BioDesign

Tree Assets Report

UTS Ku-ring-gai Campus
Lindfield

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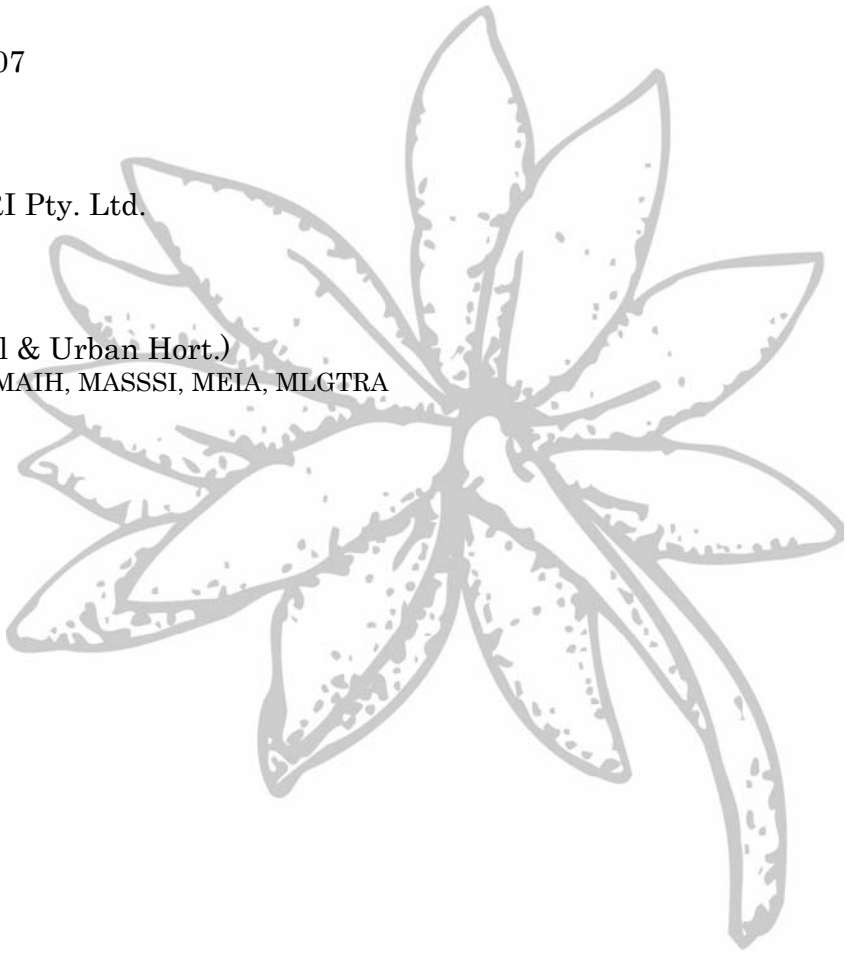

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Executive Summary

The University of Technology, Sydney (UTS) is investigating alternative uses of its Ku-ring-gai campus, including the rezoning of the site. The site contains an extensive tree cover of different species, many of them locally indigenous. The health and condition of the trees on the site varies from excellent to extremely poor (including dying or dead trees).

Trees provide valuable environmental, functional, amenity and, in many cases, ecological services. This can add considerable economic value to properties that contain or are in the vicinity of trees.

The site was assessed to try to evaluate the tree assets it contains and the likely impacts on these assets under the draft Concept Plan prepared for it. The evaluation process was based on:

1. The requirements of Ku-ring-gai Council's Tree Preservation Order.
2. Structural soundness, health and vigour of trees.
3. Likely contributions the trees are making to the benefit of natural resources (soil, air, water and biodiversity) and to the area in terms of micro-climate, shading and windbreaks.
4. Value, condition and viability of the ecosystem context of the trees, including potential use by endangered species.
5. Level of management and maintenance needed for a tree to achieve a safe, useful life expectancy of at least ten years.
6. Contributions of trees to landscape amenity (screening, shade, visual interest and spatial definition).

Vegetation values were given for the canopy cover on the site on the basis of the number of trees in defined areas that rate highly on all or most criteria and could therefore be retained and managed to provide valuable specimens for a useful period. The rating process took into account whether the existing substantial trees could be managed to maintain or achieve high ratings in the future.

The findings of the tree assets assessment were used to develop the final Concept Plan for the site. Significant modifications were made to the draft concept, including the relocation of proposed building footprints and revision of proposed subdivisions based on the values of stands of trees or individual specimens. The proposed lay-out for the sub-division and development of the site will, to a good extent, take advantage of the tree assets. Protection and preservation of significant individual trees will be determined by decisions made at the approval stage for development applications for specific properties created by sub-division of the site.

Trees are a valuable asset on this site but many of them are suffering due to site impacts and management constraints. Many trees are deteriorating due to the impacts on their ecosystem from run-off, weed invasion and lack of bushfire. In vehicular access and car-parking areas, there are many trees with wounded stems and root systems. Despite this, there remain many substantial, healthy trees in most parts of the site. Under the Concept Plan, it should be possible to retain many of them, provided a careful design approach and effective tree protection and management measures are taken.

An arborist should participate in the site assessments and preliminary design stages to enable development of individual site lay-outs and design proposals based on protection and preservation of tree assets in accordance with regulatory requirements.

The establishment of the Asset Protection Zone for bushfire management should take into account the condition of individual trees within it to retain valuable trees for future benefits. An arborist should be consulted at the planning stage to determine which trees should be retained. This will require individual tree assessments based on the Guidelines for Asset Protection Zones (NSW Rural Fire Service June 2003) or any updated information as specified by NSW Rural Fire Service.

Where possible, trees should be retained for their landscape amenity values. This may require manipulation of building and infra-structure lay-outs in the design development stage.

Where trees are to be retained as part of existing or proposed landscape treatments, they should be individually assessed by an arborist and managed according to any specifications arising from the assessment.

Plantings around the oval form a distinctive line that defines this area. Whether it will contribute to the landscape function and amenity under the development proposal will be an issue for the landscape designer to consider. These trees have been proposed for retention under the final Concept Plan, however, individual assessments may identify specimens that should be removed or replaced.

Replanting of the entrance avenue would be required to achieve plantings that contribute better to the ecological integrity of the site. The removal of any substantial, healthy trees should be on the basis of making space for plantings of substantial canopy specimens of more appropriate species.

The detailed design stage should involve collaboration between the engineers, designers and an arborist, to ensure valuable trees are retained. Specifications for their protection during construction should be developed.

If the sub-division goes ahead, some of the existing trees within the development area will be lost. However, in many, if not all cases, their retention in the long-term (beyond 15 years) may not even be viable under the current management and usage of the site. The development of an Urban Forest Master Plan (based on the principles of urban forestry as applied in the USA and Asia) for long-term preservation of tree assets on the site is recommended as part of any development strategy.

1 Introduction

1.1 Purpose

This report and the Tree Assets Plan that forms part of it were commissioned CRI Pty Ltd as part of the asset assessment process for the University of Technology, Sydney's (UTS) Ku-ring-gai Campus. UTS is currently investigating its options for the use of this site, including rezoning for residential and associated uses, with the adaptive re-use of existing buildings. The site contains a substantial number of trees. Assessment of their values and significance was commissioned to help prepare an Concept Plan for the sub-division and development of the rezoned site.

Ku-ring-gai Municipal Council is the assessment authority for the rezoning application. In assessing the proposal and making a determination about the application, Ku-ring-gai Council's responsibilities will include the protection of tree assets in the local government area.

This site contains remnant bushland linked to extensive areas under other ownership. The natural values of the site and the surrounding areas are recognised by the local community and, through the Department of the Environment and Conservation (DEC) (formerly National Parks and Wildlife Services NSW), the people of Sydney and New South Wales. Planning for the retention of trees that occur in remnant vegetation is based on values and management needs that are different to those required for trees protected under Tree Preservation Orders. The management needs of the remnant bushland on the site are not dealt with in this report. The report deals with areas already developed and areas that were proposed for development under the draft Concept Plan, including those in the final Concept Plan.

The purpose of this report and the Tree Assets Plan is to enable the owners and managers, Ku-ring-gai Council and the community of stakeholders to make decisions about the future of the site based on an understanding that includes the existing tree assets. The report provides advice on how tree assets might be managed to improve long-term outcomes for the site.

The proposed development footprint indicated in the draft Concept Plan (DEM 21/1/2004) was used to identify the likely impacts on existing tree assets and to provide guidance on developing site lay-outs and uses that take better advantage of those assets.

Development of the final Concept Plan included consideration of the findings of this report. It respected the recommendation that particularly valuable stands of significant trees be retained. It also proposes a revised subdivision that allows for a lay-out of buildings in areas containing trees that will enable most significant specimens to be retained.

If the plan is implemented, the ultimate success of any attempts to preserve the tree amenities on the site will depend on: (i) the development approval process; (ii) site management during construction; and (iii) on-going management of trees on the site.

1.2 Background:

The physiological processes of trees are crucial to the health of the earth's biosphere, especially for humans. The environmental services that trees provide include contributions to the earth's climate, atmosphere, water quality and soil resources. Large, mature trees sequester carbon by growing wood. They also utilise large amounts of water that is largely recycled into the atmosphere; this process contributes substantially to the hydrology and water quality of catchments containing trees. Trees build, stabilise and maintain soils. Soils play an important role in environmental health.

The value of trees is widely acknowledged by Australian governments. In New South Wales (NSW), the Environmental Planning & Assessment Act, 1979 (EP&A Act) provides for the protection of trees by local government authorities. The Local Environment Plan (LEP) for a local government area provides for the management of trees under the Tree Protection Order (TPO).

Trees provide different types of services to sites, including:

- environmental benefits to natural resources such as air, water and soil;
- functional roles that facilitate and improve site usage; and
- aesthetic qualities that improve the amenity and enjoyment of a landscape.

In the case of some trees, especially those that occur naturally in the locality, they frequently contribute positively to the health and function of local ecosystems and to the preservation of biodiversity.

The scale of each contribution depends on the nature of the service. Environmental and, usually, ecological services are greater when larger numbers of organisms and larger areas and volumes of spaces are involved. Functional roles of trees relate directly to the use or purpose of the related space and the role of different components within it. Landscape amenity values of trees are frequently a function of their context; they may be very high for a single tree in an urban situation but minor for an individual tree in a substantial grove in a park or a 'natural' landscape.

When making decisions about trees, local government authorities must consider such factors as: hazards to human health and safety, damage to buildings and infra-structure, threats to agriculture, protection of biodiversity and impacts on climate and natural resources. These are key issues addressed by legislation and planning instruments. In preparing this report, the following legislation, policies and guidelines have been taken into account:

- EP&A Act (1979)
- Ku-ring-gai Council's Tree Preservation Order
- Ku-ring-gai Council's Tree Management Policy
- Planning for Bushfire Protection (PlanningNSW & NSW Rural Fire Service, 2001)

- Threatened Species Conservation Act (1995)
- NSW Water Act (2000)
- Noxious Weeds Act (1993)
- NSW Heritage Act (1977)
- NSW SEPP 19 (Bushland in Urban Areas)

Ku-ring-gai Council has developed a Tree Management Policy (TMP) that outlines the values Council places on trees and establishes standards and a framework for preservation of tree amenity values in the municipality. This document was referred to in order to determine which trees on the site should be included in the assessment and for establishing key assessment criteria based on council's identified priorities. Appendix 1 contains the issues and points in the TMP that are considered to be pertinent to this site.

Trees in urban landscapes require on-going monitoring and management for health, safety and amenity. Good tree management takes into account:

- Public health and safety
- Environmental health
- Biodiversity
- Protection of property and assets
- Economic considerations
- Landscape function and amenity

The costs of maintaining unsound trees and of removing hazardous or dead specimens can be considerable, particularly in situations where infra-structure or buildings exist. The site is currently used as an educational institution servicing a student and staff population of approximately 3,500 to 4,000 people. Under the proposed Concept Plan, the site would be used for mixed-density housing ranging from single dwellings to medium-density apartments and adaptive re-use of existing buildings. The proposed development will enable greater ease of human access to and use of an increased area of the site. Any increased usage of the site would have attendant increased risk rates. However, CRI has advised that population numbers are expected to decrease on the site to levels around 2,000, depending on the reuse of existing buildings.

The site is located in an area of high natural and ecological values. The local community includes members with an active interest in the protection of these values. The site contains areas of remnant native vegetation and areas of landscaping that link to the native vegetation. The trees on the site form an intrinsic part of the whole. Threatened species are known to occur on or use parts of the site (ERM 2003). The natural values of the site contribute to its environmental and landscape amenity.

In natural[1] ecosystems trees are subject to inherent impacts that include damage incurred in natural events like bushfire, storms, winds, rockfalls, lightening strikes

[1] For the purposes of this report 'natural' refers to remnant native landscapes not subject to maintenance for a high level of human access and/or use.

and floods. Trees, particularly some of the species on this site, drop branches as part of their survival mechanisms to deal with stress from drought, waterloss, structural overload and winds. Competition between plants, particularly trees, results in unbalanced or restricted growth that affects individual vigour, form and structure.

These factors usually result in trees with structural and health problems that would be unacceptably hazardous in the vicinity of people and property. It also usually reduces their accepted amenity value as landscape specimens. In natural ecosystems, trees affected by these impacts provide valuable resources for other organisms.

It is possible that *Phytophthora cinnamomi* is present on the site. *P. cinnamomi* is a soilborne pathogen that has been introduced to Australia and is causing serious problems to native vegetation (Plant Disease Diagnostic Unit http:www.rbgsyd.gov.au/information_about_plants/pests_diseases/fact_sheets/phytophthora_root_rot Accessed: 2/3/2004). It is listed as a key threatening process in NSW national parks. The disease damages the roots of susceptible plants, preventing them from absorbing water from the soil. The results are dieback and eventually death. Although symptoms of affected plants can indicate the likely presence of the disease, establishing *P. cinnamomi* as the cause of dieback or death of vegetation requires laboratory testing.

Good tree management practice incurs on-going costs and resource use. Trees have natural lifespans that should be taken into account when planning for the preservation or establishment of trees in urban environments. Hazardous, decaying or senescent trees require a high level of monitoring and management in areas used by people.

Management of landscapes for productivity and health requires management of weed species, including trees. The Noxious Weeds Act deals with the problems of invasive plants and the level of control required for each species. Local governments are responsible for the listing of weeds affecting their area.

The dominant communities of the native vegetation on the site and its environs require fire regimes to survive as ecologically distinct communities in the long term. The urban context of the area imposes constraints on the use of fire as a tool for biodiversity management. Unmanaged fire regimes are regarded as unacceptable. Legislation to manage development in areas of high bushfire risk affects this site. Guidelines for landscape management in areas of bushfire risk include specifications relating to trees.

The development of this site for use as an educational institution involved an enlightened approach to the preservation and protection of the natural vegetation, including trees, on the site. The site is an example of an urban development that has taken into account the value of existing natural heritage assets.

SEPP 19 “Bushland in Urban Areas” applies to publicly-owned land that contains greater than 5 hectares of remnant natural bushland. The site is not publicly-owned land. However, it adjoins areas that may be covered by the policy and responsible management of trees on the site includes consideration of the health of the adjoining ecosystem.

1.3 Site Description

The site is located in the Ku-ring-gai Municipality on the escarpment above Lady Game Drive opposite Lane Cove River National Park. It is situated in an urban area that contains extensive remnant bushland. Part of the site adjoins Lane Cove River National Park. Blue Gum Creek flows through the valley below the site to the south.

The site is in the Harbour Foreshores region of the Sydney 1:100 000 soil landscape sheet (Chapman and Murphy 1989). This region is underlain by Hawkesbury sandstone. The soils of the site are of the Hawkesbury landscape, which is characterized by rugged, rolling to very steep hills on Hawkesbury Sandstone with many rock outcrops. These soils are typically shallow, stony, highly permeable and of low fertility.

The topography of the site is typical of the Harbour Foreshores region: it includes the narrow crest of the ridge that drops away steeply to a narrow, incised valley floor below, with rock platforms and small escarpments breaking its steepness.

The site is surrounded by:

- residential development to the northwest, north and northeast;
- the offices of Film Australia Pty Ltd to the north;
- Lane Cove River National Park to the east, south and south-west; and
- bushland in the care of Ku-ring-gai City Council to the west.

The previous development of the site has altered the landform and soil environment in places. Terracing for carparks, sportsgrounds, small landscape areas and the buildings has occurred, with levelling for associated access roads. Impacts on soils on the site are due chiefly to eutrophied and polluted run-off from carparks and the lawns and turfed areas. This is contributing to degradation of the affected landscape areas by promoting weed establishment and causing plant deaths due to unacceptable nutrient and pollutant regimes.

Due to its topography and aspect, the environmental conditions vary across the site. The higher sections of the site are well-drained and generally exposed to full sun and prevailing winds. The lower areas contain slightly more sheltered conditions and pockets of moister soils. The gullies of the site contain moister, deeper soils and provide more sheltered conditions.

The vegetation and landscape plantings of the site consists mostly of remnants of the bushland that occurs in the undeveloped surrounding areas and that was present on the site at the time of its development as an educational institution (Mackenzie 2004). Very little planting was done at the time of landscape establishment, most of the plantings are the product of natural regenerative processes. The vegetation types and tree species are consistent with expectations based on soil maps and local environmental conditions.

Vegetation associated with the Hawkesbury sandstone soil formations usually requires a fire regime[2] to support its on-going ecological health and functioning. In urban areas, building appropriate fire regimes in native vegetation management is not yet possible. The site is in an identified area of bushfire risk and constraints will be imposed on the landscape design to address the management of bushfire. Bushfire risk management practices and landscape maintenance will be factors in deciding the long-term ecological success of the indigenous landscape plantings of this site.

2 Aims

Clear aims were established prior to the assessments. They were:

1. To document the tree assets of the areas of the site either already developed or proposed for development in the draft indicative development scheme and to determine how development as laid out in the draft Concept Plan will impact on them. Documentation was to include the identification of areas where trees are a valuable asset in terms of environmental, landscape amenity, ecological values, heritage significance or functional services for hazard management.
2. To enable UTS to comply with Ku-ring-gai Council's regulations and policies.
3. To enable UTS to participate in community goals for the preservation of natural values through the development of a concept for the site that takes advantage of tree assets.
4. To identify any problems relating to the trees on the site, including:
   - disease and/or structural instability
   - weed invasion issues that may have a potentially negative impact on the landscape; and
   - fire management issues.
5. To make broad recommendations about the management (retention, removal, remedial treatment) of tree assets in relation to development permissible under the proposed rezoning.

3 Methods

Tree assets on the site were evaluated using a number of different value criteria. All rated areas were accessed. Aerial photographs and views into areas were used to support the findings.

The requirements of the NSW Heritage Act (1977) are not addressed in this assessment. The reported presence of threatened species (ERM 2003) on the site was noted and considered under ecological values but the requirements of the Threatened Species Act are not addressed in this report. They are dealt with in a separate report (ERM 2003).

[2] Fire regimes involve frequency and intensity of burns and have different effects depending on the season and weather associated with the burn.

The assessment involved:

- Preliminary assessment of the site to establish the existing context of the trees and the likely impacts under the proposed usage of the site as shown in the draft Concept Plan (DEM 21/1/2004).
- Identification of landscape units for assessment purposes on the basis of the proposed use under the draft concept, the characteristics of the existing vegetation and landscape contours.
- Development of assessment criteria for the tree assets in the landscape units.
- On-site assessments of the tree assets and identification of trees considered significant or problematic.
- Analysis of data.
- Visual summarisation of the tree assets in each landscape unit with notes on significant or problematic trees.
- Preparation of a report on the findings of the assessments and providing recommendations for future management of tree assets on the site.
- Input to the development of the final Concept Plan in relation to tree management based on the assessment findings.

The development of assessment criteria for the site took into account:

- The contribution the existing trees would make to the value of the property under the draft Concept Plan (DEM 21/1/2004)
- Ku-ring-gai Council's responsibilities, regulations and policies relating to trees (Ku-ring-gai Council 1999; Ku-ring-gai Council 2003)
- Other relevant legislation
- Possible issues of concern to some members of the local community (pers. comm. A. Petousis and G. Baxter, CRI, to S. Hobley 13/1/2004)
- The site and its context
- Potential costs of managing the existing trees under the draft Concept Plan should it be implemented
- Ecological report on the site (ERM 2003)
- Tree issues in environmental and urban landscape design and management

An aerial photograph of the site (provided by CRI Australia Pty Ltd, 20/1/2004) was used to determine vegetation cover and connectivity and to provide primary data on the quality and characteristics of the tree cover.

The plan of site with mapped tree cover derived from the aerial photograph and contour information (DEM 21/1/2004) was used for orienteering purposes and the recording of data.

Information obtained from Bruce MacKenzie, the original landscape architect, on the history of the site and its development as an educational institution was referred to (Mackenzie 2004; Mackenzie 2004; Mackenzie January 2004).

A data collection sheet was developed to enable consistency in assessment and recording of data (see Appendix 2). The sheet was prepared on the basis of compliance with Ku-ring-gai's Tree Management Policy and Tree Preservation Order and in accordance with current principles and 'best' practices of urban arboriculture and environmental horticulture.

Site visits were conducted on January 16th and 23rd 2004 to evaluate the site in terms of landscape units and context of the proposed site lay-out and use. Vegetation assessments were conducted on the 27th and 31st January and February 1st 2004. Further visits were made on February 10th and 12th and March 24th to evaluate the documentation and mapping based on the results of the data analysis. Inaccessible bushland on steep areas of the site not proposed for development under the draft Concept Plan was not assessed.

The criteria used to assess the trees were:

1. **Trees subject to Ku-ring-gai Council's Tree Preservation Order.** Trees of at least 5 metres in height with a canopy spread of 4 or more metres were evaluated. Council's Tree Management Policy classes trees as significant if they are substantial specimens (trees that are "prominent in the landscape; healthy and stable; have a trunk diameter of more than 250mm; and/or are rare or uncommon species").

2. **Potential risks to people's safety.** Structurally sound trees in good health rated the highest. Use of the area containing the trees was considered. Structurally unsound trees in areas of proposed frequent use by people rated lowest.

3. **Environmental services provided by trees.** Large, healthy trees that improve the health and/or preservation of resources such as soil, water, and air, and contribute positively to the area in terms of micro-climate, shading and windbreaks rated highest. Mature trees that contribute to carbon sequestration[3] rated highly.

4. **The health, integrity and long-term viability of the ecosystem.** Trees in weed-free, species-diverse vegetation were rated highly. The presence or potential use of the area by threatened species was included. Fire requirements of the ecosystem were taken into account. It is noted that most of the vegetation on the site depends on bushfire for its long-term viability.

5. **Potential need for tree management to protect infrastructure and property.** Trees with structural problems, dead limbs and decay were given a low rating. Trees that require remedial work, such as the removal of dead limbs, but otherwise appeared sound and healthy were given a medium rating.

[3] Through the storage in wood of carbon obtained from atmospheric carbon dioxide, trees contribute to reversal of the greenhouse effect.

6. **Contributions to landscape amenity.** Healthy, well-positioned trees of good form and scale that provide landscape services such as screening, shade, visual interest, spatial definition and/or interest rated highest. Trees in dense stands and unable to achieve suitable form or dimensions due to competition were rated low.

Data was collected on-site and documented in writing. Estimates were made in each landscape unit of the percentage of trees that would be worthy of retention for use in an urban landscape to provide high environmental and amenity values with low management costs. Due to the character and context of the landscape, ecological values of the trees were considered in the assessment. They are discussed in the assessments for each landscape unit. On the Tree Assets Plan they are encompassed in the environmental and amenity values.

Data was summarised graphically on a coloured plan of the existing site lay-out with the draft Concept Plan superimposed. The indicative asset protection zone (APZ) for bushfire risk management was hatched to enable assessment of its impacts on tree assets. Tree cover of the site was rated and colour-coded on the basis of the estimated percentage of substantial or significant trees (as defined in Ku-ring-gai's TMP) considered to be worthy of retention on the grounds of all values assessed. Trees considered suitable for retention are those that could probably be managed to provide a safe, useful life expectancy of upwards of 10 years[4] in areas of regular human use. The rating incorporated the likely needs for on-going management for safety of the trees. Areas containing trees and/or vegetation that are in poor or moderate condition but which are considered valuable for their landscape amenity are distinguished as highly significant.

The ratings given were:

- Very good: more than 75% of the significant trees rated highly on all or most assessment criteria and could therefore be retained and managed to provide valuable specimens for a useful period.
- Good: 50% to 75% of the significant trees rated highly on all or most assessment criteria and could therefore be retained and managed to provide valuable specimens for a useful period.

[4] The concept of safe, useful life expectancy (SULE) as a tool for evaluating trees in urban environments was developed by Jeremy Barrell, a UK arborist (Barrell, J. 2001). It is widely used in Australia and establishes short (less than 5 years), medium (5 to 15 years) and long (upwards of 15 years) life expectancies for trees in terms of their safety, management costs, benefits to landscape amenity, and species lifespans in relation to the environmental impacts of their location. I have selected a SULE of 10 years as acceptable grounds for retention on the basis of that being a reasonable period during which replacement trees could be established on the site to maintain the existing level of canopy cover by healthy, significant trees. The species of trees on the site generally attain a size that renders them subject to tree preservation orders and achieves a useful amenity value beyond the local site context within 10 years.

- Moderate: 25% to 50% of the significant trees rated highly on all or most assessment criteria and could therefore be retained and managed to provide valuable specimens for a useful period.
- Poor: Less than 25% of the significant trees rated highly on all or most assessment criteria and could therefore be retained and managed to provide valuable specimens for a useful period.
- Highly significant: contains no significant trees or less than 50% of the significant trees rated highly on all or most assessment criteria but the landscape is of high significance in relation to the buildings and existing uses of the site.

Trees were not counted and individual trees were not identified in the documentation. The number and planting densities of significant trees varied from area to area. High-rating significant trees were located at random within each area. The plan is indicative of the values of existing trees in the area and enables understanding of how they would be affected under the Concept Plan due to proposed building or possible development under the proposed subdivision.

4 Results

Twenty six (26) landscape units (numbered as A to X, the Asset Protection Zone and the existing university buildings) were identified (see Appendix 3). The assessments of each landscape unit are detailed below and summarised in the Tree Assets Plan. The uses of the different units varies from high frequency vehicular and/or pedestrian access to unused by humans. All areas of the site are affected to a greater or lesser extent by urban impacts due to such factors as water run-off, air pollution and interference with ecosystem function due to exotic organisms.

The site has an extensive vegetation cover that includes many substantial trees, small trees and understorey vegetation consisting of shrubs, grasses, herbs and vines. Trees are the most significant component of the landscape on most of the site and trees provide canopy cover to most outdoor areas (see Tree Assets Plan). The sportsground oval (landscape unit Q) and the tennis courts (landscape units I and J) only have tree cover around the perimeters. The edges of roads and carparks are generally overhung with trees. The landscape unit identified as the existing university buildings only contains a few trees.

The planting densities of substantial trees vary across the site, depending on such factors as age (which is influenced by lack of disturbance from fire or development), soil and environmental conditions, competition between plants, and landscape management practices.

Most substantial trees on the site are indigenous to the locality and occur as part of the natural vegetation that was retained and protected on the site when it was developed as an educational institution. Some are the result of regeneration and of plantings of indigenous species that occurred after completion of the first stage of the development. A small number of exotic trees and species not indigenous to the locality but native to

Sydney or other parts of Australia have either been planted or have established on the site.

The condition of the trees on the site varies according to their location and context and to tree management practices that are either appropriate or acceptable on the site under its current uses. Many parts of the site are not developed for human access and do not require management for hazards associated with such uses. Most of the landscape of the site is 'natural' in the sense that it is the result of preservation of extant vegetation during development or of the regeneration of that vegetation subsequent to the development works. It does not appear to have been subject to a high degree of tree management for amenity values.

Very few trees on the site were free of any problems that result from their association with unmanaged[5] bushland. Most of the large, old trees contain deadwood, cavities and structural weaknesses. In areas where regeneration has occurred in the absence of bushfire, dense growth of spindly, sparsely-canopied trees has resulted. Some parts of the site contain remnant vegetation that does not include substantial trees subject to Ku-ring-gai Council's TPO.

Many trees in carparks and along roadways have been damaged by vehicular traffic. Some have problems with root development associated with retaining walls, gutters and hard surfaces.

Where run-off occurs down natural or constructed drainage lines on the site, tree dieback and deaths are occurring. It was not determined whether *Phytophthora cinnamomi* was contributing to these problems.

Weeds are invading via drainage lines and in many areas bordering hardscapes. Some weed species reduce the vigour and viability of large trees and this is a threat to some trees on the site.

The condition of the trees is not uniform across the site or within landscape units (see Tree Assets Plan). Trees that are healthy, sound and well-formed, with a likely safe, useful life-expectancy of greater than 10 years (and therefore considered retainable in areas of high human use) are present in nearly all sections of the site. In some areas they represent the majority of the substantial trees, in others they are a small minority of existing trees.

Areas where more than 75% of the substantial trees are considered worthy of retention due to their condition and amenity value are located in landscape unit H and the related section of the Asset Protection Zone (APZ), landscape units W, V and X; and a small area in the south-east of the APZ. This vegetation category is coloured dark green on the Tree Assets Plan.

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[5] This does not necessarily include lack of bushfire management. Bushfire prevention and control measures are standard practice in urban environments.

Areas where more than half but fewer than 75% of the substantial trees are considered worthy of retention due to their condition and amenity value are located in landscape units A, B, C, E, F, G, H, K, L, N, O, P, R, S, T, U, V, W, X and the APZ. This vegetation category is coloured mid-green on the Tree Assets Plan.

Areas where less than half but more than 25% of the substantial trees are considered worthy of retention due to their condition and amenity value are located in landscape units A, D, E, F, G, H, I, J, L, N, O, R, S, T, U, V, W and the APZ. This vegetation category is coloured yellow on the Tree Assets Plan.

Areas where fewer than 25% of the substantial trees are considered worthy of retention due to their condition and amenity value are located in landscape units A, B, D, F, G, J, L, M, O, R, U and the APZ. This vegetation category is coloured red on the Tree Assets Plan.

Some areas of the site contain landscapes that are highly significant due to their functional role in defining spaces and access on the site and in their contribution to the character of its spaces. Many of these areas consist of tree populations with fewer than 50% that would be retainable on the values measured. Some contain no substantial trees. These areas have been identified as highly significant on the Tree Assets Plan and coloured blue.

5 Discussion

Ku-ring-gai Council's Tree Preservation Order and Tree Management Policy apply to many trees on this site. A count of the trees was not attempted, due to the large number involved, the difficulties of access in parts of the site and the purpose of the assessment. The Tree Assets Plan is indicative; accurate tree surveys and detailed assessments are required to make determinations about individual trees on the site. It is expected that this will occur as part of the development application process.

The assessment dealt with trees generally, in terms of their contribution as assets to the site, not with the condition of individual trees or of remnant bushland. However, due to the nature of the landscape, the assessment process took into account the ecological context and issues of ecosystem health in relation to the tree assets.

The assessment of the tree assets was in relation to the concept for development of the site under the proposed rezoning, not of the existing use. However, the management of trees under the existing use has led to impacts on them that will determine their viability on the site under any use. The long-term survival of many trees is unlikely under the existing use and management regime.

Trees are providing a range of different environmental, functional and landscape amenity services to varying degrees across the site. Many parts of the site are stabilized by trees and they play a significant role in hydrology involving natural flows. In the areas developed for use by people and vehicles, trees contribute to screening, definition of spaces, creating a sense of intimacy and of arrival, and indicating directions for movement through the site. Trees provide shade and windbreaks to many areas. The landscape of the site has a 'natural bushland' character that is due in large part to the species of the existing trees and their relationship to the remnant ecosystem of the locality.

The scale of the environmental contribution of trees on this site is substantial when considered in terms of the ratio of trees to resources used by humans on this site[6]. The removal of individual trees will incrementally erode the value of the environmental services that derive from the presence of trees on this site.

The scale of their functional services is high on the parts of the site serving its use as an educational and conference centre with sporting and childcare facilities. The removal of individual trees may impact on the function of some landscape plantings.

The scale of the contribution of individual trees to amenity values on the site is very small. There is a large number of trees and they mostly occur in clumps or extensive, informal plantings. A few line or avenue plantings occur along roadways and within carpark areas. The loss of individual trees would generally have minimal impact on the

[6] Consider, for comparison, the City Campus of UTS where very few trees occur and a much higher population uses the site.

integrity of the amenity value of the plantings in which they occur. In many instances, removal of the trees that are in poor condition would improve the amenity of the landscape.

Development amongst existing, mature trees in urban areas results in risk management problems. This is the existing situation on this site. Increasing the built-upon and accessed areas of the site for residential purposes will increase the requirements for risk management of trees to protect people and property. The suitability of many the trees on the site for retention in areas regularly used by people is generally not high. Under the proposal, hazard management of trees will need to be substantially increased.

Selection of trees for retention should be on the basis of their health and viability rather than their location. The development of the lay-out and installation of utility services should take individual, valuable trees into account. This should be done during the sub-division stage and applied to development applications. To achieve this, the proposed sub-division will need to be modified in many of the landscape units and relocation or design modification of some of the proposed apartment buildings is advisable.

Development of future landscape objectives for the site should be based on the biological and ecological needs of the trees that are to be retained. Therefore, the landscape objectives would have to provide for plantings that are locally indigenous and suited to the soils and localized environmental conditions in different parts of the site. The existing character of the landscape is in large part due to the retention of the indigenous trees on the site and this should be respected.

Management of the Asset Protection Zone will require management of understorey vegetation and the removal of some trees[7]. However, it should be possible to retain many trees in the APZ. The retention of trees will need to be on the basis of risk management to minimise fuel loads and ignition potential. It should take into account the health and condition of individual trees. The retention of structurally unsound trees is acceptable in APZs and this enables the preservation of some trees for their ecological services in providing habitat and nesting sites to animals.

In considering the future of the trees on the site, regardless of whether its use changes or not, the problems of managing them in their remnant bushland context must be included. The remnant bushland of the site is unviable unless it is relieved of the current deleterious impacts it is subject to. It needs a fire regime suited to its floristic requirements; run-off and stormwater need to be managed differently; weeds need to be removed and controlled; exotic species that out-compete or displace indigenous flora, fauna and other organisms need to be controlled (for example the bees); and human impacts need to be managed better.

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[7] The requirements for managing trees in some sections of APZs include the removal of trees where canopies are touching or continuous.

Under the final Concept Plan, the potential for improved management of stormwater exists. This would result in substantial reduction of soil disturbances and weed dispersal and should thus allow a productive bushland management regime to be developed and implemented. The use of fire as a tool for maintaining the remnant vegetation would need to be explored with DEC and Rural Fire Services (RFS).

6 Conclusions

The site contains valuable tree assets that are increasingly being degraded and reduced due to their current context, use and management regime; the impacts from vehicles; run-off; and lack of bushfire.

Lack of bushfire and invasion by weeds present serious threats to the on-going integrity of the remnant bushland landscape on the site. Increased development of the site will need to address these threats through carefully targeted planning and management.

The development of a suitable lay-out for future buildings that responds to and takes advantage of trees in groups or of individual specimens is required for all areas of the site. The proposed sub-divisions for housing lots will need to take advantage of tree assets.

Several locations on the site have tree assets that should be preserved. The landscape plan should specify treatments and uses suitable for their on-going health. The landscape amenity of this approach would increase property values on the site.

The establishment of an Asset Protection Zone to support further development of the site should take into account the existing trees and target the healthy, stable and most attractive specimens for retention.

Any further development on the site must take into account issues of tree management. This includes protection of their root zones, stems and other above-ground parts. The indigenous trees on the site have specific edaphic and environmental needs, so tree management must include management of the soils and site hydrology on behalf of the species involved. Planning for the long-term preservation of the tree assets is needed, regardless of any proposed development of the site.

The plan is indicative only; accurate tree surveys and detailed assessments will be required at development approval stage to make determinations about individual trees on the site.

7 The Final Concept Plan

The final Concept Plan was prepared after consultations that included the findings of the tree assets evaluations. It has been substantially modified. The Concept Plan now provides a response that is sensitive to the findings of the tree assets evaluations discussed in this report.

1. The proposed building footprints have been reduced from the original proposals. This will result in the substantial preservation of identified valuable tree assets on the site.
2. The lay-outs proposed for residential houses in the north-west and north-east of the site will result in the retention of most of the significant trees in these areas.
3. The area containing many significant trees in the central west of the site will be substantially retained, although a portion of it will need to be managed as part of the APZ.
4. Buildings have been oriented to enable the incorporation of existing tree assets into the future landscape amenity of the site. Internal views of areas containing many significant trees will be available.
5. The retention of the tree cover surrounding the site is proposed, although a portion of it will be in the managed APZ. This should still result in the preservation of existing external views of the site consisting of trees and glimpses of buildings amongst them.
6. Functional lines of plantings that define areas will be retained in most cases.
7. The entry point to the site is not affected by the proposal. The possibility of enhancing it with species in character with the plantings elsewhere on the site exists.
8. The revised lay-out has resulted in a reduction of the area required for dedication as an APZ and the new APZ will therefore have a lesser impact on existing tree assets. The APZ will include areas containing a high percentage of identified valuable tree assets, however, as has been outlined in the discussion, this does not mean that the APZ needs to be cleared of all or even most trees. It should be possible to work with the bushfire consultants to achieve a satisfactory outcome for trees in these areas.

8 Recommendations for the Future Management of Trees on the Site

The development of this site as an educational campus in the 1970s was extremely sensitive to the ecological and vegetation values of it at the time. However, understanding of the management needs of the vegetation, including the substantial trees, was limited and this has resulted in the inevitable degradation of these assets since then.

This proposal offers an opportunity to change this situation through site-wide planning, design and a clear management framework.

- An Urban Forest Master Plan should be developed for the whole site to ensure on-going coverage with trees to identified levels. As outlined in LGA Urban Forest Policy (November 2003), a Master Plan for the urban forest on this site would aim to “capitalise on the benefits of the urban forest whilst minimising the cost of such a forest” through planned, systematic and integrated management.
- If a Bushland Management Plan is proposed for the site, the Urban Forest Master Plan should be developed in collaboration with the bushland consultant.

- An APZ Maintenance Plan and Landscape Maintenance Plan should respond to and specify implementation measures for the Urban Forest Master Plan.
- The landscape design for the site should take advantage of healthy, significant existing trees in terms of their functional and amenity values.

9 Author's Statement

This report has been prepared for the exclusive use of the Client and the Client's nominated agent, CRI. BioDesign & Associates Pty Ltd accepts no responsibility for its use by other persons or agencies.

The Report and any opinions, advice or recommendations expressed or given in it, are based on the information supplied by the Client and on the inspections, data, and analyses carried out by BioDesign & Associates Pty Ltd and referred to in the Report. The Client should rely on the Report and its contents only to that extent.

I am a qualified, practicing arborist and landscape design consultant. I completed a Bachelor of Science degree in Environmental and Urban Horticulture at the University of Technology, Sydney in 1998. I have worked as a consulting arborist and landscape designer since 1997 and am a member of several relevant professional associations. I was a member of the Sydney Harbour Catchment Management Board, responsible for the development of the Sydney Harbour Catchment Blueprint.

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Date: 15th June, 2004 and 4th October, 2007

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11 Appendices

Appendix 1: Key issues and points in Ku-ring-gai Council's Tree Management Policy (TMP)

Appendix 2: Data collection form

Appendix 3: Results of landscape unit assessments based on the draft Concept Plan

Appendix 1: Ku-ring-gai Council's Tree Management Policy (TMP)

Ku-ring-gai Council has legal responsibilities as regulatory authority for the local government area in which this site is located. The protection of tree assets in the area is covered by Council's Tree Preservation Order (TPO) and Tree Management Policy (TMP). Both these documents were referred to prior to and during the assessment process. The TMP identifies the following key points that relate to this site and the proposal:

> …overall there are many benefits for everyone in living with trees.
>
> …'greening and tree preservation' is still an issue of high importance to the Ku-ring-gai community.
>
> …Trees, of the wrong type or growing in the wrong place, can create problems and risks that are not reasonable in the urban environment… Property owners and public authorities have certain legal rights and obligations with respect to protection of trees, and for the consequences of any damage or injury associated with the presence, failure, or growth of trees.

The Policy provides a philosophical context for interpretation that includes:

> A focus for tree review and appeals that places personal safety before community aesthetics, and community aesthetics before private convenience.
>
> A focus for development proposals that emphasizes the value of significant trees and recognises them as a legitimate constraint.
>
> A focus for development that requires it to occur in harmony with the natural character of an area rather than trying to dominate it.
>
> A focus for tree decision-making generally that recognises the proprietary rights of owners and legal obligations (Note: the law provides some protection of rights that may conflict with tree conservation objectives).

The identified outcome sought by Ku-ring-gai Council's Tree Management Policy is:

> An outcome which maintains trees[8] as the dominant feature in the landscape, and preserves trees as an essential component of the local ecology – for the benefit of people and the environment, present and future.

Many of the points in the Policy were relevant to this site, and taken into account in the assessment process. In particular:

Point 1.1.1

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[8] The Policy defines "tree/s" as "specimens above a height of 5 metres, covered by the Tree Preservation Order."

Take priority account of the special value of trees in the environment, and how the presence of trees makes a substantial contribution to the quality of residents lives, and the integrity of the natural environment.

Point 1.1.2

Assume that all trees are an important part of the environment unless there is substantial evidence – as defined in approved Guidelines – to indicate that they are not.

Point 1.1.3

Ensure that tree-related decisions support the retention and protection of trees unless there is strong justification – as defined in approved Guidelines – to prefer substantial works or removal.

Point 1.1.5

Encourage an understanding and appreciation, throughout the community, of the value and benefits provided by the presence and protection of trees.

Point 1.1.6

Recognise and properly take into account the negative implications of having unsafe trees or inappropriate species of trees in the area.

Point 1.2.1

Protect as many of the **Substantial**[9] remnant trees as possible and progressively direct more effort into engaging in replenishment efforts.

Point 1.8.1

Recognise the proprietary rights of property owners and any relevant legal precedents and obligations in decision-making.

Point 1.8.2

Have all decisions, reviews, and implementation guidelines, to give decreasing weighting importance to: personal / public safety; then environmental / biodiversity contribution; then asset / property protection; then community aesthetics and landscape; then private convenience or preference – with respect to 'significant trees'.

Point 1.8.12

Identify highly significant trees, identified in the Significant Tree Register, on Section 149 Certificates.

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[9] The policy defines "Substantial" when referring to trees to generally mean "those trees that are significant because of all or any of the following; prominent in the landscape; healthy and stable; a trunk diameter of more than 250mm; or rare or uncommon species".

Point 1.9.6

> Increase community awareness by consulting and informing the community about major projects involving tree removal, tree planting and pest disease management.

A number of points in the Policy provide direction for a planned approach for the future of the site that includes trees.

Point 1.2.4 of the policy:

> Maintain an up-to-date Street Tree Master Plan that sets out the suitable species for each street and considers the diversity of soils, local climate, remnant communities, utility services, landscape objectives and local character.

Point 1.2.6 of the policy:

> Ensure the streetscape master plan reflects the visual character of each area and responds to environmental and infrastructure issues.

Point 1.2.8 of the policy:

> Identify a standard of tree density for each property and progressively endeavour to have each property support the minimum number of trees.

Point 1.2.10 of the policy:

> **Where tree removal is intended within road reservations (for other than safety reasons) and the removal will have a significant impact on the streetscape, the works should be co-ordinated as part of a 'whole of street' replenishment plan.**

Point 1.5.8

> Require proper identification of all trees and vegetation on a site **as part of the site analysis before development plans are prepared**. Where Significant trees exist **they should** be preserved. **Where Substantial trees exist on a site the proportion of the total site they occupy should be retained for tree protection or replenishment.**

Appendix 2: Data collection form

Area: Location: Signed: Date:

Values: High Medium Low	Existing	Potential	Comments:
Significant trees (Species)			
Personal/Public Safety			
Environmental Soil Water Health Climate Shade Wind			
Ecological Weeds			
Bushfire People Property Ecological needs			
Hazard/Safety Asset/property Management Costs			
Landscape Amenity Visual Screening			
Heritage			

Note: This form was developed for assessment on UTS Ku-ring-gai Campus by S. Hobley. It specifically addresses Ku-ring-gai Council's Tree Management Policy.

Appendix 3: Results of landscape unit assessments based on the draft Concept Plan

Landscape Unit A

Perimeter of north-west carpark, adjoining residential properties. Trees occur in remnant vegetation associated with landscaping incursions by neighbours. The site slopes gently in places and contains areas of exposed rock.

Landscape Unit A

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum) and *Angophora costata* (Sydney Red Gum). Most trees require remedial surgery (removal of deadwood and decayed or structurally unsound branches) or complete removal.

Personal/Public Safety: Many of the trees will be hazardous in the event of development occurring in their vicinity.

Environmental Values of Trees: Many of the significant trees appear to be in moderate to good health, despite decay and structural problems. Trees are stabilising soil, contributing to on-site water retention and providing some protection from winds to adjoining properties in the north. They will provide valuable shade to any future development.

Ecological Context: Degraded remnant vegetation with impoverished species composition, high levels of weed invasions, clearing by neighbours and planting of exotic lawns and other plants. *Pittosporum undulatum* is establishing densely in places.

Bushfire: The vegetation responds positively to fire and will continue to lose species diversity in its absence. The surrounding properties need to be protected from fire, so bushfire is unlikely to be tolerated as a management practice. The significant trees are smooth-stemmed. Canopies are connected in most parts of the landscape unit and would provide a fire corridor. The existing understorey is dense in some places. The area contains a moderate amount of leaf and bark litter and more abundant dead wood.

Management Costs: Trees will require initial work and on-going monitoring and management. To maintain the existing vegetation as the context of the trees would require intensive, on-going bushland management that should not include fire.

Landscape Amenity of Trees: Trees provide little visual amenity due to the presence of dead wood and decay and the weedy and degraded condition of the associated understorey. They screen the adjoining properties. The species present are widely used in Sydney for ornamental value.

Comments: A few of the existing trees would be a valuable asset to the area. They should be selected on the basis of health, structural soundness and amenity values. The removal of the remainder would be required for hazard management. Replacement plantings should be of the same species, with regard for hazard management and scale.

Landscape Unit B

Bushland along the western boundary south of the north-west carpark. Trees occur in dense remnant vegetation. Stormwater run-off from the carpark is directed into the bushland. The area slopes gently to moderately. Clearing along the boundary with residential properties has occurred.

Landscape Unit B

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum) and *Angophora costata* (Sydney Red Gum). Very few sound trees are present; there are many dead or dying trees and trees with large branch failures. A small stand of fine trees occurs in the south-west corner.

Personal/Public Safety: Most trees will need to be removed for safety reasons if the development occurs. Those in the south-west corner will need on-going monitoring and management.

Environmental Values of Trees: Trees are stabilizing soil and contributing to on-site water retention. The area is cooler and moister than conditions in the adjoining carpark areas.

Ecological Context: Degraded remnant vegetation with weed invasions and rainforest succession species (*Acacia elata* and *Pittosporum undulatum*) establishing. Trees are stressed and in decline. The large number of dead trees and stumps provide abundant habitat for termites.

Bushfire: The vegetation responds positively to fire but will continue to lose species diversity in its absence. The adjoining properties need to be protected from fire, so bushfire is unlikely to be tolerated as a management practice. The viable significant trees are smooth-stemmed. Canopies are connected across the landscape unit and the understorey is dense to very dense in many places. The area contains a large amount of leaf and bark litter and dead wood.

Management Costs: Only a few trees would be retained under the proposal. They will need to be managed and protected from development impacts.

Landscape Amenity of Trees: With the exception of the few trees in the south-west, the area has no landscape amenity value.

Comments: Development of this area would reduce bushfire hazards to adjoining properties. The trees in the south-west are valuable environmental and landscape amenity resources that will contribute on-going ecological values to the site within an acceptable bushfire management framework.

Landscape Unit C

North-west carpark. Trees occur in narrow corridors of remnant vegetation separating alleys of the carpark. The site is level and exposed.

Landscape Unit C

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum) and *Angophora costata* (Sydney Red Gum). Most trees require at least minor remedial surgery (removal of deadwood and decayed or structurally unsound branches).

Personal/Public Safety: Several substantial trees have serious structural and stability concerns; they will need to be removed under the proposal. All trees will need to be monitored and managed. Development will cause damage to tree roots that will result in hazard management problems.

Environmental Values of Trees: Despite the presence of deadwood and decay, most trees are healthy. The soil receives some water deposition but run-off from the carpark appears to be draining into other areas (including Landscape Unit B). The trees provide useful shade and wind protection.

Ecological Context: This area contains specimens of listed threatened plant species (*Darwinia biflora*). The remnant vegetation is fragmented and weed invasion is occurring. Low diversity of species due to lack of fire is evident.

Bushfire: The vegetation responds positively to fire but will continue to lose species diversity in its absence. The properties in the vicinity need to be protected from fire, so bushfire is impracticable as a management tool. The significant trees are smooth-stemmed. Canopies are connected in parts of the landscape unit and would provide a fire corridor. The existing understorey is open in some places. Fuel build-up is mostly in the form of dead wood on trees.

Management Costs: Trees will need immediate work and on-going monitoring and management. Development impacts are likely to be severe.

Landscape Amenity of Trees: Many attractive specimens contribute high visual interest and ornamental features. Light to moderate screening of spaces in carpark is provided.

Comments: The proposed site lay-out would require the removal of many of the substantial, significant trees in this area.

Landscape Unit D

Embankment between upper Childcare Centre Carpark and lower north-west carpark. Remnant bushland. The site slopes gently.

Landscape Unit D

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum). Only a few trees are likely to be suitable for retention; they will need remedial work. There are many dead and declining trees.

Personal/Public Safety: Very few trees are sound enough for retention.

Environmental Values of Trees: The trees are stabilising the soil of the area and contributing to water retention in an area surrounded by hard surfaces. There are few healthy, substantial trees. Dense, scrappy tree growth is occurring. The vegetation provides some shade and windbreak.

Ecological Context: The ecosystem here is stressed and degraded. Minor weed invasion is occurring. It requires fire to maintain diversity of species. Run-off from the carpark may be causing the stress and decline of trees.

Bushfire: This area contains abundant fuel and the vegetation is bushfire prone. Tree canopies are dense and interconnected and the understorey is very dense. The vegetation is connected to the bushland areas of the landscape unit. Fire as an ecological management tool is unacceptable due to the location in an urban area.

Management Costs: Only a few trees would require management; they require remedial surgery. Impacts from development would need to be avoided and on-going monitoring is necessary.

Landscape Amenity of Trees: Very poor visually with dead and declining trees, and dense stands of small, leggy trees that will not achieve attractive form due to competition. The understorey is dense and unmanaged.

Other Comments: This area contains a few specimens worthy of retention. They should be assessed for structural problems prior to making any decisions about sub-division. It may be that retention is inadvisable.

Landscape Unit E

Boundary between Sportsground Carpark and Film Australia. Trees are part of remnant vegetation associated with landscape plantings in the neighbouring property.

Landscape Unit E

Significant Trees: *Angophora costata* (Sydney Red Gum) and *Eucalyptus haemastoma* (Scribbly Gum). Many of the trees need remedial work; they contain decay and structural weaknesses.

Personal/Public Safety: Careful selection of trees suitable for retention will be required. Considerations of size and proximity to buildings will be an issue, particularly with *Angophora costata.* Impacts of development will be an issue due to the root zones of trees.

Environmental Values of Trees: Trees are providing minor soil stabilisation (the area is level) and moderate water retention services. Despite decay and structural problems, most of the trees appear to be in reasonably good health. They provide useful shade and a windbreak to the adjoining property.

Ecological Context: This remnant vegetation is part of a small, fragmented and degraded ecosystem in which weed invasion is occurring. Low diversity of species due to lack of fire is evident. Areas A, C and E, along with components of B and D form a fragmented ecological community.

Bushfire: This vegetation responds positively to fire but will continue to degrade in its absence. Due to its proximity to residential and business properties bushfire is impracticable as a management tool. The significant trees are smooth-stemmed in this landscape unit but rough-barked specimens are planted in the adjoining landscape. Canopies are connected in most parts of the landscape unit and would provide a fire corridor. The understorey varies in density. Fuel build-up is mostly in the form of dead wood on trees but leaf and bark litter is present.

Management Costs: There are likely to be two or three trees available for retention on most of the proposed lots. They will require assessment, remedial work and on-going management.

Landscape Amenity of Trees: This landscape unit has a parkland-like character due to the adjoining landscaping in Film Australia[10]. The trees provide screening and shade. Some are attractive feature specimens that provide visual interest. The vegetation provides little landscape amenity due to lack of management and sensitivity to ecological values.

Other Comments: Many of the trees in this landscape unit would be worthy of retention on landscape amenity grounds. They will be located at the rear of proposed lots and will provide screening, shade and attractive features.

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[10] The trees in the Film Australia landscape are not species that occur in the area's remnant vegetation and they are not in keeping with the character of the landscape unit.

Landscape Unit F

Bushland below the Childcare Centre Carpark and the Maintenance Workshop. Trees occur in an undeveloped area of remnant bushland subject to run-off from areas above. The site slopes very steeply above rock outcrops in places.

Landscape Unit F

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum) and *Angophora costata* (Sydney Red Gum). Some fine specimens.

Personal/Public Safety: Impacts of development on trees could lead to serious hazard management problems. Trees to be retained would require careful assessment and selection prior to the development of site lay-outs.

Environmental Values of Trees: There are many very substantial and vigorous trees in this landscape unit but also many stressed and dead trees. It is likely that disturbance to the soil from run-off is causing problems. The soil of the area will destabilise if trees and associated vegetation are removed. The air is cooler and more humid in the southern sections of this area. The trees provide a windbreak from southerly winds for properties to the north. Valuable shade trees occur here.

Ecological Context: Vegetation containing the trees is part of a large expanse of remnant vegetation that links to the Lane Cove River National Park. This landscape unit is becoming degraded by impacts of adjoining developed areas and lack of bushfire but is otherwise viable and healthy.

Bushfire: The vegetation is part of a large expanse of remnant vegetation that is adapted to bushfire. It is very dense and contains abundant fuel. Parts of the area appear fairly moist. Bushfire in this landscape unit would present difficult management problems for protection of the nearby properties.

Management Costs: It is likely that tree preservation in this landscape unit would entail major remedial and protection works and on-going monitoring and management. The landscape unit is difficult to access and there are large old trees with decay and structural problems.

Landscape Amenity of Trees: Some of the trees in this landscape unit are extremely fine specimens which would add considerable amenity value to any future landscape. The trees screen views out across the Lane Cove River Valley to the south and west but provide an intimate enclosure to the spaces within the landscape unit. The approach to the Childcare Centre and Sportsground from the south through part of this landscape unit is very pleasant. The trees provide shade, visual interest and contribute to the natural character of the rocky sandstone site.

Other Comments: This landscape unit needs careful assessment prior to the development of any site lay-out. Parts of it are a valuable 'natural' landscape asset.

Landscape Unit G

Childcare Centre, Carpark and Maintenance Facility. A level landscape unit with embankments above bushland (landscape units D and F directly and, indirectly, landscape units B and H). Mostly cleared with buildings, roadways and parking. Landscaped areas contain planted and possibly remnant trees.

Landscape Unit G

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum) and *Melaleuca styphelioides* (Prickly Paperbark). Management of trees is required.

Personal/Public Safety: Some trees need assessment for structural soundness.

Environmental Values of Trees: Trees are semi-mature to mature and appear to be generally in good health. They provide good shade to an exposed area.

Ecological Context: Some of the trees may be remnant specimens, but there is no associated understorey vegetation. Weeds are establishing in parts of the landscape unit. The areas containing trees are not connected to any nearby ecosystems.

Bushfire: The trees are mostly well-spaced. They are a mixture of smooth-barked and rough-barked species.

Management Costs: These trees will need protection during construction and some of them will probably require remedial surgery. Selective thinning of trees in the eastern section near the oval may be advisable for amenity reasons.

Landscape Amenity of Trees: The trees provide visual amenity due to fine form, stature and condition. Those along the perimeter of the sportsground provide delineation and screening of two distinct areas of the landscape unit. They provide a focal point across the open ground of the sports field.

Other Comments: Most trees in this landscape unit are worthy of retention for their amenity and environmental values.

Landscape Unit H

Bushland west of the tennis courts. Trees occur in remnant vegetation subject to minor impacts from land uses above. The landscape unit contains rocky outcrops and steep sandstone cliffs.

Landscape Unit H

Significant Trees: *Angophora costata* (Sydney Red Gum), *Eucalyptus pilularis* (Blackbutt) and *Eucalyptus haemastoma* (Scribbly Gum). Many substantial, fine specimens that may require remedial surgery for hazard management.

Personal/Public Safety: Large old trees need monitoring and management for structural soundness. Trees will need removal of dead wood.

Environmental Values of Trees: The large trees in this landscape unit provide significant benefits in terms of soil stabilisation on a steep hillside. Run-off from the disturbed areas above drains through this landscape unit. The trees are healthy and provide excellent shade and protection. The understorey contains many ferns due to the cool, moist conditions induced by the trees.

Ecological Context: The understorey vegetation is a moist, closed forest community that has established in the absence of fire. The limited species diversity of this section is typical of such vegetation. It contains a prolific fern community. Weeds are invading the perimeter areas. The large trees are likely to provide valuable habitat to large mammals and birds. The moist understorey and water seepage is potential habitat for frogs and toads.

Bushfire: Although the trees usually occur in bushfire prone vegetation, the vegetation appears to have undergone a transition to a fire-sensitive understorey. This means that bushfire would not be an acceptable management tool and that this landscape unit should be protected from fire.

Management Costs: The preservation and management of any trees under the proposal would be difficult. Were the landscape to be retained as a natural asset, trees would need to be assessed for safety concerns depending on the proposed level of use by humans. Weed management is vital to the on-going health of this landscape unit.

Landscape Amenity of Trees: This landscape unit has the appearance of an old parkland in a natural setting. Many fine specimens occur providing visual interest and contributing to a landscape character suited to the topography and geology.

Comments: The trees here are a highly valuable asset to the site, whatever its future.

Landscape Unit I

Terrace containing western tennis courts and its southwestern and western perimeter embankment. Trees occur in the perimeter embankment and appear to have regenerated or grown from revegetation sowings. An invasive exotic species (*Celtis australis*) is establishing. The areas containing trees are steep embankments below the terrace.

Landscape Unit I

Significant Trees: *Angophora costata* (Sydney Red Gum)*, Eucalyptus pilularis* (Blackbutt) and *E. punctata* (Grey Gum)*.* There are also some small *Corymbia gummifera* (Red Bloodwood) and *E. haemastoma* (Scribbly Gum)*.* Many trees require remedial work due to structural problems and decay or damage.

Personal/Public Safety: Some of the trees have structural problems that will result in hazard management issues. They are located in an area that is proposed for use as landscape associated with paths and buildings.

Environmental Values of Trees: The landscape unit contains some healthy fairly substantial trees along with other structurally unsound specimens. The trees are stabilising the embankment and the root zone environment is intercepting eutrophied run-off from the terraced lawn. Trees provide shade and a windbreak.

Ecological Context: The trees are of the species occurring in the nearby natural bushland areas but the landscape is constructed and disturbed. The vegetation is which they commonly occur requires a fire regime to sustain its ecological health.

Bushfire: The trees are close to areas of bushland exposed to winds and on a crest. They are a mixture of smooth-stemmed, partially smooth and bark-covered stems and most of their canopies are joined. They occur in a line but the understorey is sparse.

Management Costs: Selected trees in this landscape unit are worthy of retention due to their fine condition and safe useful life expectancies. Many of the trees require maintenance or removal because of structural problems. All trees should be monitored.

Landscape Amenity of Trees: The trees define the tennis court space and provide screening and interest. The tennis court area is intimate and private as a result. From the embankment below the landscape unit, the poor condition of many of the trees is more visible and the amenity value of the trees is not as high.

Other Comments: This landscape unit could be managed and replanted for improved outcomes.

Landscape Unit J

The central and south tennis courts below the oval. Trees occur in a defined area to the east and southeast and in a small grove at the eastern end of the embankment below the sports oval. Many appear to be the product of natural regrowth that occurred in constructed or disturbed landscape areas.

Landscape Unit J

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum), *Angophora costata* (Sydney Red Gum) and *E. pilularis* (Blackbutt). The landscape unit contains a few substantial trees and many in poor condition. Many trees are spindly and sparse due to competition from dense growth that has not been thinned. The trees in the grove are substantial specimens and some have structural problems.

Personal/Public Safety: The unsound trees are not in areas of existing high user access and this will change only a little under the proposal. The trees in the grove should be individually assessed and monitored.

Environmental Values of Trees: The dense stands of trees in the areas to the east and southeast contribute minor values due to their lack of substantial growth. The few trees to the southwest are more substantial but are not in excellent condition. The grove of fine trees is shady and cool.

Ecological Context: The trees are specimens that either grew or were planted after the construction of the site. They do not form part of a vigorous, species diverse ecosystem, and are discontinuous stands with few connections to nearby bushland. The understorey is species poor. The species present occur naturally in vegetation that requires a fire regime for ecological health.

Bushfire: Trees occur in groups with many touching canopies. They are not well-linked to the adjoining bushland but are exposed to ignition risks in serious fires.

Management Costs: Trees to the southwest require remedial surgery and on-going monitoring and management. The trees to the east and southeast require thinning and monitoring. Trees in the grove may require some work and should be monitored.

Landscape Amenity of Trees: The grove of trees to the east has exceptional amenity value, containing well-spaced, interesting mature specimens that provide shade, intimacy and character to the space. Trees to the southwest provide some visual and screening amenity and contribute to the definition of the space. The plantings to the east and southeast are too dense to provide trees of good form and interesting character. However, they do provide some screening and shade.

Other Comments: The trees in the dense plantings are not worthy of retention under the existing management regime. They require thinning and their removal and replacement in subsequent landscaping works should be acceptable. The few substantial trees to the southwest could be replaced. The trees in the grove are very valuable and should be preserved.

Landscape Unit K

The embankment below the oval to the south. Trees occur along the embankment. They are the product of natural regrowth and subsequent plantings that occurred after construction of the embankment.

Landscape Unit K

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum), *E. pilularis* (Blackbutt) and *Corymbia gummifera* (Red Bloodwood). A mixture of trees in good to very poor condition, including some dead specimens.

Personal/Public Safety: Few of the unsound trees are close to areas of existing high user access and this will change little under the proposal.

Environmental Values of Trees: The trees on the embankment provide valuable services in terms of soil stabilising, on-site water retention and carbon sequestration.

Ecological Context: The trees are specimens that either grew or were planted after the construction of the site. They do not form part of a vigorous, species diverse ecosystem, but they are connected to the nearby natural bushland both in provenance and character. They are species that naturally occur in vegetation that requires a fire regime for ecological health. The embankment is heavily infested with weeds.

Bushfire: Trees along the embankment are on high ground, exposed to winds and adjoining natural bushland. However, they contain substantial fern understorey, indicating a moist, cool environment that will be resistant to bushfire. Few of their canopies are closely interconnected.

Management Costs: Many of the trees of the embankment require remedial tree surgery but they are not a risk to public safety due to their location. The landscape requires intensive weed control.

Landscape Amenity of Trees: Trees on the embankment are a highly visible, interesting and attractive landscape feature. They define the areas above and below, and screen the embankment and views from above.

Other Comments: Trees along the embankment are very valuable, despite being in mixed condition. They should be preserved.

Landscape Unit L

Remnant heathland adjoining the southwest lawn behind the Conference Centre. Trees occur as naturally stunted specimens due to the environmental conditions of the area; they are not subject to Ku-ring-gai Council's Tree Preservation Order. The landscape unit is level with a gentle fall to the southwest.

Landscape Unit L

Significant Trees: None

Personal/Public Safety: Trees not an issue. If develop occurred and trees were planted, they would require careful species selection to address the difficult conditions of this part of the site.

Environmental Values of Trees: Not relevant for trees. The dense heath vegetation of the landscape unit is stabilising soil and providing a buffer between the lawn area and the bushland to the south and west of the site.

Ecological Context: This is a distinctive ecological community reflecting the localised conditions in this part of the site. It has a positive relationship with bushfire but does not appear to have been burnt recently and it is very woody and dense, with only poor to moderate diversity of species. Along the boundaries with the lawn, weed invasion is occurring in plumes associated with run-off and disturbance from incursions by people.

Bushfire: The vegetation is very dense and woody and situated on top of a south-facing escarpment above dense remnant bushland.

Management Costs: Bushland management is required.

Landscape Amenity of Trees: The vegetation contributes high values to the adjoining landscape area by defining it, screening it and creating a strong sense of intimacy and privacy.

Other Comments: Despite its lack of trees and its degraded condition, this landscape unit is of high significance to the integrity of the amenity landscape at the rear of the university buildings.

Landscape Unit M

Landscape to the southeast of the Conference Centre. Trees occur in open landscaped area with natural rock outcrops and mown lawns. The landscape unit is mostly level or gently sloping.

Landscape Unit M

Significant Trees: *Eucalyptus piperita* (Sydney Peppermint Gum), *E. haemastoma* (Scribbly Gum), *Corymbia maculata* (Spotted Gum), *E. citriodora* (Lemon-scented Gum). A mixture of tall trees with some smaller, younger specimens establishing amongst them. Several of the species are not locally indigenous.

Personal/Public Safety: The trees in this landscape unit will remain as part of a landscape for public use under the proposal. Its use by the public may increase. Trees will need minor surgery in most cases, to remove dead wood and some poorly attached limbs. They should be monitored regularly.

Environmental Values of Trees: Some substantial, reasonably healthy specimens occur. They are providing shade and windbreak. In some places, dense, leggy tree growth is occurring.

Ecological Context: This landscape unit is at the interface between the highly modified landscape that includes a lawn and the remnant bushland that extends outwards to the boundary of the site and beyond. A few trees have been retained in the area under lawn. At the edge of the lawn the remnant vegetation in which the trees occur is very degraded due to the impacts of the landscape practices in this landscape unit. Weeds are abundant and have completely displaced the remnant understorey shrubs in places. The vegetation requires fire to maintain the integrity of its floristics.

Bushfire: The bushland adjoining the lawn area is situated at the top of the hill and is open to the south, south-east and west. It is fire-prone vegetation and in the vicinity of Hawkesbury sandstone heath vegetation, that is extremely fire-prone. There does not appear to have been a recent fire, although old charring is present on some trees.

Management Costs: Trees in this area require surgery to varying degrees, including a large amount in some cases. Thinning by removal of the dense, leggy specimens would improve long-term outcomes for the trees.

Landscape Amenity of Trees: Trees are of very high landscape value, providing shade, visual interest, character and aesthetic appeal. They screen buildings, define the perimeter of the area and create intimacy. They link to the surrounding natural vegetation establishing a sense of continuity between the natural and the developed areas. The dense, leggy plantings reduce the amenity in their locations.

Other Comments: Trees are an integral component of the landscape in this landscape unit and they should be retained and managed.

Landscape Unit N

Southeastern area of the site in the vicinity of the Conference Carpark. Trees occur in naturalistic landscape areas beside roads and around carparks. The landscape unit is moderately steep and the carparks form terraces in the hillside. Vegetation occurs on the slopes.

Landscape Unit N

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia maculata* (Spotted Gum), *E. punctata* (Grey Gum), *E. pilularis* (Blackbutt), *Angophora costata* (Sydney Red Gum) and *C. gummifera* (Red Bloodwood). A number of fine, significant specimens are present along with a mass of scrappy, leggy, small trees in dense stands and some attractive but structurally problematic specimens.

Personal/Public Safety: The trees require remedial surgery to remove deadwood and unsound branches. The landscape containing the trees requires management to improve the vigour of the trees.

Environmental Values of Trees: Patchy due to the condition of the vegetation and the trees themselves. The soil is being stabilised by trees and some parts of the landscape unit are well-shaded. Some good, healthy, fairly large specimens are present.

Ecological Context: Many of the trees appear to be part of the remnant vegetation on the site, but in the area close to the buildings there are some plantings, including of species that were unlikely to have occurred in this part of the site. The understorey is sparse and low in species, probably due to lack of fire. The vegetation is fragmented due to the roadways and parking areas. It is linked to the extensive bushland to the east.

Bushfire: Most of the significant trees and the remnant vegetation in this landscape unit have a positive relationship with fire. It is possible that controlled burns could be undertaken in this section of the site.

Management Costs: The trees require immediate remedial work but on-going needs may be minimal. Annual monitoring is advisable.

Landscape Amenity of Trees: In the immediate vicinity of the buildings, the trees provide good amenity in the form of shade, screening, visual interest and aesthetics. In the lower areas, the generally degraded condition of the ecosystem, including the trees, considerably reduces the amenity values.

Other Comments: Attractive views out of the site are screened by trees in this area, but this part of the site is highly visible from Fullers Bridge Road to the southeast. The trees have an important role in providing a vista of bushland landscape in which the buildings are visually minimised.

Landscape Unit O

Front entry to the buildings with access paths, roadways and small carparks. Level to gently sloping landscape containing areas of remnant vegetation and regrowth of trees, and a central landscaped area containing lawns, clipped shrubbery and planted specimen trees.

Landscape Unit O

Significant Trees: *Corymbia gummifera* (Red Bloodwood), *Eucalyptus punctata* (Grey Gum), *E. haemastoma* (Scribbly Gum), *Angophora costata* (Sydney Red Gum) and *E. piperita* (Sydney Peppermint Gum).

Personal/Public Safety: The landscape unit has high usage by pedestrians and vehicular traffic. Some trees have structural problems requiring management. Dense plantings need thinning to improve long-term healthy structural development.

Environmental Values of Trees: Trees are in variable condition with a few substantial, healthy specimens. Some are stressed and in poor condition. They contribute moderately to soil-holding and water retention services and provide some shade.

Ecological Context: The area contains landscaped sections and natural bushland regeneration zones. The landscaped section has Kikuyu lawns and screen plantings of indigenous species that do not typically occur in the vegetation on the site.

Darwinia biflora, a listed threatened plant species, has been recorded in locations within this landscape unit. No specimens were observed in the documented locations during site visits. One of the locations is heavily weed-infested.

In the regeneration zones the understorey vegetation is sparse and trees have established densely resulting in leggy, sparse foliage and poor development. The areas of natural bushland are degraded with some heavy weed infestations in places and low species diversity in the understorey due to lack of fire. The dense tree growth would also benefit from thinning by bushfire.

Bushfire: The vegetation is bushfire-prone. Tree canopies are mostly closely touching and trees in some areas are linked to bushland.

Management Costs: This landscape unit needs detailed assessment and on-going monitoring and management of trees.

Landscape Amenity of Trees: The trees in this landscape unit are an important part of the landscape, providing spatial definition, screening, linkage between landscape elements and character. A few specimens are inappropriate species that detract from the character of the landscape. An environmental weed is well-established, particularly in the area near the southeastern end of the oval.

Other Comments: A detailed landscape and vegetation assessment to develop a plan for the rehabilitation of this landscape unit is needed. This is a component of a landscape of potential heritage significance.

Landscape Unit P

The access road to the Childcare Centre and sportsfield carpark. Trees occur in a dividing median strip between the two lanes of the road. The area is level.

Landscape Unit P

Significant Trees: *Melaleuca styphellioides* (Prickly Paperbark), *Eucalyptus haemastoma* (Scribbly Gum), *Angophora costata* (Sydney Red Gum), *E. microcorys* (Tallowwood), *C. gummifera* (Red Bloodwood), *Syncarpia glomulifera* (Turpentine), and *E. punctata* (Grey Gum).

Personal/Public Safety: An area used for vehicular access. Under the proposal it will be retained for this usage with increased traffic. Trees need some minor remedial works. They will need protection and management during any construction works.

Environmental Values of Trees: The trees are small but healthy. They contribute on a small-scale to the environmental health of the site. They screen the property to the north from southerly winds.

Ecological Context: The trees appear to be part of the plantings that associated with the landscape works of the original development. The ecological appropriateness of Melaleuca styphellioides in this site is questionable.

Bushfire: Trees are from vegetation that is bushfire-prone. Melaleuca species are not recommended for use in bushfire protection zones due to high oil content of foliage. The canopies of the trees are linked and touching but the area is not immediately adjoining bushland.

Management Costs: Trees need minor remedial surgery and on-going moitoring and management. They are exposed to injury from vehicles and this will increase with increased traffic.

Landscape Amenity of Trees: These trees have important functions. They separate the uni-directonal lanes of the roadway; screen the development on the Australia Film site; form part of the plantings that define the perimeter of the sportsfield; link to the Childcare Centre plantings and give directional flow to the entry to the Centre. They are a defining, vertical landscape element along the property's northern boundary adjoining the expanse of flat, open turf of the sportsfield.

Other Comments: These trees are highly significant to the existing landscape of the site and will remain so under the development proposal.

Landscape Unit Q

Sports Oval in the centre of the northern section of the site. A level terrace covered in turf, containing no trees.

Landscape Unit Q

Significant Trees: None

Personal/Public Safety: Under the proposal, the area would be extensively developed and become a high usage zone. Selection of trees for landscape amenity would need to address functional, environmental, amenity and hazard management issues to ensure trees could be easily be maintained for health and structural viability to minimise risks to human safety.

Environmental Values of Trees: Trees would improve environmental outcomes in this area.

Ecological Context: This part of the site requires intensive management for its use as a sportsfield. The fertilizer and watering needs are contributing to the degradation of the natural landscape areas containing locally indigenous species. Tree deaths are occurring along the southern boundary of the field and the embankment is heavily weed-infested with species that thrive in the eutrophied, moist soil conditions created by run-off from the field.

Bushfire: Exposed area on top of the ridge with no trees to intercept embers and no shrubs for firescreens.

Management Costs: This landscape unit currently requires high maintenance as a turfed sportsfield. Under the proposal the landscape treatment and maintenance needs will change. Landscape design and specifications should address the costs of maintenance and management for an ecologically sustainable approach based on good selection of trees.

Landscape Amenity of Trees: Currently none. The oval benefits from the trees in the landslcape units surrounding it (discussed elsewhere). Future plantings would increase the amenity substantially.

Other Comments: The approach to tree plantings in this landscape unit should be in keeping with the character of the rest of the site.

Landscape Unit R

Area from the southern section of the northeast carparks to the northern section of the Conference Centre Carpark. Trees occur in natural landscapes surrounding carparks. The landscape unit slopes moderately to steeply from west to east.

Landscape Unit R

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood) and *Angophora costata* (Sydney Red Gum). Most trees contain wounds, decay and structural problems.

Personal/Public Safety: If increased public use is planned, most trees will need surgery or removal for hazard management.

Environmental Values of Trees: Trees are stabilising soils and contributing to on-site water retention. Few substantial healthy trees were recorded in this landscape unit.

Ecological Context: The ecosystem is in a degraded condition, with weeds invading the impoverished understorey vegetation and many tree deaths occurring. The dead trees provide habitat services for fauna and other organisms. It forms part of the extensive expanse of remnant bushland in which the site is situated. Fire is required to maintain the floristic composition of the natural vegetation. Evidence of bushfire having occurred in parts of this landscape unit is visible on old tree trunks; the date of burning is not known.

Bushfire: This area is linked to extensive bushland that has a positive relationship with fire. It is on an exposed hillside with an easterly and southeasterly aspect.

Management Costs: Existing trees would require a large amount of work and on-going monitoring in order to retain them in a publicly used landscape.

Landscape Amenity of Trees: A few very attractive, interesting specimens are present. Most of the other trees have little visual amenity value and provide limited landscape services within the site. However, the vegetation is visible from outside the site and contributes to the integrity of the whole landscape, including the screening of developed areas.

Other Comments: Trees and vegetation in this landscape unit are generally in poor condition and require management to improve their health and long-term viability.

Landscape Unit S

Upper terrace of northeastern carpark. Trees occur in natural vegetation surrounding roadways and carparks. Carparks are terraces cut into sloping site. Retaining walls have been built to stabilise cuts.

Landscape Unit S

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum), *Angophora costata* (Sydney Red Gum), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus punctata* (Grey Gum) and *Eucalyptus* sp. (Stringbark). Many of the trees are significant specimens in reasonably good condition.

Personal/Public Safety: The trees generally require removal of dead wood and work on minor structural problems. A few have more serious structural problems that need assessment and work. Trees in this landscape unit will require on-going monitoring if public access is proposed.

Environmental Values of Trees: Trees in this landscape unit are providing valuable environmental services, including soil stabilisation on steep slopes above cuttings, on-site water retention below hard surface areas, screening and shade.

Ecological Context: Trees are in fragmented, very degraded landscapes with heavy weed infestations. A rainforest successional species (*Pittosporum undulatum*) is establishing densely in places, indicating the effects of lack of fire on an ecosystem that requires it to maintain its composition.

Bushfire: Trees occur in clumps and lines with interconnected canopies.

Management Costs: Existing trees should be retainable with some remedial work and effective protection during construction. The understorey needs weeding and management.

Landscape Amenity of Trees: Many good specimens occur in an attractive lay-out. They have fine form and interesting characteristics. They provide shade, screening and intimacy, define spaces and contribute strongly to the character of the landscape.

Other Comments: Trees are an excellent asset in this landscape unit.

Landscape Unit T

Lower terrace of northeastern carpark. It faces east to northeast; residential housing lies to the northeast. Trees occur in the natural bushland beside the carpark. A steep embankment runs along the eastern side of the carpark. Beyond the embankment the land falls gently to the east.

Landscape Unit T

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum), *E. piperita* (Sydney Peppermint Gum), *Corymbia gummifera* (Red Bloodwood) and *Angophora costata* (Sydney Red Gum). The condition of the trees varies and the landscape unit contains an area of predominantly good trees and an area of predominantly poor specimens.

Personal/Public Safety: Development and increased usage of the landscape unit will increase hazard management requirements for trees. Trees to be retained should be carefully selected and managed to minimise impacts from works.

Environmental Values of Trees: Trees in the immediate vicinity of the carpark provide substantial environmental benefits, including stabilisation of the embankment and excellent shade. The area contains a good number of substantial, healthy, mature trees.

Ecological Context: Trees are part of an extensive remnant bushland area. Bushfire is needed to retain the extant ecosystem. The vegetation contains invasive weeds that have been deeply dispersed via stormwater channels. *Pittosporum undulatum*, a successional species that dominates in the absence of fire, is establishing. The understorey is very dense in places but it is low in species diversity.

Bushfire: Evidence of bushfire is seen on old trees but there does not appear to have been a recent fire in this landscape unit. The bushland contains a very heavy fuel load.

Management Costs: Trees in this area will require remedial surgery, effective protection and management during any construction activities, and on-going monitoring and maintenance.

Landscape Amenity of Trees: Many of the trees in the immediate vicinity of the carpark are fine landscape specimens, with good form and interesting characteristics. They define the lower boundary of the carpark and screen views across to the residential areas.

Other Comments: Valuable tree assets occur in this landscape unit.

Landscape Unit U

Boundary with residential properties to the north and northeast. Trees occur in disturbed bushland areas and cleared, 'gardened' landscapes along backyard boundaries. The land falls gently from west to east.

Landscape Unit U

Significant Trees: *Allocasuarina littoralis* (Black She-oak), *Eucalyptus haemastoma* (Scribbly Gum), *Angophora costata* (Sydney Red Gum) and a few planted exotic species. Trees are in poor to very poor condition with deaths occurring in bushland areas.

Personal/Public Safety: Tree hazard management will be needed if this landscape unit is developed as a high use location. Many trees have serious structural problems.

Environmental Values of Trees: Few substantial, healthy trees occur in this landscape unit. Stormwater run-off has caused is scouring and erosion in places.

Ecological Context: This is an extremely degraded area of bushland encroached on by adjoining residents. Beehives have been placed in one area; native bees are displaced by European honeybees. Extensive weed invasion has occurred along with dieback of trees and understorey vegetation.

Bushfire: Clearing along the boundary of the residences may be for bushfire management purposes. The vegetation is adapted to bushfire and forms part of the large expanse that surrounds the site to the northeast, south and southwest.

Management Costs: Few trees in this landscape unit are worth retaining. Unsound trees should be removed and replaced as part of any future landscape works.

Landscape Amenity of Trees: Trees in this landscape unit have little amenity value. They provide some shade and screening but have problems with dieback, decay and extensive deadwood in most instances.

Other Comments: Few trees in this area are a constraint on any development proposal.

Landscape Unit V

Northeast area of the site in the vicinity of the elevated bus turning bay. Trees occur in disturbed natural bushland. The land falls gently to the northeast.

Landscape Unit V

Significant Trees: *Eucalyptus haemastoma* (Scribbly Gum), *Angophora costata* (Sydney Red Gum). Trees occur in a disturbed bushland context. The trees range in condition from healthy, well-structured and fine in form to poor, structurally unsound specimens.

Personal/Public Safety: The proposed use in this landscape unit will increase risks to public safety from hazardous trees. Structurally unsound trees will need surgery or removal. Other trees will need removal of dead wood and any dangerous limbs.

Environmental Values of Trees: Many of the trees in this landscape unit are substantial, healthy specimens stabilizing the slope and providing localised shade and windbreak. Stormwater run-off flows into the soil environment and is associated with deaths and dieback of some trees.

Ecological Context: The ecosystem is degraded due to lack of fire, impacts from urban run-off and landscape practices on nearby properties. The understorey is impoverished and there is an abundance of weeds. Fire is required to maintain the floristic composition of the vegetation.

Bushfire: The landscape unit contains many large trees with connecting canopies. It is fire-prone vegetation with a build-up of fuel occurring in the vicinity of residential dwellings.

Management Costs: Some substantial trees requiring minimal surgery could be retained in this landscape unit. They will need on-going monitoring. The unsound trees should be removed if the proposed sub-division is approved.

Landscape Amenity of Trees: The large, healthy trees in this landscape unit provide a valuable visual amenity to this area of the site. They screen the nearby residential properties and provide an attractive back-drop to the elevated conrete bus turning bay.

Other Comments: The sub-division should take advantage of the tree assets by allowing for building footprints based on the removal of poor specimens and the retention of the fine trees.

Landscape Unit W

A small section in the northeast of the site to the south of the bus turning bay and along the roadway to the northeastern carparks. Trees occur in a disturbed and modified natural landscape. The boundaries along the roads are steep, constructed embankments. The unaltered landform below the embankments falls gently to the east and northeast.

Landscape Unit W

Significant Trees: *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Sydney Red Gum) and *Eucalyptus haemastoma* (Scribbly Gum). Trees occur in the top of the embankment along the access road and on the gentle slope below it. They embankment specimens are generally fine, healthy specimens whereas those below are mostly in poorer condition.

Personal/Public Safety: Under the proposed sub-division, many trees would require removal of deadwood and dangerous limbs to reduce risks to the public. A number should be removed altogether. The plantings along the access road should be retained but monitored and managed. Development of the area should address the needs of these trees.

Environmental Values of Trees: Along the northern perimeter of the access road, many substantial, healthy, sound specimens occur in the embankment. Their removal would result in erosion and stabilisation problems. The trees below the embankment

Ecological Context: The ecosystem is very degraded in most parts of this landscape unit. There is little remnant understorey, weeds are well-established and rainforest succession species are abundant in places. Lack of fire is a threat to the survival of the remnant vegetation and disturbance from run-off is a further problem.

Bushfire: The vegetation in this landscape unit has a positive relationship with fire. The understorey is quite sparse but the canopies of the trees are mostly touching and the fuel load is building up.

Management Costs: Trees in this area need individual assessment and on-going monitoring. Many specimens should be removed if the proposed sub-division occurs.

Landscape Amenity of Trees: Trees lining the access road to the north-eastern carparks provide a valuable visual amenity in this landscape unit. The area below the embankment contains fewer substantial, healthy trees, but it has a park-like character due to their presence and spacings. Some of them have an interesting form.

Other Comments: The substantial, healthy trees in this landscape unit give a park-like character to the interface between the site and the adjoining residential properties.

Landscape Unit X

The entry road to the university campus. Trees occur on both sides of the road. The northern side has a pedestrian path beside the road. The site drops steeply down an embankment below the footpath and trees occur along the ungrassed embankment at different levels within it. The southern side adjoins the property of Film Australia. The trees occur along the verge with the road in grass.

Landscape Unit X

Significant Trees: Mixed locally indigenous species and native species. Most of the trees in this landscape unit are either part of the remnant vegetation on the site or the result of plantings associated with landscape works in the vicinity of buildings and paths.

Personal/Public Safety: The trees on the east overhang a public footpath. Some of them contain dead wood and minor structural problems that need attention. A few need individual assessment to determine the level of surgery needed.

Environmental Values of Trees: Almost every tree in this landscape unit is a substantial specimen. Very few signs of health problems were evident in any trees. Along the eastern edge of the landscape unit, the trees are stabilising the steep embankment. They provide a high level of shade to the whole landscape unit at most times.

Ecological Context: The trees in the eastern area occur in interface between remnant vegetation and urban development. The remnant ecosystem is stressed and degraded due to the impacts associated with its urban context. They include stormwater run-off, lack of fire and fragmentation. Weed invasion, loss of species diversity, and sparse understorey vegetation is evident. The mixed provenance of tree species further reduces the integrity of the remnant ecosystem.

Bushfire: Many trees in this landscape unit have touching canopies. The remnant vegetation with which they are associated is fireprone.

Management Costs: On-going monitoring of these trees should be conducted. Many will be at risk of damage or stress if the proposed sub-division results in development.

Landscape Amenity of Trees: These trees are mostly fine, substantial specimens with either good individual or linked form. They provide an avenue-like point of arrival that is impaired by the number and types of tree species used. The failure to select species on the basis of the ecological context of the landscape unit and the nature of the landscape plantings throughout the rest of the site detracts seriously from the value of many of these trees, particularly those on the western boundary.

Other Comments: This landscape unit is of particular importance as the point of entry and arrival to the site. A future design response may propose tree plantings more in keeping with the character of the site beyond and with the function of this landscape unit.

Landscape Unit Existing University Buildings

A few landscaped areas in close proximity to the university buildings. Trees occur in a few small gardens and edges of other landscape areas. The landscape unit is mostly level or gently sloping and contains paths, roads and buildings. A small area of lawn is located in the south of the landscape unit.

Landscape Unit Existing University Buildings

Significant Trees: *Banksia integrifolia* (Coastal Banksia), *Eucalyptus haemastoma* (Scribbly Gum), *E. piperita* (Sydney Peppermint).

Personal/Public Safety: Very few issues due to the small number of trees. However, trees in these environments commonly incur damage from vehicles and are exposed to stresses that may lead to structural problems.

Environmental Values of Trees: Most trees are small and contribute only minor environmental benefit to the site. Some provide minor shade.

Ecological Context: Most trees occur in reconstructed landscape areas associated with fragments or edges of remnant ecosystems.

Bushfire: Due to the extent of hard surfaces and clearing, the trees are mostly in areas with cleared or paved access. Some have touching canopies.

Management Costs: The few trees need to be monitored regularly.

Landscape Amenity of Trees: Where they occur, trees screen the mass of the buildings and provide visual interest. They also help define access to some parts of the site.

Other Comments: The development of a future landscape masterplan for the site should involve the evaluation of the heritage and landscape values of the plantings in this landscape unit.

Landscape Unit Asset Protection Zone (APZ)

A large zone extending from the west of the site around the south and east to the northeast. The APZ is proposed for the perimeter of the areas of the site for which development is proposed. Its width varies from approximately 22 metres in the southeast to approximately 56.5 metres in parts of the eastern and western sections. Trees occur in remnant vegetation subject to impacts from the site development and use. The APZ contains the lower conference centre carpark, several constructed stormwater drains, some constructed access paths and some informal tracks resulting from 'desire lines' and recreational incursions into the bushland and rock outcrops of this zone. Its topography varies and is typical of the Harbour Foreshores landscapes of the Sydney region. In places it is very steep and in others level. The fall is predominantly outwards, away from the high points of the site to the north.

Landscape Unit Asset Protection Zone (APZ)

Significant Trees: *Angophora costata* (Sydney Red Gum), *Eucalyptus haemastoma* (Scribbly Gum), *C. gummifera* (Red Bloodwood). The condition of trees is very varied throughout this landscape unit, reflecting the site's drainage, impacts of landscape practices and uses, and the lack of bushfire. It contains many fine, healthy specimens, many stressed and unsound specimens, and many dead trees.

Personal/Public Safety: The requirements for this landscape unit as an APZ in the event of bushfire will specify practices that will minimize many of the usual risks associated with trees in urban open spaces. Selection of trees for retention will contribute to good hazard management outcomes.

Environmental Values of Trees: The APZ contains vegetation in all the categories described after analysis of the assessment findings. They contribute, in particular, to soil stabilsation and erosion control.

Ecological Context: Trees occur in remnant bushland that is subject to deleterious impacts of varying degrees. They form part of the extensive remnant bushland area with which the site is associated. Bushfire is needed to retain the extant ecosystem. In places, the vegetation contains invasive weeds that have been dispersed via drainage flows and stormwater channels. *Pittosporum undulatum*, a successional species that dominates in the absence of fire, is establishing in places. The understorey varies from open to very dense in places but it is generally low in species diversity.

Bushfire: Clearing for bushfire management purposes would be a requirement in this landscape unit. The vegetation is adapted to bushfire and forms part of the large expanse that surrounds the site to the northeast, south and southwest.

Management Costs: To establish and manage this area as an asset protection zone will require careful collaboration between an arborist and a bushfire consultant to ensure that the maximum number of trees is retained within the constraints imposed. Trees will need to be felled and removed and the understorey will need to be modified, substantially in places.

Landscape Amenity of Trees: Due to the dimensions of, and impacts on, this zone, it contains many trees, ranging from significant to dead or dying specimens.

Other Comments: This landscape unit contains many access tracks and informal paths.