result in the mass failure of the tree.
2. The ability of the tree to absorb and transfer the essential nutrients, oxygen and water from the soil to the leaves is greatly affected. This will place the tree under stress and reduce the tree's ability to photosynthesise, and in turn cause the tree to use up stored energy reserves. These energy reserves are used to fight infection and insect attack, for new growth, maintenance of existing tissues and also for healing wounds. Once energy reserves become depleted a tree is much more susceptible to drought, disease and pest attack.
3. Open wounds are sites by which decay-causing pathogens can enter the tree. The severance or damage of woody roots creates sites where pathogens may gain ingress. Whilst the effect of decay may not be immediately apparent, the long term health and structure of the tree will be compromised.

8.14. Comments

Comments generally relate to the suitability for retention. The comments allow for a brief notation of other factors relevant to the assessment of the tree.

9. Tree Location Plan



DATE: 17/05/2013			TIME: 17:03:12			 104 DERBY STREET, PENRITH			EXTENSION AND ALTERATION								
SUBMITTED TO CLIENT FOR COMMENT						104 DERBY STREET, PENRITH						TREE LOCATION PLAN					
NTS @ A4						DA						T-01					
VF						AM						17-05-13					
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10. General Tree Protection Notes

10.1. Structural Root Zone (SRZ)

The SRZ is a radial area extending outwards from the centre of the trunk calculated as follows:

$$\text{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

10.2. Tree Protection Zone (TPZ)

The TPZ is a radial area extending outwards from the centre of the trunk equal to the DBH x 12. This area shall be protected by a TPF (see below). For all trees to be retained a TPZ is to be created and maintained.

The TPZ function is primarily to protect the root zone by restricting access however the canopy of the tree shall also be protected from damage or injury. The Project Arborist shall approve the extent of the TPZ.

The TPZ shall be mulched to a depth of 75mm with an approved organic mulch. Supplementary watering shall be provided in dry periods to reduce water or construction stress, particularly to those trees which may have incurred root disturbance.

In the TPZ the following activities shall be excluded:

- Excavation, compaction or disturbance of the existing soil.
- The movement or storage of materials, waste or fill.
- Movement or storage of plant, machinery, equipment or vehicles.
- Any activity likely to damage the trunk, crown or root system.
- Scaffolding.

10.3. Tree Protection Fencing (TPF)

Prior to site establishment, tree protection fencing shall be installed to establish the TPZ for trees to be retained. Tree protection fencing shall be maintained entire for the duration of the construction program.

Tree protection fencing shall be:

- Enclosed to the full extent of the TPZ, or enclose as much of the TPZ as can reasonably be enclosed, allowing for pedestrian access and 1m offset around construction footprint.
- Cyclone chain link wire fence or similar, with lockable access gates.
- Certified and Inspected by the Project Arborist
- Installed prior to the commencement of the works.
- Prominently signposted with 300mm x 450mm boards stating **"NO ACCESS TO THIS AREA - TREE PROTECTION ZONE CONTACT PROJECT ARBORIST 0407 006 852"**.

10.4. Trunk and Root Zone Protection

Other measures may be required in addition to tree protection fencing. These specific protection measures will be installed as directed by the Project Arborist to protect the canopy, trunk or branches from the risk of damage.

The Project Arborist shall be consulted if there is risk of damage to a retained tree. The Project Arborist may require:

- A 75mm layer of approved mulch to be installed to the TPZ.
- A temporary drip irrigation system to be installed to the TPZ.
- Additional root protection to be installed.
- Additional trunk and branch protection to be installed.

10.5. Tree Damage

In the event of damage to a tree or the TPZ of a tree to be retained the Project Arborist shall be engaged to inspect and provide advice on remedial action. This should be implemented as soon as practicable and certified by the Project Arborist.

10.6. Excavation within the TPZ

Excavation within the TPZ shall be avoided. All care shall be undertaken to preserve tree root systems. Excavation within the canopy drip line or TPZ shall subject to the approval and supervision of the Project Arborist. Excavation shall be executed by hand to avoid damage to roots.

If excavation within the TPZ is required a root mapping exercise is to be undertaken and certified by the Project Arborist. Root mapping shall be undertaken by either ground penetrating radar (GPR), air spade, water laser or by hand excavation. The purpose shall be to locate woody structural roots greater than 50mm in diameter.

Where roots 50mm dia. or greater are encountered, alternative construction method shall be considered to ensure roots are not severed. Adequate allowance must also be made for future radial root growth. In paved areas, consideration should be given to raising the proposed pavement level and using a porous fill material in preference to excavation.

If there is no avoiding placing services through the TPZ excavate outside the TPZ and underbore below the root ball of the tree as directed by the Arborist.

10.7. Fill

All fill material to be placed within the TPZ should be approved by Arborist and equal to 5-7mm Round River Pea Gravel to provide aeration and percolation to the root zone. Otherwise no fill should be placed within the TPZ of trees to be retained.

10.8. Pavements

Proposed paved areas within the TPZ should be placed on or above grade to minimise excavation, and avoid root severance and/or damage. Pavements should be permeable or avoided otherwise.

10.9. Pruning

All pruning work required (including root pruning) should be in accordance with Australian Standard No 4373-1996 - Pruning of Amenity Trees.

If required, roots should be severed with clean sharp implement flush with the face of the excavation and maintained in a moist condition. Root pruning shall be performed under the supervision of the Project Arborist.

10.10. Tree Removal

Tree removal work shall be carried out by an experienced tree surgeon in accordance with the NSW Work Cover Code of Practice for the Amenity Tree Industry (1998).

Care shall be taken to avoid damage to trees during the felling operation. Stumps shall be grubbed-out using a mechanical stump grinder to a minimum depth of 300mm without damage to other retained root systems.

10.11. Post Construction Maintenance

In the event of any tree deteriorating in health after the construction period, the Project Arborist shall be engaged to provide advice on any remedial action. Remedial action shall be implemented as soon as practicable and certified by the Project Arborist.

Tree protection fencing with additional trunk and root protection shall be removed following completion of construction. The mulch layer in the TPZ shall be retained and replenished where required to maintain a 75mm thickness.

11. References

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2. **AS 4373 - 1996 Pruning of Amenity Trees**; Standards Australia.
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