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Cherrybrook Station State Significant Precinct Tree Canopy Audit

Landcom

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Abbreviations

Abbreviation	Description
API	Aerial Photo Interpretation
CHM	Canopy Height Model
DGL	Developable Government Land
DPIE	NSW Department of Planning, Industry and Environment
ELA	Eco logical Australia
GIS	Geographic Information System
LEP	Local Environment Plan
LGA	Local Government Area
SSP	State Significant Precinct
TEC	Threatened Ecological Community

1. Background

1.1 Overview

This study relates to a proposal to develop land called the 'Cherrybrook Station Government Land State Significant Precinct' (the State Significant Precinct) by Landcom on behalf of the landowner, Sydney Metro. The State Significant Precinct is centred around Cherrybrook Station on the Metro North West Line. The Metro North West Line delivers a direct connection with the strategic centres of Castle Hill, Norwest, Macquarie Park and Chatswood. It covers 7.7 hectares of government-owned land that comprises the Cherrybrook Station, commuter carpark and station access road (Bradfield Parade) and vacant land to the east of the station (referred to as the Developable Government Land) (DGL). It is bound by Castle Hill Road (south), Franklin Road (south east) and Robert Road (north west).

As a State Significant Precinct, the Minister for Planning and Public Spaces (the Minister) has determined that it is of State planning significance and should be investigated for rezoning. This investigation will be carried out in accordance with study requirements issued by the NSW Department of Planning, Industry and Environment (now Department of Planning and Environment (DPE)) in May 2020. These study requirements were prepared in collaboration with Hornsby Shire Council and The Hills Shire Council.

The outcome of the State Significant Precinct process will be new planning controls. This will enable the making of development applications to create a new mixed-use local centre to support Cherrybrook Station and the needs of the local community.

At the same time, DPE is also working with Hornsby Shire and The Hills Shire Councils, as well as other agencies such as Transport for NSW, to undertake a separate planning process for a broader area called the Cherrybrook Precinct. Unlike the State Significant Precinct, the outcome of this process will not be a rezoning. Instead, it will create a Place Strategy that will help set the longer term future for this broader area. Landcom will be consulted as part of this process.

Figure 1 illustrates the site boundaries of the State Significant Precinct and the Cherrybrook Precinct.



Figure 1: Cherrybrook Precinct and Cherrybrook Station State Significant Precinct (subject of this proposal)

Source: NSW Department of Planning & Environment

1.2 Purpose

The purpose of this study is to address the relevant study requirements for the State Significant Precinct, as issued by DPE. It is part of a larger, overall State Significant Precinct Study. This State Significant Precinct Study undertakes planning investigations for the precinct in order to achieve a number of objectives that are summarised as follows (refer to the State Significant Precinct Study Planning Report for a full list of the study requirements):

- facilitate a mixed-use local centre at Cherrybrook Station that supports the function of the station and the needs of the local community
- deliver public benefit through a mixed use local centre
- deliver transport and movement initiatives and benefits
- demonstrate the suitability of the site for the proposed land uses
- prepare a new planning framework for the site to achieve the above objectives.

1.3 Proposal

The proposed new planning controls for the State Significant Precinct are based on the investigations undertaken as part of the State Significant Precinct Study process. A Reference Scheme has also been prepared to illustrate one way in which the State Significant Precinct may be developed in the future under the proposed new planning controls.

The proposed planning controls comprise amendments to the Hornsby LEP 2013 to accommodate:

- Rezoning of the site for a combination of R4 High Density Residential, B4 Mixed Use and RE1 Public Recreation zoned land;
- Heights of between 18.5m – 22m;
- FSR controls of 1:1 – 1.25:1;
- Inclusion of residential flat buildings as an additional permitted use on the site in the B4 Mixed Use zone;
- Site specific LEP provisions requiring the delivery of a minimum quantity of public open space and a maximum amount of commercial floor space; and
- New site-specific Design Guide addressing matters such as open space, landscaping, land use, built form, sustainability and heritage.

The Reference Scheme (refer to Figure 2) seeks to create a vibrant, transit-oriented local centre, which will improve housing choice and affordability and seeks to integrate with Hornsby's bushland character. The Reference Scheme includes the following key components:

- Approximately 33,350m² of residential GFA, with a yield of approximately 390 dwellings across 12 buildings ranging in height from 2 to 5 storeys (when viewed from Bradfield Parade).
- A multi-purpose community hub with a GFA of approximately 1,300m².
- Approximately 3,200m² of retail GFA.
- Over 1 hectare of public open space, comprising:
 - A village square with an area of approximately 1,250m², flanked by active retail and community uses.
 - A community gathering space with an area of approximately 3,250m².
 - An environmental space around the pond and Blue Gum High Forest with an area of approximately 8,450m².
- Green corridors and pedestrian through site links, providing opportunities for potential future precinct-wide integration and linkages to the north.



Figure 2: Reference Scheme

Source: SJB

1.4 This study

The aims of this study are to address the State Significant Precinct Study requirements for Urban Forest (4.1) in a detailed breakdown of the tree canopy across the Cherrybrook Station State Significant Precinct (study area).

This report provides an update to the 2020 Cherrybrook Station State Significant Precinct Tree Canopy Audit undertaken by ELA and includes minor revisions as described in **1.4.1**.

Specifically, the audit requirements addressed in this report include:

- Preparation of a Tree Canopy Audit for the site and adjoining streets, including documentation of tree canopy calculations:
 - by location (e.g. private land, open space, street trees);
 - by classification (i.e. exotic, native, indigenous, endangered community); and
 - by generalised age of trees, generalised state of senescence and generalised life expectancy;
- Identification and mapping of any significant trees and heritage listed trees as nominated by Hornsby Shire and the Hills Shire Councils;
- Mapping, graphic and written presentation of tree canopy coverage documentation, analysis, percentages and results.

In preparation of the Tree Canopy Audit, ELA considered information prepared in the Cherrybrook Station Precinct Urban Tree Canopy Audit, Ecological Australia (2018) and also the information and requirements to be addressed from the Urban Forest Strategy, Hornsby Shire Council (2021).

This audit provides an update of existing information prepared for a previous Cherrybrook Precinct wide study (ELA 2018) and describes the current status of tree canopy cover associated with the Cherrybrook Station State Significant Precinct (SSP) study area.

A series of maps and associated statistics provided in this audit will assist in developing future urban tree canopy guidelines for the SSP.

1.4.1 2022 Update

ELA understands that the amendments to the Reference Scheme at the focus of this study include revisions to building heights and placement within the original proposed footprint, that was considered in the 2020 tree canopy audit. Therefore, minor updates to figures and statistics were required to be undertaken with consideration to the current land typology of the site and boundary amendments for the existing electricity easement. As there have been no changes to the developable area within the SSP boundary, no further updates to maps, statistics or additional site validation was necessary as the proposed revisions to the Reference Scheme sit within the previously assessed footprint.

1.5 Project Approach

The approach to prepare the urban tree canopy audit includes:

1. Review and collate existing background information and suitable data including:
 - Cherrybrook Station Precinct Urban Tree Canopy Audit (ELA 2018)
 - Cherrybrook Station State Significant Precinct Tree Canopy Audit (ELA 2020)
 - Urban Forest Strategy (Hornsby Shire Council 2021a)
 - Study area boundary
 - Current aerial photography
 - Significant and Heritage listed tree locations (from Council)
 - Mapping data from previous tree canopy audit project
2. Analysis of spatial data
3. Site validation to validate tree classification and generalised age
4. Mapping and statistical analysis for the tree canopy audit results:
 - by location typology (developable/non-developable government land, easement, streets);
 - by classification (exotic, native, endangered vegetation community); and
 - by generalised age of trees, generalised state of senescence and generalised life expectancy

2. Methods

2.1 Information and data review

A data audit was carried out to identify and assess available base information. The audit identified the suitability of each data set with regards to relevance and suitability to the analysis.

Spatial data identified for use in the analysis is shown in Table 1, below.

Table 1: Analysis data

Data layer	Source	Description
Canopy Height Model (CHM)	ELA / DPIE	Canopy height derived from LiDAR point cloud information prepared for the Cherrybrook precinct, depicting modelled height of tree canopy
Study area	Landcom / ELA	Cherrybrook Station State Significant Precinct study area boundary
SSP areas	Landcom / ELA	Breakdown of the draft land use design across the SSP (including new streets for street tree canopy cover)
Imagery	Nearmap	Nearmap imagery dated 23 June 2020. Provides current land cover configuration to update tree canopy cover
Vegetation	DPIE	Native vegetation community mapping (Hornsby Shire Council 2008; OEH 2016; ELA 2017). Confirms remnant native vegetation and endangered vegetation
LEP Heritage sites	DPIE	Areas of heritage significance from relevant Local Environment Plans (DPE 2017). Identified heritage items including items of local significance

Within the study area, a tree was defined as:

“a long lived woody perennial plant with one or relatively few main stems with the potential to grow to a height greater than 3 metres” (Hornsby Shire Council 2013).

Hornsby Urban Forest Strategy

The Hornsby Urban Forest Strategy was publicly exhibited between 10 September and 13 November 2020 and was finalised on 23 February 2021 (Hornsby Shire Council 2021a; 2021b). The Strategy shows the SSP study area having a tree canopy cover of 0-20%. This compares to an average of 22% across the medium and high density residential areas in the Hornsby LGA which the Strategy acknowledges are lower than other zones because of the presence of underground car parks and utilities which limit the availability of tree planting space. The Strategy includes the following targets for the LGA by 2040:

- Tree canopy cover over private residential areas will be maintained at 33% to ensure no net loss
- Tree canopy cover over Hornsby's urban road network will increase from 39% to 50%
- Tree canopy cover over commercial zones will increase from 11% to 15%
- Increase the number of streetscapes incorporating biodiversity corridors
- Improve the species diversity and useful life expectancy distribution of street trees in Hornsby

Note, the draft Greener Places Design Guide (Government Architect NSW) identifies an indicative place-based target of greater than 25 per cent tree canopy cover in urban residential (medium- to high-density)

2.2 Tree canopy audit analysis

The tree canopy analysis consisted of aerial photo interpretation (API) and the combination of a number of spatial data layers to derive a suite of attributes to the tree canopy extent within the study area (Figure 1). Methods for each component is discussed further in the following sections.

2.2.1 Aerial photo interpretation (API)

The existing canopy height model (CHM) covering the study area was updated based on the latest available imagery.

The existing CHM was developed using LiDAR data dated 2016 and updated with imagery dated January 2018. Since 2018, the vegetation and land cover across the study area has altered through:

- Some removal of existing trees / vegetation
- The addition of landscaping adding a number of newly planted trees; and
- The formation of infrastructure / buildings / landforms across the study area

A systematic API process was carried out at a scale of 1:250 to refine the extent of tree canopy cover across the study area and add (digitise) areas of new tree plantings to the CHM.

2.2.2 GIS analysis

A GIS analysis of the CHM was undertaken using a process model in ArcGIS based on available data, in order to further classify the CHM. The data was filtered to include all tree canopy with a height of 3m or greater and to exclude other vegetation, in accordance with the definition of a tree.

The analysis included the development of the following four key components for the derived layer.

Table 2: Tree canopy cover components - GIS analysis

Item	Data	Classes
Tree Canopy Height Classes	CHM	Six height classes were produced to classify the CHM data. Classes were: <5m; 5-10m; 10-15m; 15-20m; 20-25m; >25m
Tree Canopy Typology	SSP design	Construction design boundaries were used to develop a land typology layer based on the following: <u>Non-Developable Government Land</u> – areas of the updated CHM that occurred within the area containing the station, carpark and associated structures and lands. <u>Developable Government Land</u> – areas of CHM that occurred within lands identified as additional to the station development but Government owned. <u>Easements</u> – areas of CHM that occurred within lands designated as a power line easement. <u>Street Trees</u> – areas of CHM that occurred within areas identified as forming part of the road infrastructure including footpaths.
Tree Canopy Classification	Vegetation LEP Heritage Nearmap	Existing vegetation type and heritage mapping was used to determine tree canopy classification contained within the 2018 CHM. Nearmap imagery was used to assign tree canopy classification to newly planted vegetation. The tree canopy was classified into the following:

Item	Data	Classes
		<p><u>Endangered Vegetation Community</u> – all areas mapped as being comprised of a threatened ecological community (TEC) from vegetation type mapping were identified and refined, then validated through API. From existing 2018 CHM layer.</p> <p><u>Heritage</u> – areas identified in the LEP heritage layer (Inala School) was incorporated into the mapping. This area occurs just outside of the study area.</p> <p><u>Planted Native / Exotic Trees</u> – areas of existing vegetation not identified as making up a native vegetation community from vegetation type mapping were considered to be planted vegetation made up of non-associated individual trees. The planted vegetation incorporated a range of individual tree species, both native and exotic. From existing 2018 CHM layer.</p> <p><u>Planted Native Trees</u> – areas of newly planted vegetation identified from API in and around the metro station and adjacent roads</p> <p><u>Planted Exotic Trees</u> – areas of newly planted Cherry trees identified from API primarily located in the proximity of the metro station entrance</p>
Tree Canopy Age	CHM Nearmap	The initial tree canopy age class was taken from the existing 2018 classified CHM layer. Further desktop validation was carried out using the latest available high-resolution aerial photography to confirm the existing classes from the CHM layer, as well as identifying the observable class of Juvenile for newly planted trees.

A single vector layer (shapefile) based on the updated CHM extent was prepared which incorporated each of the four classifications and associated attribution.

2.3 Site validation

A site survey was carried out on the 21st of July 2020 to validate the desktop mapping. Key aims of the site survey were to validate the tree canopy height, vegetation classification and general age.

Age classes were defined as:

- Juvenile (Y) – refers to a well-established but juvenile tree, generally recently planted
- Mature (M) - refers to a large, well established tree with capacity for further growth and longer remaining life cycle
- Late Mature (LM) - refers to a full-sized tree with little capacity for growth that is not yet about to enter decline
- Over Mature (OM) - refers to a tree about to enter decline or already declining
- Dead Stag (S) – refers to a dead tree (potentially retained for habitat value)

Of all age classes, those falling into Juvenile, through to Late Mature provide the greatest value for developing and maintaining an established canopy in the area.

The site survey was carried out on foot. The accessible areas of the study area were traversed and the characteristics of the observable trees (general age, general height and vegetation classification) was compared against the initial classification.

Following site validation, the mapping was updated based on field observations.

2.4 Limitations

The following limitations for the tree canopy audit analysis are identified:

- Field survey was limited to areas that were publicly accessible for observation only. The majority of the area designated as “Developable Government Land” was not accessible and observations of existing trees in that area were made from a distance, from publicly available vantage points.
- It is outside the scope of this project to determine specific detailed tree species information or provide any recommendation regarding useful life expectancy that requires additional measurement data to be collected.

3. Results

An area and percentage breakdown of tree canopy coverage across the Cherrybrook Station State Significant Precinct was prepared. The tree canopy cover was classified into four key attributes, made up of distribution of tree canopy typology; tree canopy vegetation classification; tree canopy height; and tree canopy age class.

The breakdown of the area of tree canopy coverage and a combination of all the key attributes is found in **19**.

3.1 Tree canopy cover

The Precinct covers an area of 7.7 ha in total. Table 3 details the area and proportion of canopy coverage mapped through GIS analysis and aerial imagery from Nearmap (dated 23rd of June 2020).

Table 3: Tree canopy cover within the study area

SSP	Total SSP Area (ha)	Area of Mapped Canopy (ha)	% Tree Canopy within SSP
Cherrybrook Station SSP	7.74	0.75	10%

Tree canopy currently covers less than 1 ha across the study area, representing 10% canopy across the SSP. It is fair to note that much of the canopy cover is made up of a number of new plantings and landscaped areas which will increase the proportion of cover over time.

The canopy tree cover is further broken down in the following sections.

3.1.1 Tree canopy land typology

The distribution of land typology across the study area is shown in Figure 3. The land typology broadly reflects existing and proposed land use through land ownership classes (Developable and Non-developable Government / Easement), as well as function (streets). This provides a breakdown where there may be potential future management opportunities for trees making up the canopy within the study area.

The tree canopy cover analysis results were then broken down by the land typology classes (Figure 4).



Figure 3: Land typology within the study area



Figure 4: Distribution of tree canopy land typology

From the GIS analysis, the estimated breakdown of tree canopy land typology is shown in Table 4 and Figure 5.

Tree canopy coverage across the study area is primarily distributed across the Developable (47.64%) and Non-developable (36.53%) Government lands. It is important to note though that almost all of the tree canopy in the Non-developable Government lands and Streets (78.89% within Non-developable land and 89.46% within Streets) is made up of new tree plantings (juvenile age class).

Table 4: Distribution of tree canopy land typology

Land Typology	Total SSP Area (ha)	% of Typology in SSP	Tree Canopy Area (ha)	% Tree Canopy in SSP	Distribution of Tree Canopy
Developable Government Land	3.43	44.32%	0.36	10.36%	47.64%
Non-Developable Government Land	2.30	29.72%	0.27	11.85%	36.53%
Easement	0.45	5.80%	0.019	4.24%	2.55%
Streets	1.56	20.16%	0.099	6.35%	13.28%
Total	7.74	100%	0.75	9.64%	100%

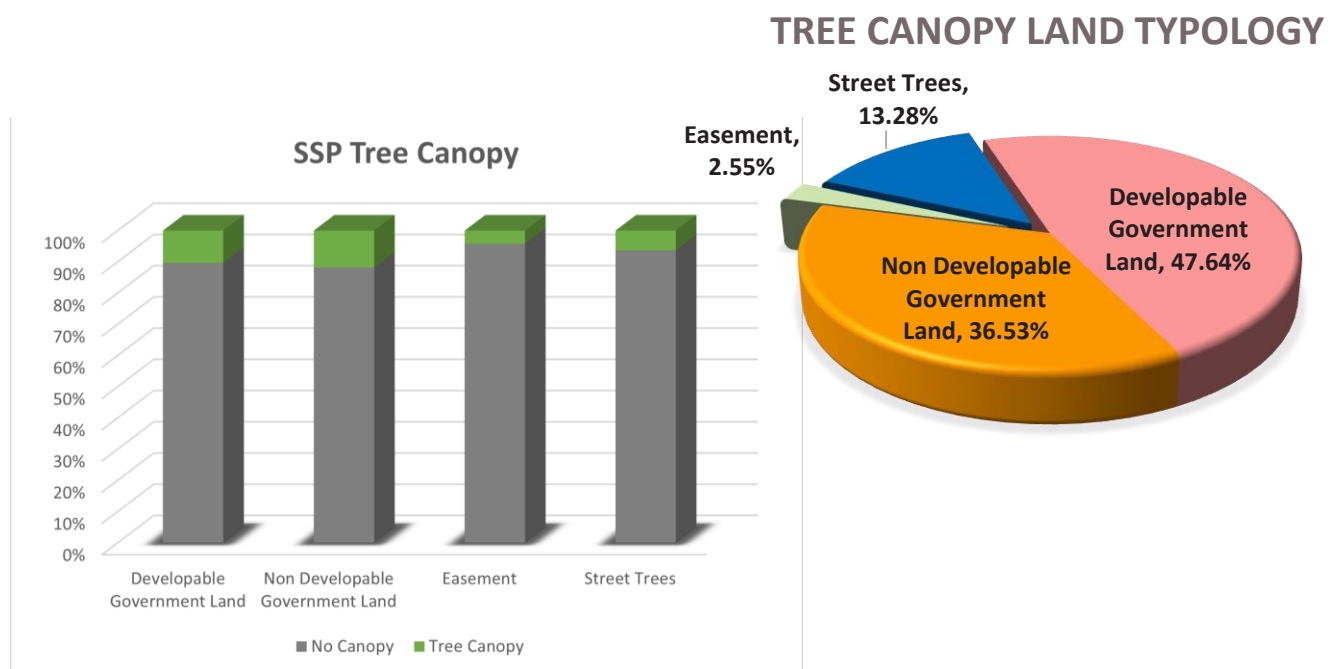


Figure 5: Comparative distribution of tree canopy land typology percentages

3.1.2 Tree canopy classification

The distribution of tree canopy cover vegetation classification across the SSP is shown in Table 5 and in Figure 6: Distribution of tree canopy vegetation classification and Figure 7. About 46% of the tree canopy cover over the study area is made up of planted (native and exotic) individual tree cover. Small areas of tree canopy associated with items of local heritage significance occur to the east of the new Cherrybrook Station (Inala School) which are not included in the SSP.



Figure 6: Distribution of tree canopy vegetation classification

About 54% of the canopy across the study area is made up of endangered vegetation communities (Figure 7). Since the 1970's, much of what is now considered endangered vegetation communities (as opposed to individual tree plantings) existed across the study area. The endangered vegetation communities have previously been mapped as Blue Gum High Forest. (Ashby 2016, OEH 2016).

A further 34% of the tree canopy across the study area is made up of recently planted native trees as part of new landscaping and street plantings.

Table 5: Distribution of tree canopy vegetation classification

Tree Canopy Classification	Area (ha)	%
Planted Exotic Trees	0.06	8%
Planted Native Trees	0.26	34%
Planted Native / Exotic Trees	0.03	4%
Endangered Vegetation Community	0.40	54%
Total	0.75	100%

TREE CANOPY VEGETATION CLASS

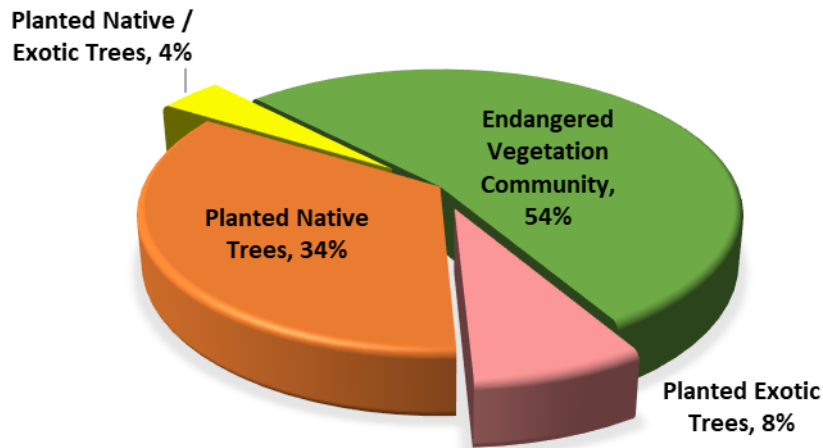


Figure 7: Distribution of tree canopy classification percentage

3.1.3 Tree canopy height class

Height class distribution of tree canopy cover across the precinct is shown in Table 6 and Figure 8 and Figure 9.



Figure 8: Distribution of tree canopy height classes

The majority (54%) of the tree canopy is currently less than 10m in height across the study area, with most of this being in the < 5m category (Table 6). It is important to note that the majority of the trees currently within the < 5m in height class are recently planted native trees that have the potential to achieve a much greater height over time.

Table 6: Distribution of tree canopy height class

Tree canopy height	Area of Tree Canopy (ha)	% of Tree Canopy
< 5m	0.32	42%
5-10m	0.09	12%
10-15m	0.06	8%
15-20m	0.07	9%
20-25m	0.13	17%
>25m	0.08	11%
Total	0.75	100%

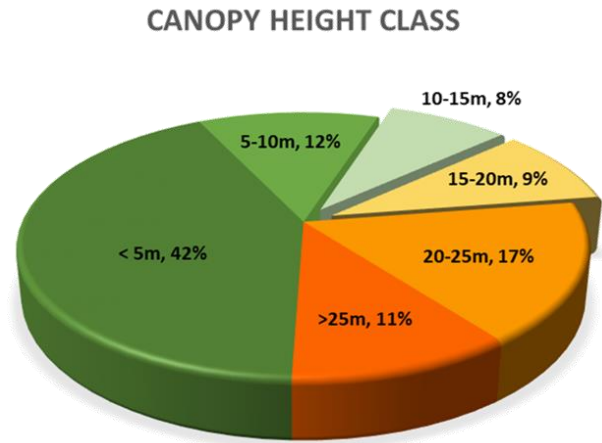


Figure 9: Distribution of canopy height percentage

3.1.4 Tree canopy age class

About 54% of the tree canopy cover across the study area is made up of mature (M) trees; with the majority of the remainder of the tree canopy being mainly younger, juvenile trees made up of recent plantings, primarily associated with the newly developed area in and around the metro station.

There were a small number of individual trees where canopy age could be classed late mature (LM), or over mature (OM); and two trees were observed to be dead stags (S), potentially retaining a biodiversity habitat role.

Figure 10 and Figure 11 show the distribution across the study area spatially and statistically (respectively), with the associated breakdown of areas shown in Table 7.

Generally, trees which can be classed as over mature (OM) are in decline and moving towards senescence, whereas trees classified as late mature (LM), while normally not yet in a stage of senescence, are moving towards the later stages of life expectancy. Tree canopy classed as mature (M) describes the life cycle of a well-established tree, with capacity for further growth and generally a longer remaining life expectancy. Juvenile trees (Y) are in an early stage of life and have the greatest potential for growth and long life expectancy.

It is important to note that the mapped tree canopy area includes a range of tree species (both native and exotic), with widely varying age ranges, so a mature age class rating does not imply the same age range for all trees. Also, depending on the species of tree, the overall life expectancy may also vary widely.



Figure 10: Distribution of tree general age classes

Table 7: Breakdown of tree general age classes

General Age Class	Tree	Area of Tree canopy (ha)	% of Tree Canopy
Juvenile		0.32	42%
Mature		0.40	54%
Late Mature		0.01	1%
Over Mature		0.01	2%
Dead Stag		0.01	1%
Total		0.75	100%

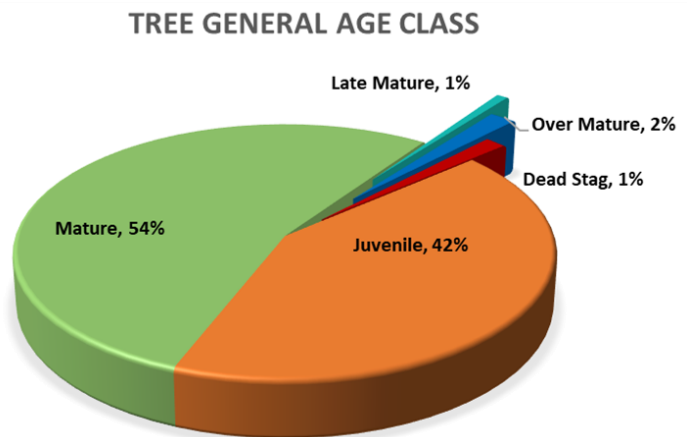


Figure 11: Distribution of tree general age classes

4. Key findings

An audit of the current configuration of the tree canopy across the Cherrybrook Station State Significant Precinct was carried out to provide base information to build and enhance the urban environmental values as well as support the development of relevant policies and goals for the Precinct.

Key findings of the audit identified that:

- The study area currently has a 10% tree canopy cover totalling less than 1 ha in area.
- Tree canopy coverage across the study area is reasonably evenly distributed between the Developable and Non-developable Government lands; however, almost all of the tree canopy in the Non-developable Government lands and Streets is made up of new tree plantings and almost all of the tree canopy on the Developable Government lands is situated on and around its boundary to the north.
- The majority of the canopy across the study area has been mapped as an endangered vegetation community (Blue Gum High Forest), adjoining a larger patch of remnant vegetation to the north of the site. The endangered vegetation community is primarily restricted to the mature trees at the boundary of the Developable Government land typology and includes a suite of tree species varying in height.
- The majority of individual trees across the site are less than 10m in height, with a significant proportion currently being < 5m in height, made up of the recently planted native trees that have the potential to achieve a much greater height over time.
- Over half of the tree canopy across the areas of the Precinct is made up of mature trees, with the majority of the remaining tree canopy being mainly younger, juvenile trees made up of recent plantings. These younger trees have the greatest potential for growth and are expected to reach maturity in approximately 10-15 years (dependant on the individual tree species), with a long life expectancy.
- Over time, the growth of the recently planted trees will contribute to an increase in overall canopy cover across the study area. Potentially, the overall canopy cover for the precinct may increase by 5-10% through the growth of the recently planted trees; however, this will be dependent on the individual tree species and their growth rate, their overall health over time, climatic conditions and other environmental factors.

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Appendix A - Key Attributes Combined (ha)

Tree Canopy Typology	Height Class	Tree Canopy Classification									Grand Total
		Planted Exotic Total	Planted Native Total	Planted Native / Exotic Trees		Planted Native / Exotic Trees Total	Endangered Vegetation Community			Endangered Total	
		Tree Canopy Age Class		Tree Canopy Age Class			Tree Canopy Age Class				
		Y	Y	LM	M		M	OM	S		
Developable Government Land	< 5m		0.011								0.011
	5-10m			0.0017	0.0066	0.0083	0.067	0.0022		0.069	0.078
	10-15m				0.0071	0.0071	0.042	0.011		0.053	0.060
	15-20m				0.0024	0.0024	0.059		0.0050	0.064	0.066
	20-25m				0.0016	0.0016	0.092		0.0017	0.094	0.096
	>25m				0.0052	0.0052	0.040			0.040	0.045
Developable Government Land Total			0.011	0.0017	0.023	0.025	0.30	0.013	0.0067	0.32	0.36
Non Developable Government Land	< 5m	0.055	0.16								0.21
	15-20m						0.002			0.002	0.0016
	20-25m						0.022		0.0037	0.026	0.026
	>25m						0.031			0.031	0.031
Non Developable Government Land Total		0.055	0.16				0.024		0.0037	0.027	0.24
Powerline easement	5-10m			0.0041	0.0010	0.0051	0.01			0.0079	0.013
	10-15m			0.00010		0.00010	0.00			0.0013	0.0014
	15-20m						0.00		0.00029	0.0014	0.0014
	20-25m						0.00			0.0033	0.0033
Powerline easement Total				0.0042	0.0010	0.00010	0.01		0.00029	0.0060	0.0061
Streets	< 5m	0.00041	0.088								0.089
	10-15m				0.0000084	0.0000084	0.00043			0.00043	0.00043
	15-20m						0.00057			0.00057	0.00057
	20-25m						0.0038			0.0038	0.0038
	>25m						0.0057			0.0057	0.0057
Street Tree Total		0.00041	0.088		0.0000084	0.0000084	0.0048			0.0048	0.093
Grand Total		0.055	0.26	0.0059	0.02	0.030	0.34	0.013	0.011	0.37	0.75

