



# ALL ARBOR SOLUTIONS

## Arboricultural Impact Assessment

**Prepared for:**

SNC Lavalin Atkins

**Site Address:**

Narara Railway Station  
Narara Valley Drive  
Ourimbah  
NSW  
2250

**Date:**

29 July 2020

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## 1.0 Introduction and Background

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### 1.1 Purpose

1.1.1 All Arbor Solutions Pty Ltd was commissioned by SNC-Lavalin Atkins on behalf of Transport for New South Wales (TfNSW) to prepare an Arboricultural Impact Assessment to assess the impacts of the proposed Narara Station Upgrade (the Proposal). This specialist assessment forms part of the Review of Environmental Factors (REF) which is being prepared to assess the impacts of the Proposal, in the considerations for determination under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

### 1.2 Overview of the Project

1.2.1 Transport for NSW (TfNSW) is the lead agency of the NSW Transport cluster. TfNSW is responsible for strategy, planning, policy, procurement, regulation, funding allocation and other non-service delivery functions for all modes of transport in NSW including road, rail, ferry, light rail, point to point, cycling and walking. TfNSW is the proponent for the Narara Station Upgrade (the 'Proposal').

1.2.2 TfNSW is the government agency responsible for the delivery of major transport infrastructure projects in NSW. TfNSW is proposing to upgrade Narara Station as part of the NSW Government's Transport Access Program (TAP) to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure.

### 1.3 Need for the Proposal

1.3.1 The Narara Station Upgrade, the subject of the REF, forms part of the Transport Access Program. This Program is an initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure.

1.3.2 Narara Station has been identified for an accessibility upgrade as it does not currently meet key requirements of the *Disability Standards for Accessible Public Transport 2002* (DSAPT) or the Commonwealth *Disability Discrimination Act 1992* (DDA). The non-compliant pathways, car parking and stairs to the footbridge do not facilitate access for people with reduced mobility, parents or carers with prams, or customers with luggage.

1.3.3 The Proposal would improve accessibility of the station in line with the requirements of the DDA and the DSAPT. The upgrades would provide an improved customer experience for existing and future users of the station through providing safe and equitable access to the platforms and car parks, and to the bus and pedestrian network on the northern side of the station.

1.3.4 The needs and objectives of the Proposal are further discussed in Chapter 2 of REF.

### 1.4 Site description

1.4.1 Narara Station is located in the suburb of Narara, within the Central Coast Council (CCC) Local Government Area (LGA). Narara Station is approximately 80 kilometres from Central Station, Sydney, and about four kilometres north of Gosford Station on the Central Coast and

Newcastle Line of the Intercity Trains Network (Figure 1-2). The station consists of platforms either side of the rail lines. The southern platform (Platform 1) provides services south to Sydney Central and the northern platform (Platform 2) provides services north to Newcastle Interchange. The location of the Proposal and its regional context is shown in Figure 0-1.

- 1.4.2 The station lies between Goonak Parade to the south and Narara Valley Drive to the north. Narara Station is accessed from the southern side of the rail corridor from the Pacific Highway via Goonak Parade, and from the northern side of the rail corridor from Narara Valley Drive. Informal driveways with no kerbs and no pedestrian footpaths provide vehicular access to commuter carparks on both sides of the rail corridor. A footpath located on the southern side of Narara Valley Drive provides pedestrian access to the northern commuter carpark.
- 1.4.3 The commuter car parks currently provide a total formal capacity of 79 car parking spaces, one secure bike locker and one bike rack. There are no existing accessible car parking spaces nor any formal kiss and ride spaces.
- 1.4.4 Additional transportation options are located to the north-west of the station along Narara Valley Drive, with northbound and southbound bus stop zones located immediately outside the station.



Figure 0-1 Regional and local site context

## 1.5 Proposal area

1.5.1 The Proposal includes upgrades to Narara Station on land owned by RailCorp, with the station facilities operated and maintained by NSW TrainLink. In addition, the Proposal includes some work within the road reserve of Narara Valley Drive, which is on CCC land. This proposed work within the road reserve is to facilitate a new accessible path and pedestrian crossing between the existing bus stops on Narara Valley Drive and the station.

1.5.2 The Proposal Area is shown in Figure 2-1 and includes:

- the rail corridor around Narara Station (including the platforms, shelters, and footbridge)
- the station commuter car parks either side of the rail corridor
- a proposed construction compound area within the rail corridor, to the south of the southern commuter car park
- the northbound and southbound bus stop areas on Narara Valley Drive, and the road verge adjacent the northern commuter car park

## 1.6 Proposal features

1.6.1 The key features of the Proposal are shown in Figure 0-3 and summarised as follows:

- installation of two new lifts (and lift landings) connecting from the existing footbridge to the two commuter car parks and the platforms
- Localised surface regrading in both commuter car parks to provide an accessible parking space and a kiss and ride space within each car park
- a new pedestrian crossing across the northern commuter car park to connecting to Narara Valley Drive
- a new path from the Station to Narara Valley Drive
- relocation of the existing southbound bus stop on Narara Valley Drive and provision of a formalised pedestrian crossing across Narara Valley Drive
- formalised Boarding Assistance Zones (BAZ) on each platform
- provision of a localised ramp from Platform 1 into the waiting area
- new fencing and bollards
- reshaping of mound surrounding electrical pole at the southern commuter car park to improve traffic flow
- ancillary work including electrical upgrades to support new infrastructure, service relocation, opal car reader relocation, drainage works, upgrades to lighting and public address systems, CCTV, wayfinding signage and relocation of bins and furniture

1.6.2 Figure 2-2 shows the general layout of key elements of the Proposal based on the strategic concept design. The design would be further refined during the detailed design phase.

1.6.3 Subject to planning approval, construction is expected to commence in late-2020 and take around 12-18 months to complete.

1.6.4 A detailed description of the Proposal is provided in Chapter 3 of the REF.

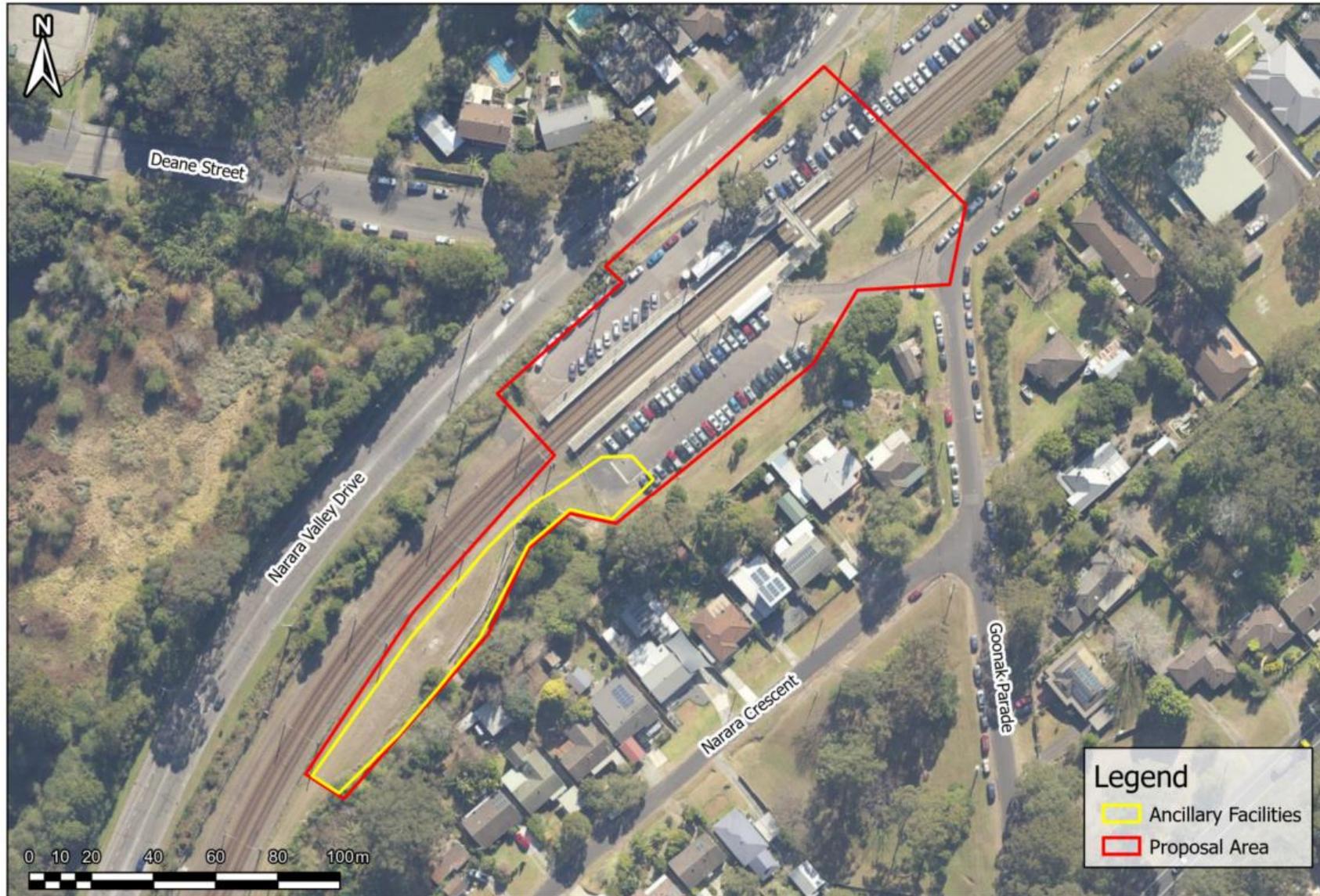


Figure 0-2 Proposal Area

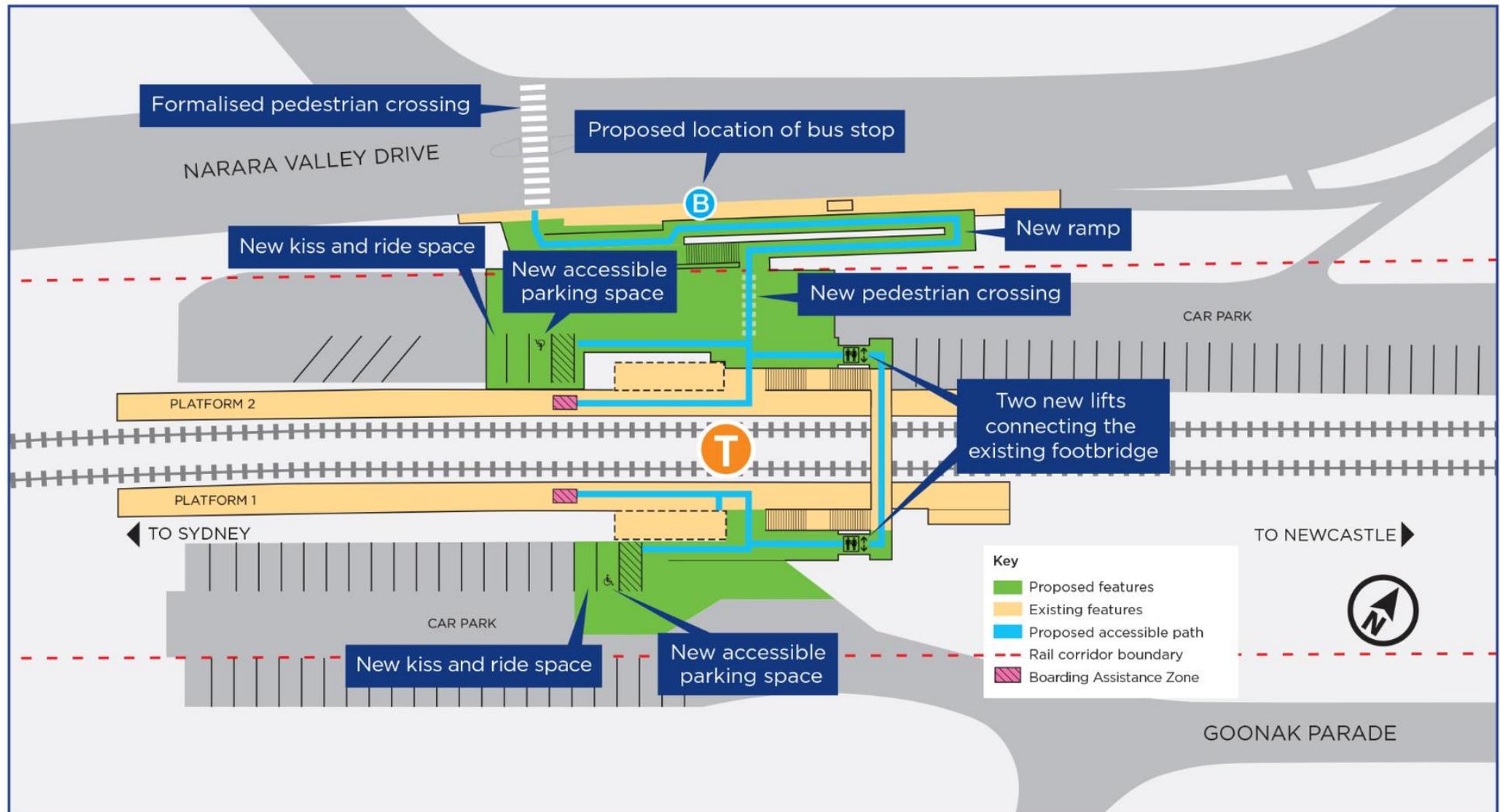


Figure 0-3 Key features of the Proposal (Note: this is indicative, subject to detailed design)

## 2.0 Existing infrastructure and land uses

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### 2.1 Platforms and stairs

- 2.1.1 The station consists of two concrete side platforms. The southern platform (Platform 1) provides services southbound 'up' to Sydney Central and northern platform (Platform 2) provides services northbound 'down' to Newcastle.
- 2.1.2 The platforms are accessed directly from each of the adjoining commuter car parks. A reinforced concrete footbridge, with precast concrete steps and pole mounted lights, is located towards the eastern end of the platforms, providing a pedestrian link between the two platforms.
- 2.1.3 On each platform there is an open-sided, covered waiting area (refer Figure 2-2). There is no station building or toilet facilities at the station.

### 2.2 Commuter car parks

- 2.2.1 Dedicated commuter car parks are provided on both the southern and northern sides of the rail corridor. The southern car park is accessed by vehicles from the Pacific Highway off Goonak Parade via an informal driveway with no kerbs and no pedestrian footpath. The car park is sealed with 42 car parking spaces at 90 degrees to the rail lines that are formally marked (refer Figure 2-1).
- 2.2.3 The northern car park is accessed by vehicles from Narara Valley Drive via an informal driveway with no kerbs and no pedestrian footpath. A pedestrian path provides access up a steep incline from the footpaths on Narara Valley Drive to the northern car park. The car park is sealed and has 37 formally marked car parking spaces, comprising 31 spaces at 90 degrees to the rail lines, one small car space and a further five angled parking spaces at the southern end of the car park (refer Figure 2-1). Informal parallel parking occurs along the western side of the western car park, with the area accommodating about 25 car parking spaces.
- 2.2.3 A parking area for service vehicles only is provided directly adjacent the footbridge stairs in the western car park. Beneath the footbridge stairs is an electrical transformer.
- 2.2.4 A bike rack with capacity for seven bikes and one secure bike locker is provided in the northern commuter car park beside the waiting area shelter.

### 2.3 Land uses

- 2.3.1 Under the *Gosford Local Environmental Plan 2014* (Gosford LEP), Narara Station is zoned as SP2 Infrastructure, similarly east of the rail corridor is a designated road reserve corridor also zoned as SP2 Infrastructure. Areas to the north, east and south of the station contain predominately R2 low-density residential areas with some RE1 public recreation areas. The area west of the station is zoned as an E2 Environmental Conservation zone (refer Figure 1-1).

## 3.0 Introduction to Arboricultural Impact Assessment

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### 3.1 Background to Arboricultural Impact Assessment

- 3.1.1 This Arboricultural Impact Assessment (AIA) was prepared for SNC Lavalin Atkins on behalf of TfNSW, The AIA assesses the impacts of construction works from the Narara Station Upgrade on trees located within, and adjacent to, the subject site.
- 3.1.2 The following documentation was reviewed and assisted in the preparation of this report:
- Transport Access Program Package 2 (TAP3), Narara Station, Volume 2-Scoping Design Drawings, TfNSW, Ref 502774, dated 14 December 2018
  - TAP3 Narara Station, Ourimbah Station Scoping Design Report, TfNSW, Ref 502774, Revision 2, dated 14 December 2018
- 3.1.3 The conclusions drawn within this report are based on the information provided and data collected during an on-site inspection.
- 3.1.4 This report is to only be used in its entirety. Any written or verbal submission, report or presentation that includes statements taken from the findings, discussions, conclusions or recommendations made in this report may only be used where the whole original report (or a copy) is referenced to and directly attached to that submission, report or presentation. Information contained in the report covers only the trees that were inspected and reflects the trees condition at the time of the inspection. There is no guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future.

### 3.2 Inspection Methodology and Data Collection

- 3.2.1 The trees were assessed using the principles of a ground based Visual Tree Assessment (VTA)<sup>1</sup> and methods consistent with modern arboriculture. No aerial (climbing) inspection, tissue sampling or diagnostic testing was undertaken as part of the inspection process unless otherwise stated.
- 3.2.2 Full results of the tree inspection and data collection can be found within the Tree Assessment Schedule (**Appendix 1**).
- 3.2.3 The height, radial canopy spread, trunk Diameter at Breast Height (DBH) and trunk diameter above root buttress was collect for each tree assessed. These physical dimensions were either estimated or measured.
- 3.2.4 The vigour, structure and age class of the tree(s) has been assessed and reflects the tree(s) at the time of the inspection (13 May 2020). The methodology for determining vigour, structure and age class can be found within the Tree Inspection Criteria (**Appendix 5**).
- 3.2.5 Each tree has been given Safe Useful Life Expectancy (SULE) rating. This rating defines the length of time that the arborist feels an individual tree can be retained with an acceptable level of risk based on the information available at the time of inspection. Methodology used

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<sup>1</sup> Mattheck, C. and Breloer, H (2006), *The Body Language of Trees – A Handbook for Failure Analysis*, The Stationary Office. Pages 118-122.

to determine these ratings can be found within the SULE description and categories (**Appendix 6**).

- 3.2.6 Each tree has been assessed against the Institute of Australian Consulting Arborists (IACA) Significance of a Tree Assessment Rating System (STARS). This provides a dual method of objectively rating the viability and retention value of urban trees on development sites. The STARS assessment criteria and retention matrix table can be found within the Tree Significance Assessment Criteria and Retention Value Matrix (**Appendix 7**)
- 3.2.7 Photographs were taken using a digital camera on the day of the inspection and can be found as Site Photographs (**Appendix 4**).

### 3.3 Trees on Development Sites

- 3.3.1 The *Australian Standard (AS) 4970-2009 Protection of Trees on Development Sites* defines the requirements for assessing trees with respect to development. It provides the guidance on how to decide which trees are appropriate for retention and on the means of protecting them during construction works. It describes the areas and offsets, referred to as the Tree Protection Zone (TPZ) and Structural Root Zone (SRZ), required to be free from development works to maintain tree vitality and stability. This report has been prepared in accordance with the conditions set out within the standard.
- 3.3.2 Tree Protection Zone – The TPZ is defined as a specified area above and below ground set aside for the protection of the tree’s roots and crown. It is expressed as a radial measurement taken from the centre of the trunk at ground level.
- 3.3.3 Structural Root Zone – The SRZ is defined as a specified area around the base of a tree required to maintain its stability within the ground. It is expressed as a radial measurement taken from the centre of the trunk at ground level. Excavation and development works are not recommended within the SRZ unless additional investigation as to root size and location is undertaken.
- 3.3.4 TPZ and SRZ calculations have been made in accordance with AS4970-2009 and can be found within the Tree Assessment Schedule (**Appendix 1**).
- 3.3.5 Under AS4970 development encroachments into the TPZ are defined as either minor or major.
- A minor encroachment is less than 10% of the area of the TPZ and is outside of the SRZ. Where this occurs detailed root investigation works should not be required and the loss of root zone compensated for elsewhere and contiguous with the TPZ.
  - A major encroachment is greater than 10% of the area of the TPZ or is inside the SRZ. Where a major encroachment exists the project arborist must demonstrate that the tree will remain viable. The area lost should be compensated for elsewhere and contiguous with the TPZ. Major encroachments may require detailed root investigation works to be undertaken.

- 3.3.6 It should be understood that the TPZ and SRZ are indicative and do not consider the physical constraints of a site or species of the tree which may influence the architecture, development and spread of its root system. The establishment of TPZs to their fullest extent may not be possible due to environmental or site constraints. Where this occurs, their establishment is to be undertaken under the guidance of the project arborist.
- 3.3.7 A two metre construction offset has been given around the proposed works area. This area represents the additional space required around the development footprint to allow for the safe and practical undertaking of construction activities. Appropriate tree protection measures can generally be employed within these areas to minimise their impacts upon adjacent trees. These areas are shown on the attached plan, **Appendix 3**, TPZ encroachments.
- 3.3.8 A general guidance note for protecting trees on development sites has been provided and can be found as **Appendix 7**. This note provides basic information regarding the protection of trees during the planning and construction phases of development. All works within a designated TPZ are to be undertaken under the guidance and supervision of the project arborist.

## 4.0 Findings and Observations

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### 4.1 The site

- 3.1.1 The subject site is identified as Narara Railway Station. It is located adjacent to the southern side of Narara Valley Drive at Narara.
- 4.1.2 A total of six trees were assessed as part of this report. They consist of five native tree species and one exotic tree species. Four of the trees are located on the northern side of the station adjacent Narara Valley Drive. Two trees are located on the southern side of the station adjacent Goonak Parade.

### 4.2 The Trees

- 4.2.1 A Tree Location Plan can be found as **Appendix 1**. Individual tree details and data captured during the on-site inspection may be found as **Appendix 2** Tree Assessment Schedule.
- 4.2.2 Tree 1, *Eucalyptus elata* (River Peppermint) was found to be a mature specimen in fair overall health and condition. It has been assessed as having medium safe useful life expectancy, retainable within the landscape for 15 to 40 years and medium landscape significance. Epicormic growth was observed on the trunk and throughout the canopy. The top of the canopy has died but remains connected as deadwood. The trunk of the tree has a slight lean likely to be as a result of successive pruning works undertaken to provide clearances to the adjacent overhead high voltage powerlines. Damage to the base of the trunk was noted and is likely a result of poor landscape management practices. Photograph 1 of **Appendix 4** shows this tree.
- 4.2.3 Tree 2, *Eucalyptus umbra* (Broad-leafed White Mahogany) was found to be a mature specimen in fair overall health and condition. It has been assessed as having medium safe useful life expectancy, retainable within the landscape for 15 to 40 years and medium landscape significance. Photograph 2 of **Appendix 4** shows this tree.
- 4.2.4 Tree 3, *Eucalyptus umbra* (Broad-leafed White Mahogany) was found to be a mature specimen in good overall health and condition. It has been assessed as having medium safe useful life expectancy, retainable within the landscape for 15 to 40 years and medium landscape significance. Photograph 3 of **Appendix 4** shows this tree.
- 4.2.5 Tree 4, *Eucalyptus umbra* (Broad-leafed White Mahogany) was found to be a mature specimen in fair overall health and condition. It has been assessed as having medium safe useful life expectancy, retainable within the landscape for fifteen to forty years and medium landscape significance. Photograph 4 of **Appendix 4** shows this tree.
- 4.2.6 Tree 5, *Callistemon viminalis* (Bottlebrush) was found to be a mature specimen in good overall health and condition. It has been assessed as having medium safe useful life expectancy, retainable within the landscape for 15 to 40 years and medium landscape significance. Photograph 5 of **Appendix 4** shows this tree.
- 4.2.7 Tree 6, *Cinnamomum camphora* (Camphor Laurel) was found to be a mature specimen in good overall health and condition. It has been assessed as having medium safe useful life

expectancy, retainable within the landscape for 15 to 40 years and medium landscape significance. Camphor Laurel are commonly thought of as a weed and are identified as an undesirable tree species by the Central Coast Council. Photograph 6 of **Appendix 4** shows this tree.

- 4.2.8 No significant hollows or cavities that may be utilised as wildlife habitat were observed within any of the assessed trees.
- 4.2.9 None of the trees are identified as threatened species or form part of an endangered ecological community.
- 4.2.10 None of the trees are identified as weeds of national significance.

## 5.0 Impacts of the proposed works

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### 5.1 General

- 5.1.1 The impacts of the proposed works are based upon the plans provided. The impacts on individual trees and their control measures have been provided in the Tree Assessment Schedule, **Appendix 2**.
- 5.1.2 Tree Protection Zones and encroachments have been scaled and plotted over an extract from the provided Site Plan and can be found as **Appendix 3**.
- 5.1.3 Under the plans provided the proposed works do not encroach upon the TPZ of Tree 1 allowing for its retention.
- 5.1.4 Site Plan, drawing No TAP-150084-AR-DWG-0100 shows the alignment of the new pedestrian access ramp. The ramp poses an encroachment of 4% into the TPZ of Tree 2 and 30% into the TPZ of Tree 3. The ramp is also aligned through the SRZ of Tree 3.
- 5.1.5 Under the plans provided the 4% encroachment into the TPZ of Tree 2 is considered to be minor and can be managed through tree sensitive excavation and construction methods allowing for the tree's retention.
- 5.1.6 It was advised that alterations to the pedestrian ramp design may be required during or prior to construction. Design changes may result in significant encroachments into the TPZ and SRZ of Trees 1 and 2. The project arborist is to assess the impacts of these encroachments and provide recommendation as to the retention and protection of the trees.
- 5.1.7 The 30% encroachment through the TPZ of Tree 3 is significant given the restricted root space posed by the grassed area and its alignment within the SRZ. Damage or cutting of roots within the alignment of the access ramp will significantly increase the risk of tree failure. As such the tree shall require removal.
- 5.1.8 3D Image Plan, drawing No TAP-150084-AR-DWG-9001 shows the alignment of the retaining wall associated with the pedestrian access. This retaining wall is located approximately 0.7m from the base of Tree 4 within its SRZ. At the time of the inspection Tree 4 was found to be in fair condition likely as a result of pruning works around the overhead electrical network. Further impact upon the tree posed by the works is likely to significantly affect its health and condition shortening its useful life expectancy. As such, the tree cannot be safely and viably retained as part of the works.
- 5.1.9 The L2 lift footprint poses only a 3% encroachment into the TPZ of Tree 5. However, observations made during the site inspection suggest that a higher percentage of the root system of the tree falls within the footprint due to existing below ground structures. This encroachment is also significantly increased due to excavation required for the L2 lift pit and to requirement for a safe works area to undertake construction works. As such, the tree cannot be safely and viably retained as part of the works.
- 5.1.10 The TPZ of Tree 6 is clear of the proposed works. One branch was observed to be hanging low over the access road into the commuter car park off of Goonak Parade. It is thought that

this branch may be impacted upon by construction traffic, in particular trucks, accessing the site for the works. Details regarding the pruning of this tree are given within point 5.4.

- 5.1.11 It is proposed to establish the site compound within the rail corridor south of Platform 1 and accessed from the car park off Goonak Parade. The area appears maintained and regularly used. Establishment of the site compound within this area is not expected to impact upon neighbouring trees or vegetation. Refer to Figure 2-1 for proposed site compound location.
- 5.1.12 Hi-rail vehicles will access the site from the nearby Ourimbah Station hi-rail access pad. The hi-rail plant may include a rail-mounted elevated work platform, flatbed trucks, Hiab crane trucks, excavators, pilling rigs and dump trucks. The use of Hi-rail equipment throughout the construction process is not expected to impact upon adjacent trees or vegetation.

## 5.2 Trees That Cannot be Retained

- 5.2.1 Tree 3 is significantly impacted upon by the station access ramp. As such, the tree cannot be retained.
- 5.2.2 Tree 4 is significantly impacted upon by the retaining wall associated with the station access. As such, the tree cannot be retained.
- 5.2.3 Tree 5 is significantly impacted upon by the L2 lift works and cannot be retained.

## 5.3 Trees That Can be Retained

- 5.3.1 Under the plans provided Tree 1 is clear of the proposed works and can be retained.
- 5.3.2 Under the plans provided TPZ encroachments for Tree 2 are considered minor allowing for its retention.
- 5.3.3 Tree 6 is clear of the proposed works and can be retained. Pruning works are considered minor and not expected to impact upon tree health and condition.

## 5.4 Tree Pruning Works

- 5.4.1 In the first instance to avoid the requirement to undertake unnecessary pruning, where possible small diameter flexible branches are to be tied back and secured clear of any access requirements. The removal of branches is only to be undertaken where all options to retain the branch have been thoroughly investigated and exhausted.
- 5.4.2 Tree 6, *Cinnamomum camphora* (Camphor Laurel) was identified as potentially requiring selective pruning to provide clearances for construction truck access to the site. One first order branch approximately 100mm in diameter located at 2.5m height within the tree canopy was identified for removal. This branch constitutes less than 5% of the total canopy volume of the tree and its removal is not expected to have a significant impact upon the health and condition of the tree. Image 1 shows the branch to be removed.

- 5.4.3 All pruning works are to be undertaken by suitably qualified tree workers (minimum AQF level 3 or equivalent) in accordance with *AS4373-2007 Pruning of Amenity Trees* and *Safe Work Australia's Guide to Managing Risks of Tree Trimming and Removal Works*. All appropriate approvals and consents are to be obtained prior to tree pruning works commencing.



**Image 1:** Tree 6 *Cinnamomum camphora* (Camphor Laurel). Branch identified for removal to provide clearances for truck access during construction works.

## 6.0 Site Specific Tree Protection Measures

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- 6.1 A project arborist is to be appointed prior to the commencement of any construction works. The project arborist is to advise, monitor, inspect and ensure that industry standards are complied with regarding trees retained within and adjacent to the site. Any work within a designated TPZ requires authorisation from the project arborist.
- 6.2 All tree removal and pruning works are to be undertaken prior to site establishment and/or construction works commencing on site. All tree and vegetation removal is to be undertaken in accordance with **Appendix 7** Section 4 – Tree and vegetation pruning and removal.
- 6.3 It is understood that the ability to establish a tree protection zone, to its fullest extent, may be difficult and impractical due to physical site restrictions and the need for a workable area. In the event that Trees 1 and 2 are to be retained it is recommended that the protection measures are established under consultation between the property owner, construction contractor and project arborist. Based on the information provided this is likely to involve a combination of protective fencing (**Appendix 7** - Section 7 Tree protection fencing), trunk battening (**Appendix 7** - Section 8 Trunk and branch protection) and ground protection (**Appendix 7** - Section 9 Ground protection). Tree protection measures may be altered and adjusted under guidance of the project arborist as construction works progress. Where encroachments through or over a tree protection zone are required appropriate ground protection measures are to be implemented.
- 6.4 Arborist supervision shall be required for ground works associated with the pedestrian ramp area within the TPZ of tree 2. All excavation with the TPZ is to be undertaken using methods that do not damage tree roots. In the event that tree roots are exposed works are to cease and the project arborist is to inspect. Exposed roots are to be managed in accordance with the project arborists recommendations.
- 6.5 The health and condition of trees retained on the site is to be monitored throughout the duration of construction works by the project arborist. It is recommended that monthly visits are undertaken by the project arborist. All visits are to be documented by the project arborist with a copy of any reporting provided to the construction contractor.
- 6.6 Any discernible change in the characteristics of any retained tree throughout the construction period is to be reported to the project arborist and an inspection undertaken. These changes can include, but are not limited to:
- a change in foliage colour and or density
  - dieback or death of branches or areas of the tree canopy
  - occurrence of branch failure
  - infestation by pest species

## 7.0 Conclusions

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- 7.1 A total of six trees were assessed as part of the proposed station upgrade works. Trees 1 and 2 may be retained under the current plans. However, their retention is subject to final design of the pedestrian ramp. Trees 3 and 4 *Eucalyptus umbra* (Broad-leafed White Mahogany) and Tree 5 *Callistemon viminalis* (Bottlebrush) shall require removal. Trees nominated for removal are to be clearly identified prior to construction works commencing. All tree removal works are to be undertaken by suitably qualified tree workers (minimum AQF level 2) and in accordance with the NSW Workcover Code of Practice for the Amenity Tree Industry 1998. All care shall be taken to avoid damaging trees identified for retention during removal and pruning works.
- 7.2 Tree 6 *Cinnamomum camphora* (Camphor Laurel) may be retained and has been identified for pruning. Based on the provided plans the TPZ encroachment of Tree 2 can be managed under guidance of the project arborist.
- 7.3 TPZs are to be maintained to their fullest extent throughout the construction process to ensure construction impacts are minimised. The health and condition of trees retained on the site is to be monitored and reported upon by the project arborist throughout the construction process.
- 7.4 Replacement tree planting is to be undertaken to offset tree removals as a part of the works. Replacement planting is to be undertaken in accordance with *TfNSW's Vegetation Offset Guide (2019c)*.

# Appendices

**Appendix 1:** Tree Location Plan

**Appendix 2:** Tree Assessment Schedule

**Appendix 3:** Tree Protection Zones

**Appendix 4:** Site Photographs

**Appendix 5:** Tree Inspection Criteria

**Appendix 6:** Significance of a Tree Assessment Rating System (STARS)

**Appendix 7:** Guidance Note for Trees on development Sites



Aerial image of Narara station showing Tree locations. Source: SIXMaps accessed 28/05/20.



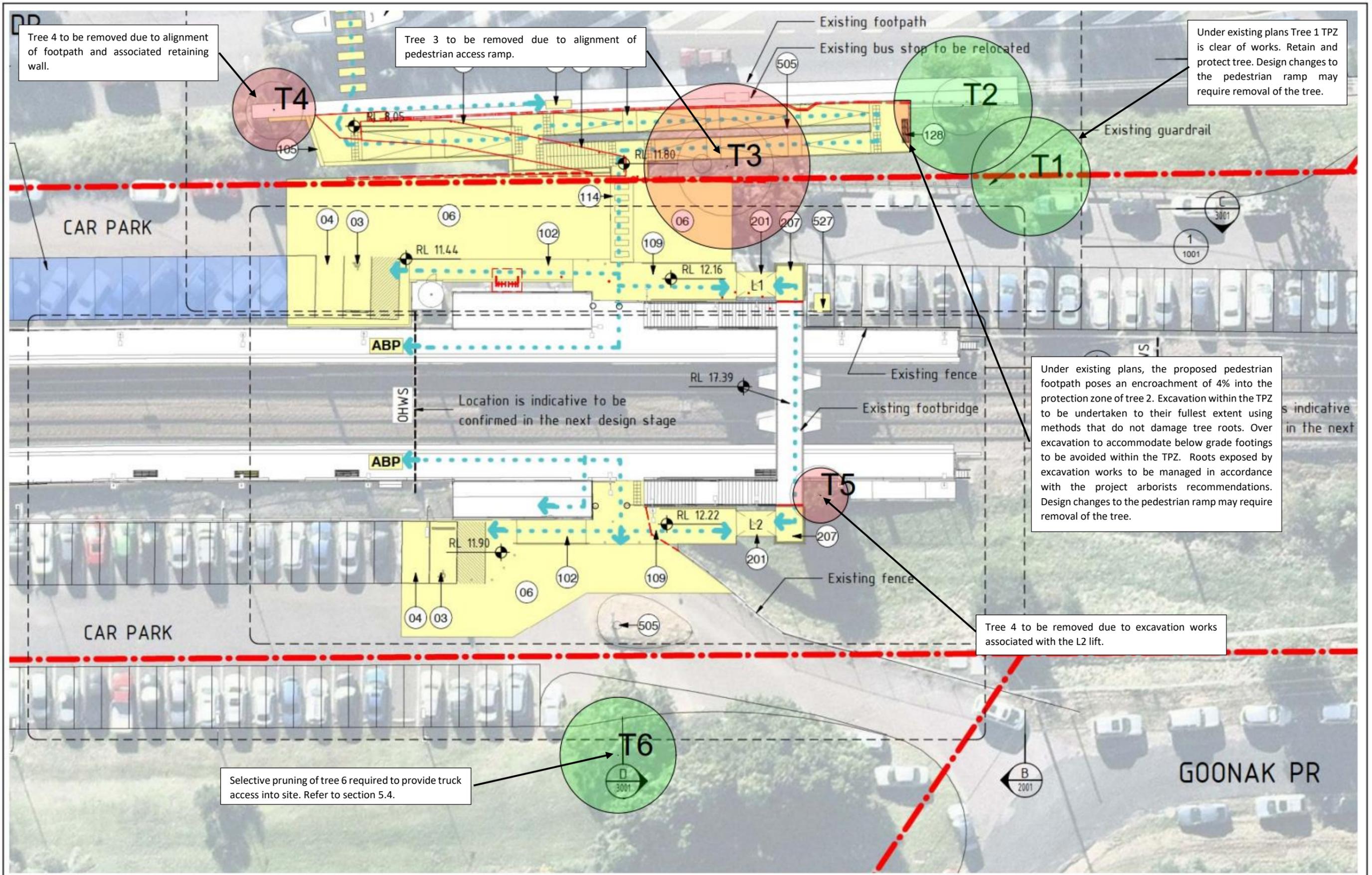
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**Appendix 1: Tree Location Plan**

## Appendix 2: Tree Assessment Schedule

Tree No	Botanical Name Common Name	Height (m)	Canopy Spread (m)	DBH (mm)	DAB (mm)	Age Class	Vigour	Condition	ULE	Landscape Significance	Retention Value	Native or Exotic	TPZ (m)	SRZ (m)	Comments	Development Impacts	Controls	Retain or remove tree
1	<i>Eucalyptus elata</i> (River Peppermint)	10-15	4x4	430	500	M	N	F	M	M	M	N	5.16	2.47	Top of tree appears to be dying off. Epicormics along trunk and around previous pruning sites. HV powerlines over tree. Slight damage around base of trunk from landscape maintenance works. Possible landscape planting.	Under existing plans TPZ clear of works. However, flexibility in the pedestrian ramp design and location may result in significant encroachments into the TPZ and SRZ.	Retain tree where possible. Monitor tree health and condition throughout construction phase. Remove tree where design changes require.	Retain
2	<i>Eucalyptus umbra</i> (Broad-leafed White Mahogany)	5-10	3x3	500	500	M	N	F	M	M	M	N	6	2.47	Tree has been lopped under overhead HV powerlines. Canopy consists predominantly of epicormic regrowth. Twiggy deadwood present throughout canopy. Slight discolouration of foliage observed during inspection.	Under existing plans, the pedestrian footpath to Narara Valley Drive and encroaches through the TPZ by 4%. However, flexibility in the pedestrian ramp design and location may result in significant encroachments into the TPZ and SRZ.	Under existing plans excavation within the TPZ to be undertaken to their fullest extent using methods that do not damage tree roots. Over excavation to accommodate below grade footings to be avoided within the TPZ. Roots exposed by excavation works to be managed in accordance with the project arborists recommendations. Remove tree where design changes require.	Retain
3	<i>Eucalyptus umbra</i> (Broad-leafed White Mahogany)	10-15	5x5	600	750	M	N	G	M	M	M	N	7.2	2.93	Pruned to provide clearance of adjacent HV powerlines. Skewed canopy has developed as a result of pruning works. Trunk develops two stems at 2m. Stem junction included. Deadwood to 60mmØ and epicormics observed within canopy.	Pedestrian footpath to Narara Valley Drive encroaches through the TPZ by 30% and is aligned within the SRZ.	Tree cannot be retained under the current design.	Remove
4	<i>Eucalyptus umbra</i> (Broad-leafed White Mahogany)	5-10	2x2	300	400	M	N	F	M	M	M	N	3.6	2.25	Tree has been lopped to provide clearance from overhead powerlines and adjacent power pole. Canopy consists predominantly of epicormics. Kink in trunk.	Front face of retaining wall located approx. 0.7m from tree within the SRZ.	Tree cannot be retained under the current design.	Remove
5	<i>Callistemon viminalis</i> (Bottlebrush)	5-10	2x2	200	300	M	N	G	M	M	M	N	2.4	2	No access to tree, assessment undertaken from station carpark. Tree likely to be self-seeded. Root system of tree likely to be restricted by adjacent below ground footings of pedestrian bridge pier and station platform. Possible self-seeded specimen.	L2 footprint occupies 3% of the TPZ. Tree likely to be within wider works area to allow for the safe operation of construction works.	Tree cannot be retained under the current design.	Remove
6	<i>Cinnamomum camphora</i> (Camphor Laurel)	5-10	4x4	240 280 210	580	M	N	G	M	M	M	E	5.04	2.63	Multi-stemmed specimen located atop of embankment. Tree species identified on Central Coast Councils Undesirable Species List and is exempt from local compliance laws when located on private property. Likely to be self-seeded specimen	TPZ clear of proposed works. Selective pruning may be required to allow for construction access into the carpark.	Selective pruning works are to be undertaken by suitably qualified tree workers (AQF 3) in accordance with AS4373-2007-Pruning of Amenity Trees.	Retain



Extract from Site Plan, drawing No TAP-150084-AR-DWG-0100. Indicative TPZ have been scaled and plotted. TPZ encroachments calculated to AS4970-2009 Protection of Trees on Development Sites.

DRAWN
DATE
SCALE

TITLE/DWG NO.

**Appendix 3: Tree protection Zones**



## Appendix 4: Site Photographs



**Photo 1:** Tree 1, *Eucalyptus elata* (River Peppermint) located adjacent the commuter car park off Narara Valley drive.



**Photo 2:** Tree 2, *Eucalyptus umbra* (Broad-leafed White Mahogany) located adjacent Narara Valley drive.



**Photo 3:** Tree 3, *Eucalyptus umbra* (Broad-leafed White Mahogany) located adjacent the car park off Narara Valley drive.



**Photo 4:** Tree 4, *Eucalyptus umbra* (Broad-leafed White Mahogany) located adjacent Narara Valley drive.



**Photo 5:** Tree 5, *Callistemon viminalis* (Bottlebrush) located adjacent the pedestrian footbridge to Platform 1.



**Photo 6:** Tree 6, *Cinnamomum camphora* (Camphor Laurel) located adjacent the Goonak Parade access to the commuter car park.

## Appendix 5: Tree Inspection Criteria.

**Tree number:** Identifying number given to individual (or group of) trees.

**Botanical Name:** Latin name for tree showing genus and species.

**Common Name:** The common name given to the tree.

**Tree Dimensions:** The physical dimensions of the tree.

- **Height:** Estimated or measured height of tree in meters.
- **Spread:** Estimated or measured radial canopy spread of tree in meters.
- **Diameter at Breast Height (DBH):** The estimated or measured diameter of trunk in given in millimetres measured at 1.4m from ground. The D.B.H of trees/shrubs with multiple or groups of stems are given as a range or defined by the number of stems using the preceding smaller text.

**Age Class:** An estimation of how old the tree is in relation to its life expectancy.

- **Young** – Age less than 20% of life expectancy of tree in situ
- **Mature** – Age 20% - 80% of life expectancy of tree in situ
- **Old** – Age greater than 80% of life expectancy of tree in situ
- **Dead** – Tree is dead

**Vigour:** Ability of a tree to sustain its life processes. This is independent of the condition of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. dormant, deciduous or semi-deciduous trees. Vigour can be categorised as Dormant, Low, Normal and High.

- **Dormant Vigour** – Determined by the existing turgidity in the lower order branches in the outer extremity of the crown, with good bud set and formation, and where the last extension growth is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.
- **Low Vigour** – Reduced ability of a tree to sustain its life processes. This may be evident by the atypical growth of leaves, reduced crown cover and reduced crown density, branches, roots and trunk, and a deterioration of their functions with reduced resistance to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.
- **Normal Vigour** – Ability of a tree to maintain and sustain its life processes. This may be evident by the typical growth of leaves, crown cover and crown density, branches, roots and trunk and resistance to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.
- **High Vigour** – Accelerated growth of a tree due to incidental or deliberate artificial changes to its growing environment that are seemingly beneficial, but may result in premature aging or failure if the favourable conditions cease, or promote prolonged senescence if the favourable conditions remain, e.g. water from a leaking pipe, water and nutrients from a leaking or disrupted sewer pipe, nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard, a tree subject to stringent watering and fertilisation program, or some trees may achieve an extended lifespan from continuous pollarding practices over the life of the tree.

**Condition:** A tree's crown form and growth habit, as modified by its environment (aspect, suppression by other trees, soils) the stability and viability of the root plate, trunk and structural branches (first (1<sup>st</sup>) and possibly (2<sup>nd</sup>) order branches), including structural defects such as wounds, cavities or hollows, crooked trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with vigour and it is possible for a tree to be of normal vigour but in poor condition. Condition can be categorised as Dead, Poor, Fair and Good.

- **Dead Condition** – Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms; Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves), Osmosis (the ability of the roots system to take up water), Turgidity (the ability of the plant to sustain moisture pressure in its cells), Epicormic shoots or epicormic strands in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a lignotuber), Permanent leaf loss, Permanent leaf wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots), Abscission of the epidermis (bark desiccates and peels off to the beginning of the sap wood).
- **Poor Condition** - Tree is of good habit or misshapen, a form that may be severely restricted for space and light, exhibits symptoms of advanced and irreversible decline such as fungal, or bacterial infestation, major die-back in the branch and foliage crown, structural deterioration from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local environment that would normally be sufficient to provide for its basic survival if in good to fair condition. Deterioration physically, often characterised by a gradual and continuous reduction in vigour

but may be independent of a change in vigour, but characterised by a proportionate increase in susceptibility to, and predation by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from, or contributed to by vigour.

- **Fair Condition** - Tree is of good habit or misshapen, a form not severely restricted for space and light, has some physical indication of decline due to the early effects of predation by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the environment essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from, or contributed to by vigour.
- **Good Condition** - Tree is of good habit, with crown form not severely restricted for space and light, physically free from the adverse effects of predation by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from, or contributed to by vigour.

**Useful Life Expectancy (ULE)** is the length of time that the arborist assesses an individual tree can be retained with an acceptable level of risk based on the information available at the time of inspection. It is a snapshot in time of the potential an individual tree has for survival in the eyes of the assessor. ULE is not static – it is closely related to tree health and the surrounding conditions. Alterations in these variables may result in changes to the ULE assessment. Consequently, the reliability all ULE assessments have will decrease as time passes from the initial assessment and the potential for changes in variables increases. ULE can be categorised as Long, Medium, Short, Remove, Young or Small.

- **Long (L)**: Trees that appear to be retainable at the time of the assessment for more than 40 years with an acceptable level of risk.
- **Medium (M)**: Trees that appear to be retainable at the time of the assessment for 15-40 years with an acceptable level of risk.
- **Short (S)**: Trees that appear to be retainable at the time of the assessment for 5-15 years with an acceptable level of risk.
- **Remove (R)**: Trees that should be removed within the next 5 years.
- **Young or Small Trees (Y)**: Trees that can be reliably moved or replaced.

## Appendix 6: Tree Significance Assessment Criteria & Retention Value Matrix

### IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) ©

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd in June 2010.

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured quantitative criteria to assist in determining the retention value for a tree. To assist this process all definitions for terms used in the *Tree significance – Assessment Criteria and Tree Retention Value – Priority Matrix*, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.

This rating system will assist in the planning processes for proposed works, above and below ground where trees are to be retained on or adjacent a development site. The system uses a scale of High, Medium and Low significance in the landscape. Once the landscape significance of an individual tree has been defined, the retention value can be determined.

### Tree Significance – Assessment Criteria

#### 1. High significance in landscape

- The tree is in good condition and good vigour
- The tree has a form typical for the species
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age
- The tree is listed as a heritage item, threatened species or part of an endangered ecological community or listed on council's significant tree register
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ – tree is appropriate to the site conditions

#### 2. Medium significance in landscape

- The tree is in fair-good condition and good or low vigour
- The tree has form typical or atypical of the species
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street
- The tree provides a fair contribution to the visual character and amenity of the local area
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ

#### 3. Low significance in landscape

- The tree is in fair-poor condition and good or low vigour
- The tree has form atypical of the species
- The tree is not visible or is partly visible from the surrounding properties as obstructed by other vegetation or buildings
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area
- The tree is a young specimen which may or may not have reached dimensions to be protected by local Tree Preservation Orders or similar protection mechanisms and can easily be replaced with a suitable specimen
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ – tree is inappropriate to the site conditions
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms
- The tree has a wound or defect that has the potential to become structurally unsound
- **Environmental Pest / Noxious Weed Species**
- The tree is an environmental pest species due to its invasiveness or poisonous/allergenic properties.
- The tree is a declared noxious weed by legislation
- **Hazardous / Irreversible Decline**
- The tree is structurally unsound and/or unstable and is considered potentially dangerous
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or in part in the immediate to short term

**The tree is to have a minimum of three (3) criteria in a category to be classified in that group.**

**Note:** The assessment criteria are for individual trees only, however, can be applied to a monoculture stand in its entirety e.g. hedge.

**Table 1.0 Tree Retention Value – Priority Matrix**

	Tree Significance					
		1. High	2. Medium	3. Low		
		Significance in Landscape	Significance in Landscape	Significance in Landscape		
Useful Life Expectancy					Environmental Pest / Noxious Weed Species	Hazardous / Irreversible Decline
	Long >40 years					
	Medium 15-40 years					
	Short <1-15 years					
	Dead or Young & Small					

**Legend for Matrix Assessment**

	<b>Priority for retention (High):</b> These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 <i>Protection of trees on development sites</i> . Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	<b>Consider for retention (Medium):</b> These trees may be retained and protected. These are considered less critical; however, their retention should remain priority with the removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	<b>Consider for removal (Low):</b> These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	<b>Remove (R):</b> These trees are considered hazardous, in irreversible decline or weeds and should be removed irrespective of development.

**References**

Australia ICOMOS Inc. 1999, The Burra Charter – The Australian OCOMOS Charter for Places of Cultural Significance, International Council of Monuments and Sites, [www.icomos.org/australia](http://www.icomos.org/australia)  
 Draper BD and Richards PA 2009, Dictionary For Managing Trees in Urban Environments, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood Victoria, Australia.  
 Footprint Green Pty Ltd 2001, Footprint Green Tree Significance & Retention Value Matrix, Avalon, NSW Australia, [www.footprintgreen.com.au](http://www.footprintgreen.com.au)

## Appendix 7: General Guidance Note for Trees on Development sites.

### 1.0 Purpose of this guidance note

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- 1.1 This guidance note details the basic general requirements that must be followed when trees are retained on and in some cases adjacent to development sites. The tree protection requirements are determined by the tree species, the existing physical constraints of the growing environment both above and below ground and the development proposal itself.
- 1.2 This guidance note should always be used in conjunction with the tree assessment information specific for the particular site.
- 1.3 The aim of this guidance note is to provide site personnel with a basic understanding of the requirements needed to successfully protect and maintain trees whilst development works are undertaken. All personnel working adjacent to or within tree protection zones must be properly briefed about their responsibilities towards the trees and their retention.
- 1.4 This guidance note is based on the Australian Standard AS4970 – 2009 *Protection of Trees on Development Sites* and AS 4373 – 2007 *Pruning of Amenity Trees*.

### 2.0 Site Personnel

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- 2.1 All site personnel including contractors are to be made aware of the relevant tree protection requirements and the role of tree protection zones on the site.

### 3.0 The project arborist

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- 3.1 A project arborist shall be engaged prior to any works commencing on the site. The project arborist shall have a minimum qualification of the Australian Qualifications Framework (AQF) level 5 in Arboriculture.
- 3.2 The project arborist is to advise on, monitor, inspect and ensure compliance where trees are retained within and where required adjacent to the development site.
- 3.3 Any work within a designated tree protection zone requires authorisation from the project arborist.

### 4.0 Tree and vegetation removal and pruning

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- 4.1 Trees and vegetation approved for removal by the relevant consent authority shall be undertaken prior to any other works commencing on site, including the establishment of tree protection zones.
- 4.2 All tree removal works are to be undertaken by suitably qualified tree workers (minimum AQF level 2) and in accordance with the NSW Workcover Code of Practice for the Amenity Tree Industry 1998.
- 4.3 In addition, all tree pruning works (including roots) are to be undertaken in accordance with the Australian Standard AS4373-2007 *Pruning of Amenity Trees*.
- 4.4 All care shall be taken to avoid damaging trees identified for retention during removal and pruning works.

## **5.0 Tree Protection Zone (TPZ)**

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- 5.1 The tree protection zone is the designated area around a tree to protect the trunk, roots and crown during development works.
- 5.2 Tree protection fencing is to be installed in compliance with Section 4 of the Australian Standard AS4970-2009 *Protection of Trees on Development Sites*.
- 5.3 The following activities unless otherwise authorised by the project arborist are restricted within the tree protection zone:
- Machine excavation including trenching
  - Excavation for silt/sediment fencing
  - Cultivation
  - Storage
  - Preparation of chemicals, including preparation of cement products
  - The parking of vehicle and/or plant
  - Refuelling
  - Dumping of waste
  - Washing down and cleaning of equipment
  - Placement of fill
  - Lighting of fires
  - Soil level changes
  - Temporary or permanent installation of utilities and signs
  - Physical damage to the trees
- 5.4 Any work within a designated tree protection zone requires authorisation from the project arborist.

## **6.0 Signage**

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- 6.1 Signs identifying the TPZ shall be attached to the tree protection fencing and clearly visible from within the development site. The contact details of either the site manager or project arborist shall be displayed on the sign.
- 6.2 Further reference to the Australian Standard AS4970-2009 *Protection of Trees on Development Sites* should be made regarding signage.

## **7.0 Tree protection fencing**

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- 7.1 Tree protection fencing is to be installed at the limits of the TPZ or as determined by the project arborist. Fencing shall consist of 1.8m high interlocking chain link or plywood fencing panels. The fencing shall be erected in such a way as to prevent building materials, soil and unauthorised personnel entering the TPZ. Refer to the diagrams at the end of this note.

## **8.0 Trunk and branch protection**

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- 8.1 Where necessary trunk protection may be required. Trunk protection is installed by first wrapping the stem of the tree in hessian or like material then strapping timber battens over the top. It is recommended that timber battens with the dimensions of length 2000mm,

width 75mm and depth 50mm are used. The battens are not to be directly screwed or nailed into the tree. Refer to the diagrams at the end of this note.

- 8.2 Where necessary branch protection may be required. Branch protection is installed in the same fashion as the trunk protection mentioned above but cut to suit the shape of the branch. Refer to the diagrams at the end of this note.
- 8.3 Reference to Section 4.5.2 of the Australian Standard AS4970-2009 *Protection of Trees on Development Sites* should be made for further details.

## **9.0 Ground protection**

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- 9.1 Where temporary access or encroachment into the TPZ is required ground protection measures are to be implemented. The purpose of ground protection measures is to avoid damage to tree roots and compaction of the soils within the TPZ. Refer to the diagrams at the end of this note.
- 9.2 Ground protection generally consists of 100mm deep layer of mulch overlaid with rumble boards or road plates (light traffic). Where heavy traffic through or over the TPZ is required the existing ground is to be protected by a geo-textile fabric covered with a 300mm layer of compacted road base or railway ballast.
- 9.3 Reference to Section 4.5.3 of the Australian Standard AS4970-2009 *Protection of Trees on Development Sites* should be made for further details.

## **10.0 Excavation within the TPZ**

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- 10.1 Excavations within the TPZ may only be undertaken under the supervision and authorisation of the site arborist.
- 10.2 All excavation within the tree protection zone must be carried out carefully using spades, forks, and trowels, taking care not to damage the bark and wood of any roots. Specialist tools for removing soil around roots using compressed air may be an appropriate alternative to hand digging, if available. All soil removal must be undertaken with care to minimise disturbance of roots beyond the immediate area of the excavation. Where possible, flexible clumps of smaller roots, including fibrous roots, should be retained if they can be displaced temporarily or permanently beyond the excavation without damage. If digging by hand, a fork should be used to loosen the soil and help locate any substantial roots. Once roots have been located, the trowel should be used to clear the soil away from them without damaging the bark.
- 10.3 Roots temporarily exposed must be protected from direct sunlight, drying out and extremes of temperature by appropriate covering.

## **11.0 Fill within the TPZ**

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- 11.1 Where possible soil levels are not to be raised within the TPZ. Retaining walls and alternate engineering solutions are to be considered to avoid over battering and encroachment into the TPZ.
- 11.2 Where fill is required within the TPZ it is to be of an approved courser material than the existing site soil and allow for free gaseous and water exchange into the natural soil profile.

## **12.0 Pier and beam footings within the TPZ**

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- 12.1 Where footings are required within the TPZ they are to be of pier and beam type construction. Excavation shall be restricted to pier/post holes only. All other footing and foundation parts shall be constructed and installed above the existing ground level.
- 12.2 Pier locations within the TPZ are to be excavated using non-destructive techniques and where possible to their full extent. Where this is not achievable a minimum depth of 600mm shall be excavated. Any further excavation that is then to be undertaken mechanically is to be of a diameter less than that excavated by hand whilst avoiding compaction of the soils within the TPZ.
- 12.3 A degree of flexibility should be built into the design to allow for the pier locations to be moved if structural or significant roots are found. A minimum clearance distance of 100mm shall be allowed around significant roots.

## **13.0 Scaffolding**

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- 13.1 Where possible scaffolding shall not be erected or installed within the TPZ nor come into contact with any part of a tree scheduled for retention and protection.
- 13.2 Where scaffolding is required within the TPZ suitable ground protection measures are to be implemented. Flexible branches shall be temporarily tied back to avoid the need for unnecessary pruning or potential tree damage. Refer to the diagrams at the end of this note.
- 13.3 Further reference to section 4.5.6 of the Australian Standard AS4970-2009 *Protection of Trees on Development Sites* should be made for further details.

## **14.0 Damage to Trees**

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- 14.1 Damage to any part of the tree including roots, bark, trunk, branches and leaf material shall be avoided.
- 14.2 Damage to trees may also be incurred by contamination of the TPZ through chemical, paint or cement wash out.
- 14.3 The ripping and tearing of roots by excavators or shovels will cause damage and potentially impact tree health. Where roots are accidentally damaged during the works they are to be exposed back to intact woody tissue and pruned in accordance with the arborist's recommendations.
- 14.4 Any damage to any part of a retained tree is to be reported to the project arborist immediately.

## **15.0 Demolition of structures and surfaces within the TPZ**

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- 15.1 The demolition of existing structures and surfaces within the TPZ is to be supervised by the project arborist.
- 15.2 Where possible existing structures are to be dismantled manually using hand tools. Demolition works should start closest to the tree and work backwards moving out of the TPZ avoiding damage or compaction to the soil. Heavy machinery such as excavators should not be used within the TPZ unless they can be positioned on and work from existing hard surfaces such as concrete slabs.

- 15.3 Tree roots exposed by the demolition of existing site structures are to be kept in place and advice sought from the project arborist.

**16.0 Soft landscaping within the TPZ**

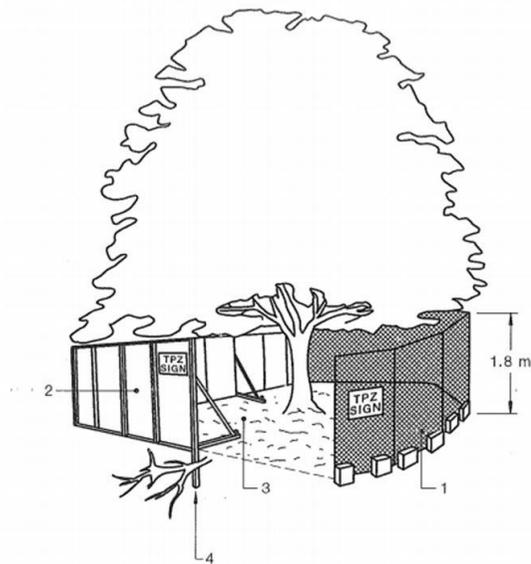
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- 16.1 Soft landscaping works are regarded as the installation of plants or organic ground covers (mulch). New tree plantings requiring excavation should refer to section 10.0 *Excavation within the TPZ*. Hard landscaping features such as retaining walls, edging and footpaths are regarded as construction works.
- 16.2 Where possible trees to be retained shall be incorporated into the landscape design.
- 16.3 Where fill is required for planting it is to be of an approved courser grade than the site soils and comply with section 11.2.

**17.0 Utilities and services within the TPZ**

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- 17.1 Where possible the installation of utilities and services are to be kept out of the TPZ.
- 17.2 Where this is not deemed possible trenchless or underground boring techniques are to be employed. Underground boring should be no less than 600mm below the existing soil level.
- 17.3 Suspension of service wires through the TPZ should be kept clear of the trees canopy and regulatory safety clearances observed.

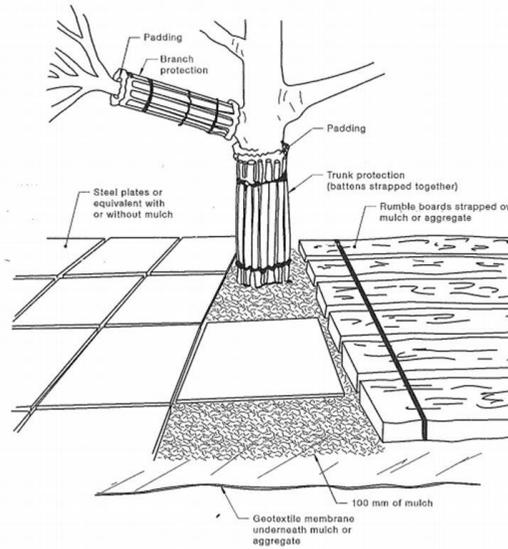


**Tree Protection Fencing**

Tree protection fencing shall comprise of interlocking wire mesh, plywood or wooden paling fence panels. The fence must be rigid and no less than 1.8m in height. AS 4687 specifies applicable fencing requirements. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area.

Legend:

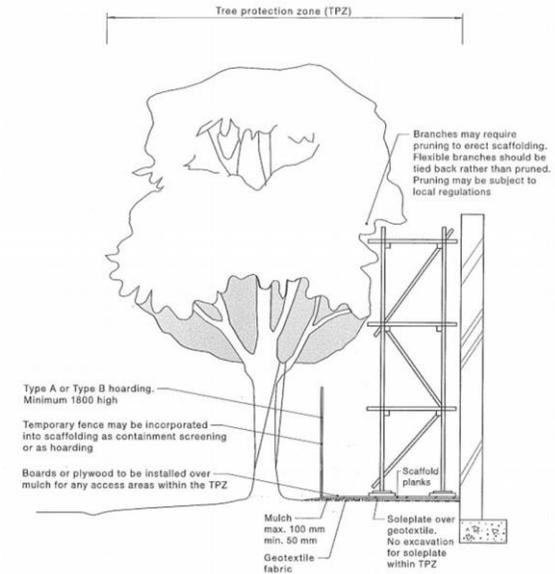
1. Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2. Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
3. Mulch installation across surface of TPZ (at the discretion of the arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.
4. Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.



**Trunk, Branch & Ground Protection**

Trunk and branch protection shall be installed as shown in the attached diagram. The materials and positioning of protection are to be specified by the project arborist. A minimum height of 2m is recommended. Do not drive nails into the trunks or branches.

If temporary access for machinery is required within the TPZ ground protection measures will be required. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards.



**Erection of Scaffolding within the TPZ**

Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimised. The ground below the scaffolding should be protected by boarding as shown in the adjacent figure.