PEDESTRIAN WIND ENVIRONMENT STATEMENT

SSD 7081 - FACULTY OF ARTS AND SOCIAL SCIENCES BUILDING, UNIVERSITY OF SYDNEY

WC968-01F03(REV4)- WS REPORT

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Prepared for:

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DOCUMENT CONTROL

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May 2, 2016	Referenced SSD 7081. Modified methodology section.	-	1	TH	TR	TH
September 28, 2016	Updated Landscape Design	-	2	KP	TR	KP
October 2, 2016	Comments	-	3	KP	TR	KP
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EXECUTIVE SUMMARY

This report is in relation to the proposed development known as the Faculty of Arts and Social Sciences Building (SSD 7081), located within the University of Sydney Camperdown campus and presents an analysis on the likely impact of the proposed design on the local wind environment to the critical outdoor areas within and around the subject development.

The effect of wind activity is examined for the three predominant wind directions for the Sydney region; north-easterly, southerly and westerly winds. The analysis of the wind effects relating to the proposal was carried out in the context of the local wind climate, building morphology and land topography. The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the architectural drawings which have been prepared by the project architects Architectus, received April 2016 and landscape drawings received September 2016. No wind tunnel tests have been undertaken for the subject development, and hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection. Due to the extensive shielding of the subject development by the surrounding buildings, topographic effects and relatively low-rise built form of the subject development, unusual wind patterns which are not able to be readily identified and hence would typically require more detailed wind tunnel testing is not expected for this project. Note that any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

The results of this study indicate that wind conditions within and around the various outdoor areas of the site are potentially exposed to adverse wind effects. These include potential down-wash effects off the building façade, accelerating flows around the corners of the development and exposure to the direct winds due to the lack of shielding from the up-stream developments. It is expected that suitable wind conditions can be achieved for all trafficable outdoor areas within and around the site with the inclusion of the recommendations outlined in this report which include:

- The inclusion of the proposed awning connecting the subject development to the adjacent RD Watts Building.
- The inclusion of recommended densely foliating trees within and around the subject development site.
- The inclusion of the proposed awning above the outdoor seating area on the rooftop communal terrace.
- The inclusion of recommended 1.5m high impermeable balustrades along the perimeter of the rooftop communal terrace.

Hence, with the inclusion of the abovementioned recommendations within the final design of the development, it is expected the wind conditions for all outdoor trafficable within and around the development will be acceptable for its intended uses. The inclusion of additional densely

foliating vegetation such as trees or shrubs/hedge planting is expected to further enhance the localised wind conditions within and around the subject development site.

Note that the densely foliating trees should be capable of growing to a height of 4m with a foliating canopy with a diameter of approximately 4m and be of an evergreen to ensure their effectiveness in wind mitigation throughout all seasons. All trees planted need to be protected by means of effective screening (e.g. hessian on four sides) for the first couple of years until the branch structures have developed and are able to connect with the adjacent tree and the tree has reached substantial maturity in terms of height and density of foliage.

1 DESCRIPTION OF THE PROPOSED DEVELOPMENT AND SURROUNDS

The proposed development site is bounded by the Parramatta Road to the north and a service road to the east between the subject development and the Heydon-Lawrence Building. Abutting the site to the south is the five storey high RD Watts Building with a single storey high demountable building to the west proposed to be redeveloped in the future. Surrounding the site along the northern boundary are primarily residential tenancies varying up to five storeys in height with the low to mid rise high buildings and sporting fields of the University of Sydney Campus along the remaining boundaries. A survey of the local land topography indicates a rise in elevation towards the north and east of the site. An aerial image of the site and the surroundings is shown in Figure 1.

The subject development is a 6 storey high education building with a lecture theatre and mechanical plant rooms are proposed on Level 1, with lecture/tutorial rooms and private offices on the remaining levels.

The critical trafficable outdoor areas associated with the proposed development, which are the focus for pedestrian wind effects in this assessment, are detailed as follows:

- The outdoor trafficable areas along the southern boundary of the site. These include the pedestrian footpath, open courtyard and outdoor seating areas.
- The pedestrian footpath along the eastern boundary of the site.
- The communal rooftop terrace.

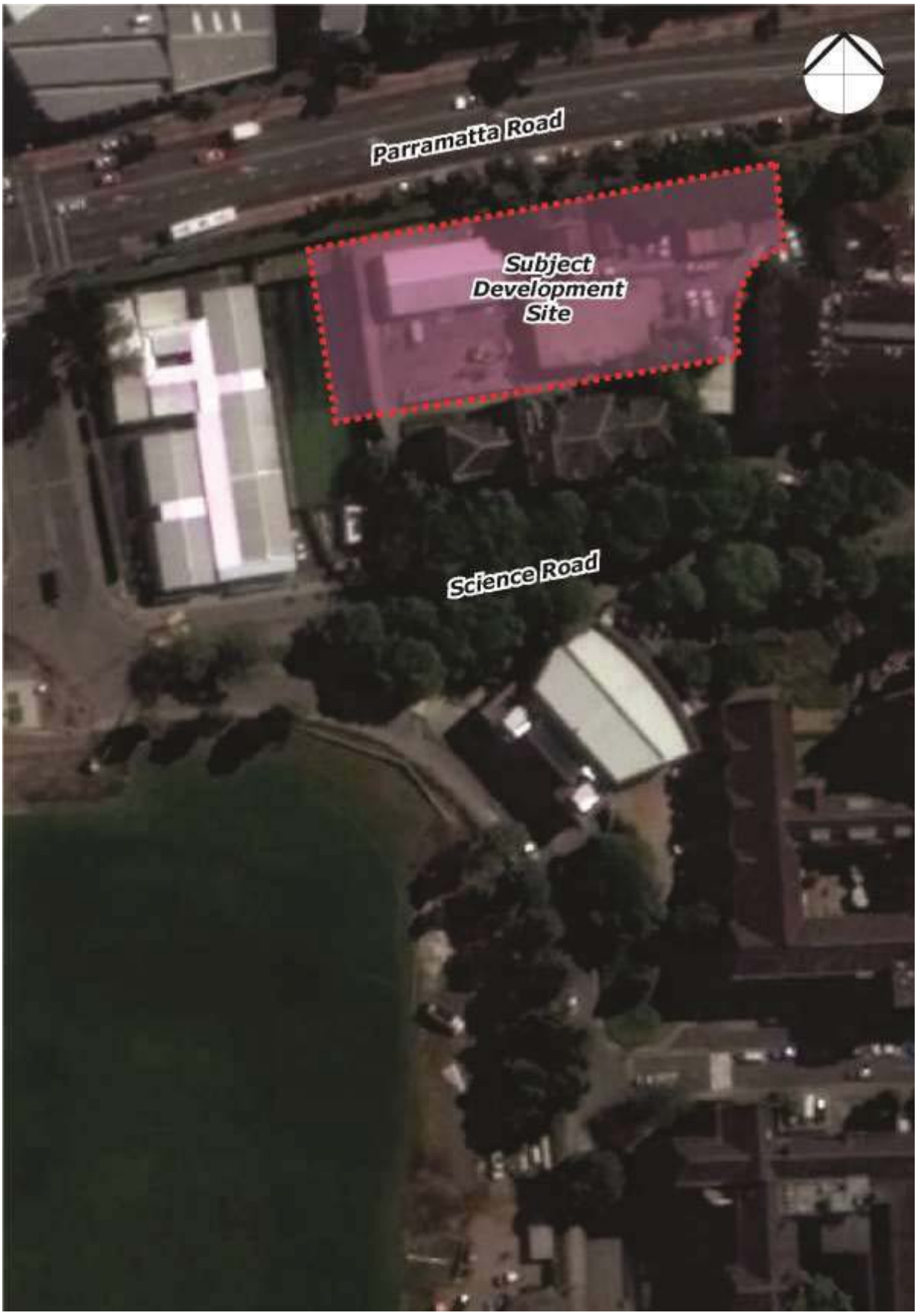

Figure 1: Aerial Image of the Site Location

2 WIND CLIMATE OF THE SYDNEY REGION

The Sydney region is governed by three principle wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary is based on a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1939 to 2008). From this analysis, a directional plot of the annual and weekly recurrence winds for the Sydney region is also determined, as shown in Figure 2. The frequency of occurrence of these winds is also shown in Figure 2.

As shown in Figure 2, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. The westerly winds occur most frequently during the winter season for the Sydney region, and although they are typically not as strong as the southerly winds, they are usually a cold wind since they occur during the winter and hence can be a cause for discomfort for outdoor areas. North-easterly winds occur most frequently during the warmer months of the year for the Sydney region, and hence are usually welcomed within outdoor areas since they are typically not as strong as the southerly or westerly winds.

Table 1: Principle Time of Occurrence of Winds for Sydney

Month	Wind Direction		
	North-Easterly	Southerly	Westerly
January	X	X	
February	X	X	
March	X	X	
April		X	X
May			X
June			X
July			X
August			X
September		X	X
October	X	X	
November	X	X	
December	X	X	

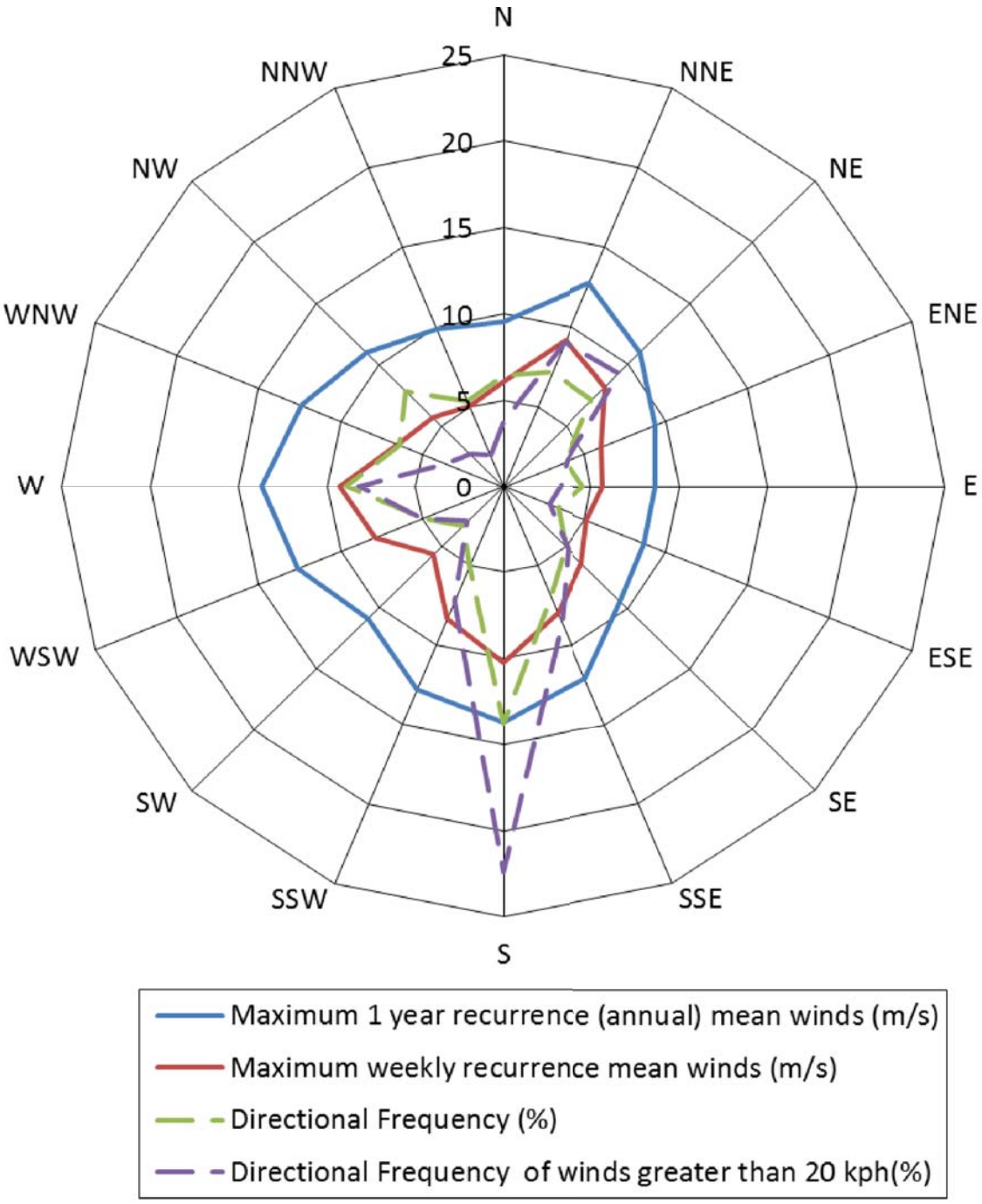

Figure 2: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10-minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

3 WIND EFFECTS ON PEOPLE

The acceptability of wind in any area is dependent upon its use. For example, people walking or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as Davenport, Lawson, Melbourne, Penwarden, etc, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have also adopted elements of some of these into their planning control requirements in Australia. The following table is an example, which was developed by Penwarden in 1975, and describes the effects of various wind intensities on people. Note that the applicability column relates to the indicated wind conditions occurring frequently (exceeded approximately once per week on average). Higher ranges of wind speeds can be tolerated for rarer events.

Table 2: Summary of Wind Effects on People (Penwarden, 1975)

Type of Winds	Mean Wind Speed (m/s)	Effects	Applicability
Calm, light air	0 - 1.5	Calm, no noticeable wind.	Generally acceptable for Stationary, long exposure activities such as in outdoor restaurants, landscaped gardens and open air theatres.
Light breeze	1.6 - 3.3	Wind felt on face.	
Gentle breeze	3.4 - 5.4	Hair is disturbed, Clothing flaps.	
Moderate breeze	5.5 - 7.9	Raises dust, dry soil and loose paper. Hair disarranged.	Generally acceptable for walking & stationary, short exposure activities such as window shopping, standing or sitting in plazas.
Fresh breeze	8.0 - 10.7	Force of wind felt on body.	Acceptable as a main pedestrian thoroughfare
Strong breeze	10.8 - 13.8	Umbrellas used with difficulty, Hair blown straight, Difficult to walk steadily, Wind noise on ears unpleasant.	Acceptable for areas where there is little pedestrian activity or for fast walking.
Near gale	13.9 - 17.1	Inconvenience felt when walking.	
Gale	17.2 -20.7	Generally impedes progress, Great difficulty with balance.	Unacceptable as a public accessway.
Strong gale	20.8 - 24.4	People blown over by gusts.	Completely unacceptable.

It should be noted that wind speeds can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and the acceptability of the conditions for outdoor areas are determined based on their intended use (rather than referencing specific wind speeds). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

4 RESULTS AND DISCUSSION

The expected wind conditions are discussed in this section for the various outdoor areas within and around the subject development for each of the three predominant wind directions for the Sydney region. The interaction between the wind and the building morphology in the area was considered, and important features taken into account include the distances between the building form, their overall heights and bulk, as well as the landform. Note that only the potentially critical wind effects are discussed in this report.

4.1 Ground Level Areas Within and Around the Development

The pedestrian footpath along the service road between the subject building and the neighbouring Heydon-Lawrence Building east of the site benefits from the shielding provided by the subject building to the prevailing westerly winds. The existing densely foliating trees along Science Road to the south and adjacent to Parramatta Road to the north are expected to be effective in mitigating the direct southerly and north-easterly winds respectively. The eastern corner areas of the subject building are potentially exposed to accelerating flow around the building. It is expected the inclusion of densely foliating trees around these corners as indicated in Figure 3b will be effective in mitigating these potential adverse wind effects.

The outdoor trafficable areas along the southern boundary of the site, benefits from the shielding provided by the subject and neighbouring Heydon-Lawrence Building and RD Watt Building to the prevailing north-easterly and southerly winds. It is however potentially exposed to variety of adverse wind effects such as the direct westerly winds side-streaming along the southern building façade, the direct southerly winds around the RD Watts Building and accelerating flows around the southern corners of the building. The effect of downwashed winds off the southern façade to the forecourt below will be minimal given the height of the proposed development with respect to the RD Watt Building roof. Furthermore, note the adjacent Life Sciences site to the west of the development is proposed to be redeveloped into a taller four to five storey building with through-site links connected to the proposed pedestrian footpath. The majority of the outdoor trafficable areas will subsequently benefit from the additional shielding provided by the Future Life Sciences Building built form. Prior to the completion of this future development, the latest landscape design for the ground floor areas will include additional landscaping in the following key areas:

- Along the western aspect of the site
- Along the western and eastern aspects of the RD Watt Building.

The inclusion of the additional tree planting in these areas will be effective in baffling any approaching winds to the forecourt area of the subject development. Furthermore this layout will assist in helping to stagnate the any downwashed southerly winds.

It is expected the inclusion of densely foliating trees along the southern boundary of the site as indicated in Figure 3b will be effective in mitigating these potential adverse wind effects.

Furthermore, the proposed awning between the subject building and the RD Watts Building is expected to enhance the localised wind conditions and is recommended to be retained.

Hence with the inclusion of the abovementioned recommended treatments and indicated in Figure 3b, the wind conditions within the various ground level outdoor trafficable areas of the site are expected to be acceptable for its intended uses. Note that the densely foliating trees are to be capable of growing to a height of 4m with a 4m wide canopy. Furthermore, the densely foliating trees are recommended to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year. The inclusion of additional densely foliating vegetation such as trees and shrubs within and around the outdoor seating, courtyard and pedestrian footpaths is expected to further enhance the localised wind conditions within these areas.

In can be noted that from the initial recommended treatments, as outlined in Figure 3a, and the latest proposed landscape design, Figure 3b, there is a considerable amount of additional tree planting along the western aspect of the site beyond what was initial recommended to mitigate potential wind effects.

4.2 Rooftop Communal Terrace

The rooftop communal terrace wrapping along the southern, eastern and northern boundaries of the site is exposed to the prevailing winds due to the lack of shielding provided by the up-stream developments. To mitigate these potential adverse wind effects it is recommended the proposed awning above the outdoor seating area is retained and 1.5m high impermeable balustrades are included along the perimeter of the communal terrace. Hence with the inclusion of the abovementioned treatments into the final design of the development, the wind conditions within the various private balconies and terraces are expected to be tolerable for its intended uses.

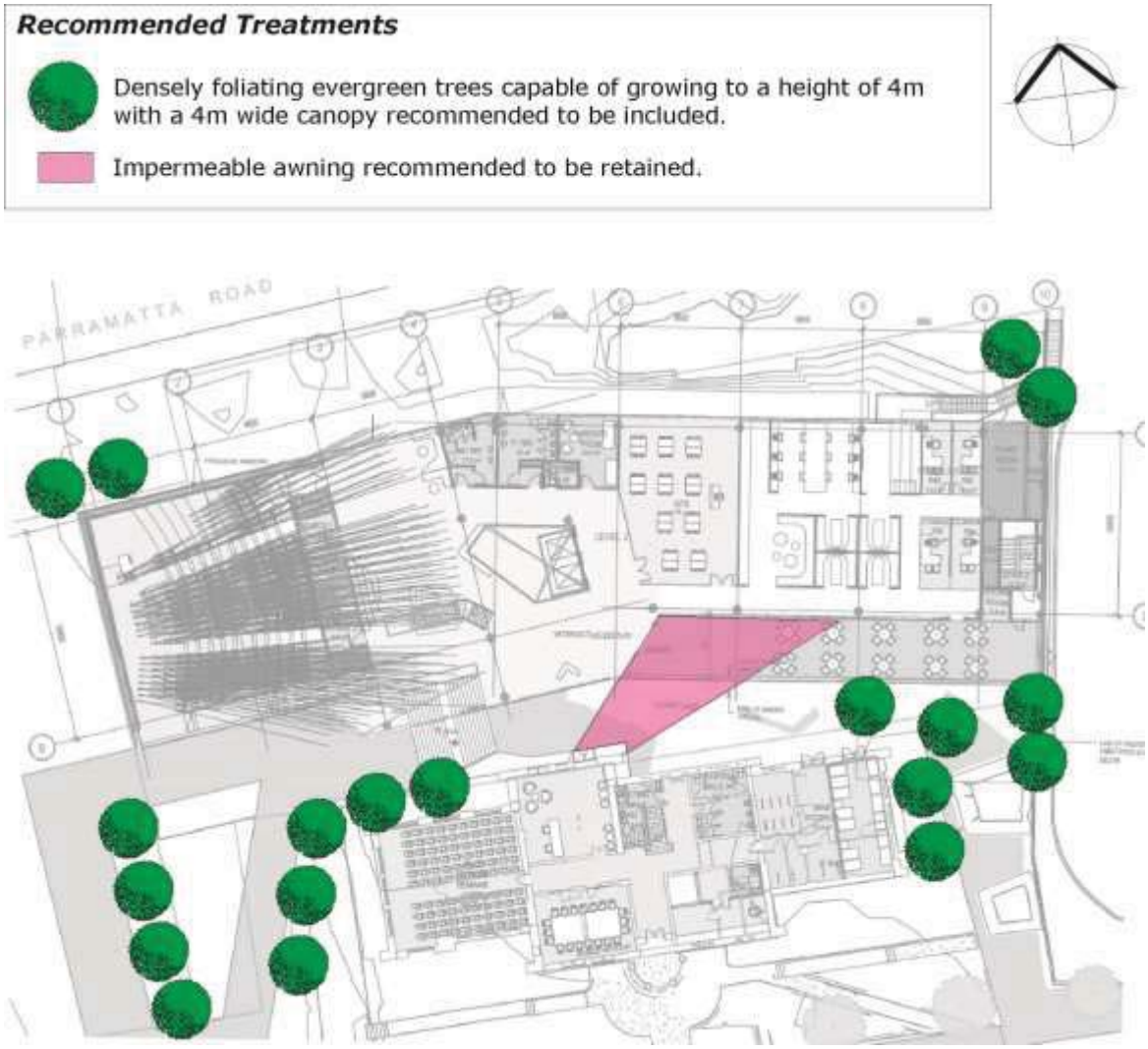

Figure 3a: Initial Recommended Treatments – Ground Level

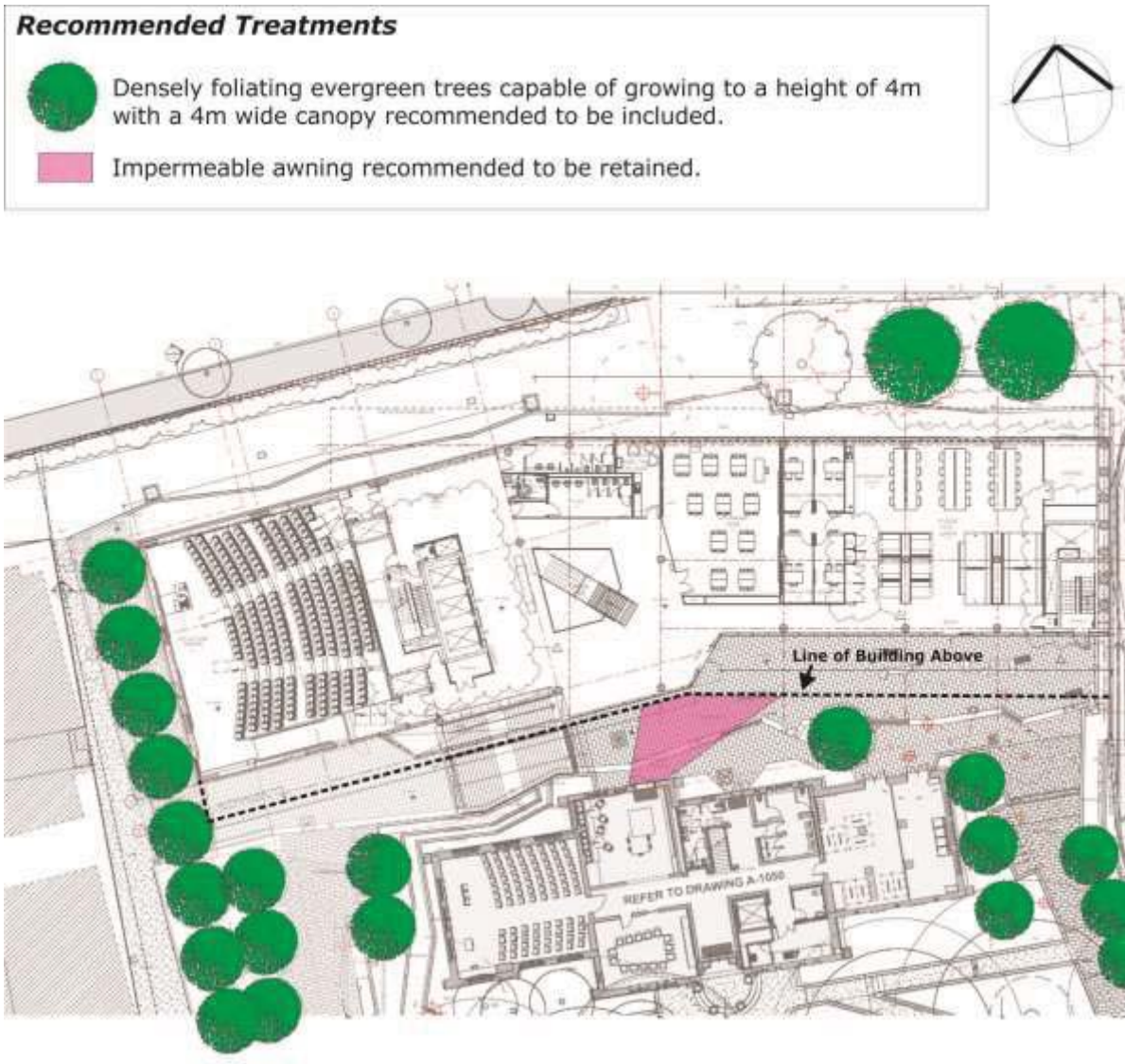

Figure 3b: Landscape Design with Recommended Treatments – Ground Level