PEDESTRIAN WIND ENVIRONMENT ASSESSMENT

MACQUARIE PARK COMMERCE CENTRE, 396 LANE COVE ROAD, MACQUARIE PARK

WD738-01F02(REV2)- WS REPORT

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DOCUMENT CONTROL

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February 1, 2018	Comments	1	KP	TR	KP
February 7, 2018	Updated Ground Floor Plan	2	KP	TR	KP

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EXECUTIVE SUMMARY

This report is in relation to the proposed Modification Application to MP 09_0209 relating to the Macquarie Park Commerce Centre development located at 396 Lane Cove Road in Macquarie Park and presents an opinion on the likely wind conditions affecting the various trafficable 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 subject development 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 Section 75W architectural drawing set which have been prepared by Bates Smart, dated February 2018. 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. 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 assessment indicate that the change to the proposed development is not expected to adversely impact the wind conditions for the local surrounding area due to the main buildings being setback from the site boundary and inclusion of landscaping throughout the development. The development is mainly exposed to the north-easterly and westerly winds due to the current exposure however will benefit from proposed developments in the nearby areas. Recommendations have been made within the report to mitigate the potential for funnelling between the building forms as well as the communal terrace areas which will be exposed to direct winds due to their elevated location on the buildings.

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. Note that 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.

1 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

The proposed Macquarie Park Commerce Centre development site is located at 396 Lane Cove Road in Macquarie Park and is bounded by Waterloo Road to the north, Lane Cover Road to the east, Giffnock Avenue and the Hyundai Building to the south and Coolinga Street to the west. The site is predominantly surrounded by low to medium-rise industrial buildings. The Macquarie Park corridor is located towards the south-east and north-west of the site, where numerous high-rise developments are proposed. Residential houses are generally located further beyond towards the north-east and south-west of the site, with Lane Cove National Park also located to the north-east. A survey of the local land topography indicates the land slopes downwards from south to north across the site and beyond, as well as to the east, while being relatively flat towards to west of the site. An aerial image of the subject site and the local surroundings is shown in Figure 1a.

The proposed development consists of 4 commercial buildings, with Building A 17 levels above ground and Buildings B, C and D 9 levels above ground. Buildings A, B and C are located along Waterloo Road, with Building A located along Lane Cove Road. While Building D is located at the corner of Coolinga Street and Giffnock Avenue. The proposed precinct site plan is shown in Figure 1b.

The critical trafficable areas associated with the proposed development, which are the focus of this assessment with regards to wind effects, are detailed as follows:

- Ground level pedestrian footpaths within and around the development.
- Building A:
    - Communal terrace areas on the northern aspect of Levels 8 and 13
- Building B and C:
    - Communal terrace areas on the northern aspect of Levels 2, 4 and 6.
    - Communal terrace areas on the southern aspect on Level 7.
- Building D:
    - Communal terrace area on the northern aspect on Level 7.

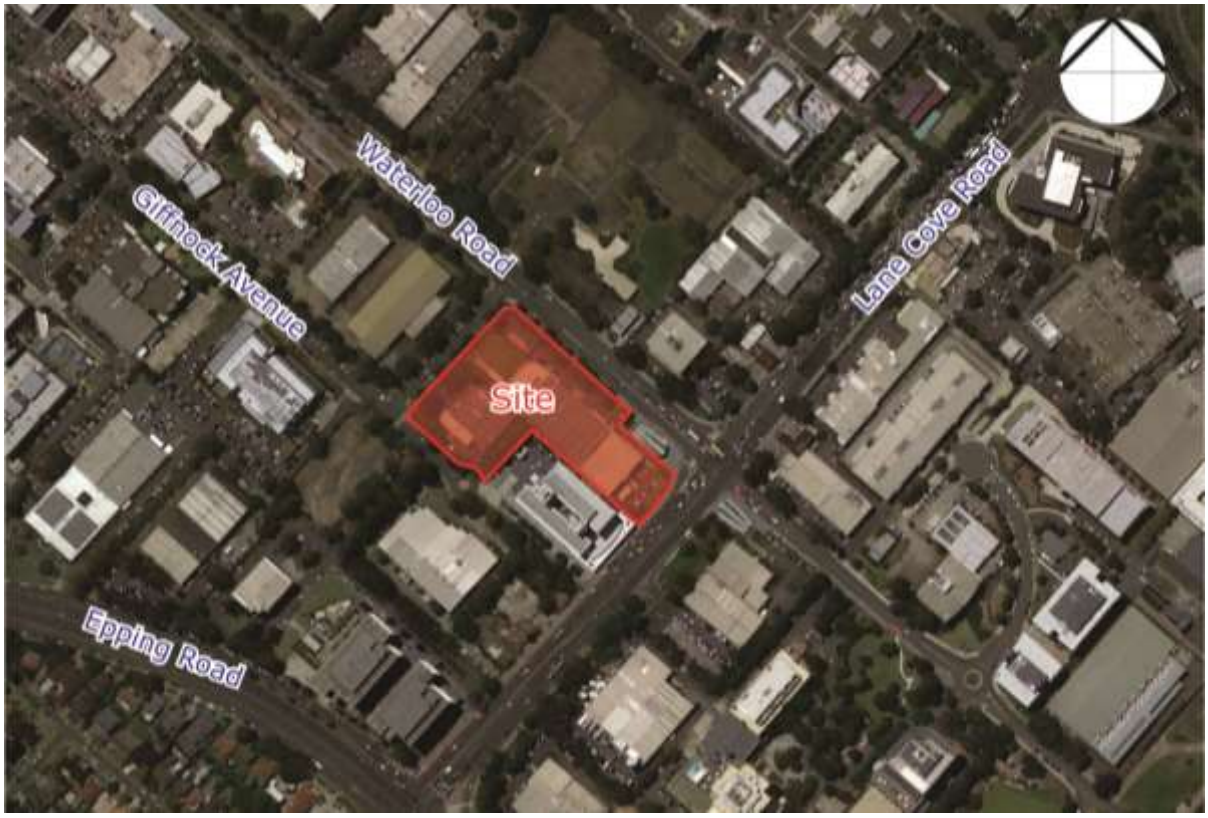

Figure 1a: Aerial Image of the Site Location

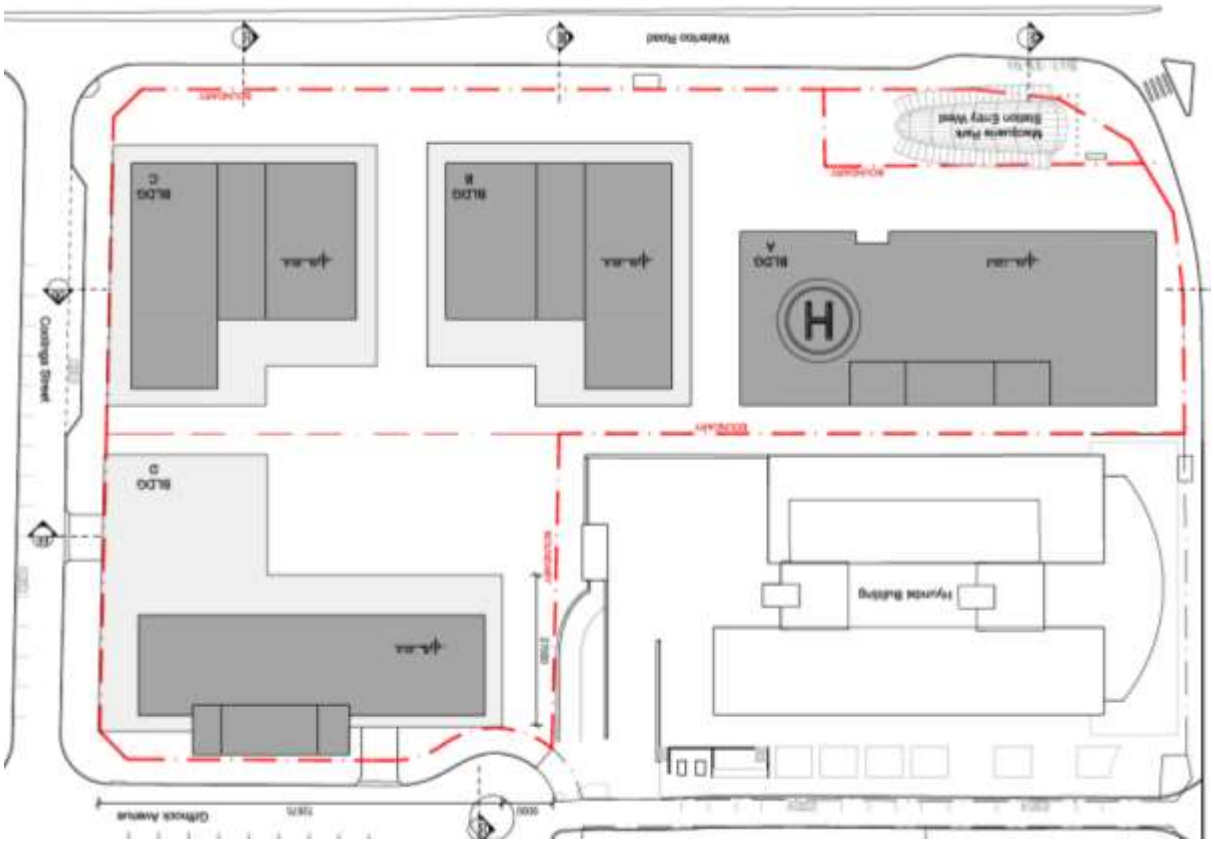

Figure 1b: Proposed Precinct Site Plan

2 WIND CLIMATE OF THE SYDNEY REGION

The Sydney region is governed by three principal 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 1995 to 2016). The recorded wind data from Bankstown Airport is noted to be influenced by the close proximity of the anemometer to the warehouses located to the north-east and is not deemed to be suitable as part of the wind analysis for this project. 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: Principal 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	

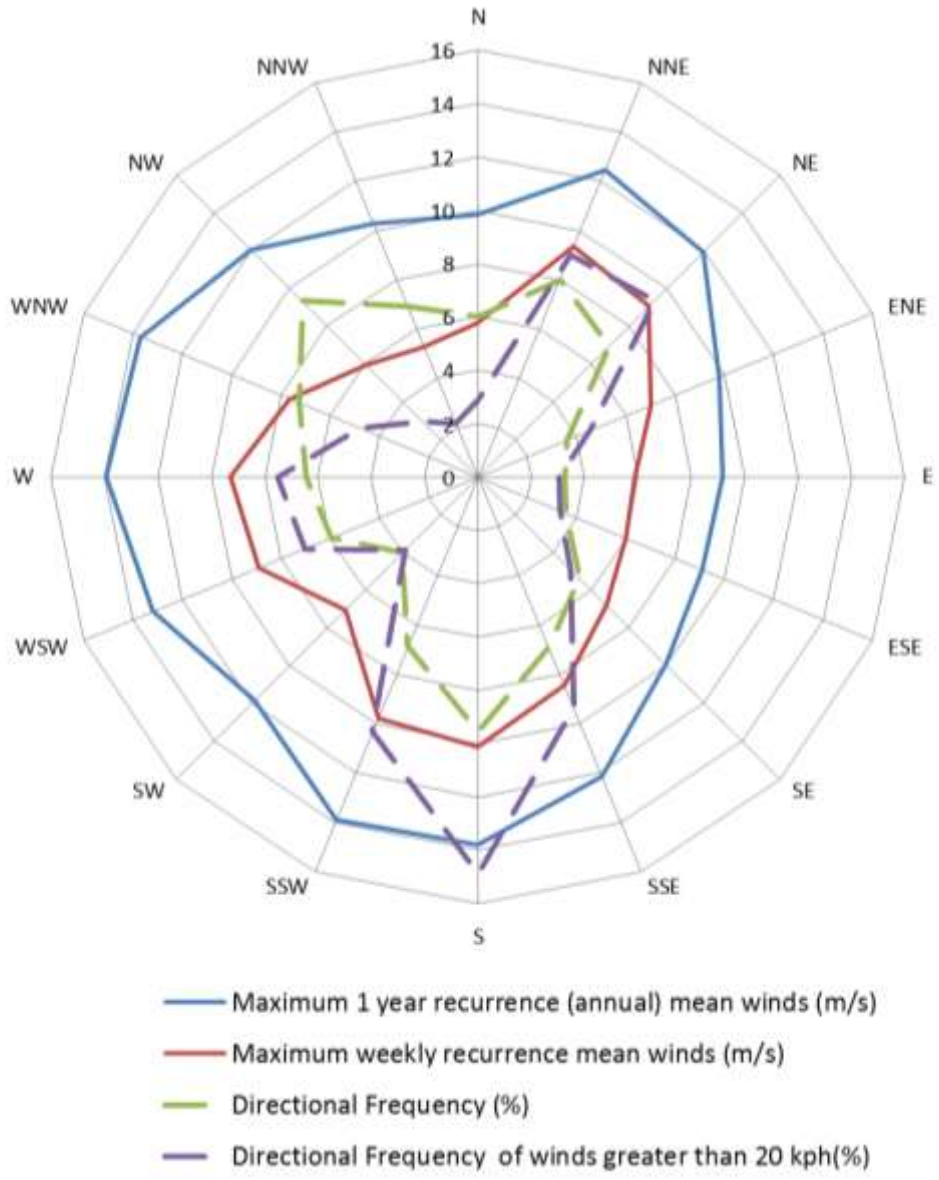

Figure 2: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10-minute mean observations from Kingsford Smith Airport from 1995 to 2016, corrected to open terrain at 10m)

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 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. Recommendations made within this report will be reviewed and developed as part of the detailed design of the buildings.

4.1 Ground Level Areas

The subject site is currently somewhat exposed to the prevailing north-easterly and westerly winds due to the surrounding areas generally consisting of low-rise industrial buildings or undeveloped/proposed sites. The completion of the under-construction Adina Apartment Hotel will further assist in mitigating the southerly winds across the site. The area however does benefit from the significant vegetation throughout the surrounding streets.

The proposed development site is aligned north-west to south-east which assist in generally directing the prevailing westerly and southerly winds around the site, reducing the potential for downwash effects from the tower form above. The Waterloo Road aspect however directly faces the prevailing north-easterly winds which occur during the warmer months of the year hence should be accounted for. Buildings A, B and C are all subsequently setback from the Waterloo Road boundary which will reduce any impact to the pedestrian footpath, while the inclusion of the proposed significant landscaping along this aspect will further enhance conditions to this region. The inclusion of an awning along the north-eastern aspect which wraps around to the adjacent aspects of the three buildings is recommended to mitigate potential downwash effects to the recessed ground floor below. The further development of the vacant site to the north will further enhance conditions in this area. Building A is also expected to provide additional shielding to the southerly winds for the Macquarie Park Station Entry West.

The westerly winds are expected to affect the drop-off area and stair entry along Coolinga Street due to the current exposure to the west. The dense existing tree planting to the west will provide significant protection to these winds. The stairway entry to the central landscape area is expected to be exposed to adverse pressure driven flow. It is therefore recommended that consideration be made for the inclusion of localised screening/landscaping at either end of this entrance or the inclusion of a canopy over this stairway entrance.

The central landscape area is expected to be generally well shielded to the prevailing winds by the subject development as well as the existing Hyundai Building and under-construction Adina Hotel. The inclusion of the proposed landscaping along the site boundary to the west of Building D and south of Building A is recommended to ensure no localised funnelling occurs.

While the ground plane is still being developed, consideration should be made for an effective air-lock for at least one end of the various ground floor lobby spaces. Due to openings being proposed on different aspects of the various buildings, adverse pressure driven wind entry effects are expected to occur which will impact the internal space.

The Child Care terrace area is generally well shielded from the prevailing winds, however the inclusion of screening at the northern and southern ends will help to ensure that localised side-stream winds do not impact this area.

4.2 Communal Terrace Areas

4.2.1 Building A

Communal terrace areas are proposed along the entire northern aspect of Building A at Level 8 and 13. These areas are expected to be exposed to the southerly and westerly winds side-streaming around the eastern and west corner respectively. Subsequently it is recommended that an impermeable screen included at the eastern and western ends of these terrace areas to mitigate these effects.

The large extent of the terrace space along the northern aspect will also make this space susceptible to the north-easterly winds recirculating and causing adverse conditions. It is therefore recommended that a combination of an impermeable balustrade and dense foliating shrubs, capable of growing to a height of 1.5m be included along the northern aspect of these terrace space to enable suitable conditions for the occupants.

4.2.2 Buildings B and C

Communal terrace spaces are proposed on the northern aspect of Building B and C in mid-span of the façade on Levels 2, 4 and 6. The terrace spaces are proposed to be partially recessed into the façade and extruded out from the façade with a double height spacing. The area is mainly expected to be exposed to the north-easterly winds due to the alignment of the site, which typically occur during the summer period of the year. The inclusion of a 1.5m high impermeable balustrade is recommended around the perimeter of the terrace space to provide suitable protection for the direct north-easterly winds. It should also be noted that the proposed future development to the precinct on the northern side of Waterloo Road will also provide further protection from these north-easterly winds.

The communal terrace area located on Level 7 overlooking the central landscaped area benefits from shielding from the prevailing winds by the subject development. The inclusion of an impermeable balustrade will ensure that suitable conditions are provided for this outdoor area.

4.2.3 Building D

The communal terrace area proposed for Building D is located overlooking the central landscaped area and hence benefits from shielding from the prevailing winds by the subject development and the under-construction Adina Apartment Hotel development to the south. The

inclusion of an impermeable balustrade will ensure that suitable conditions are provided for this outdoor area.

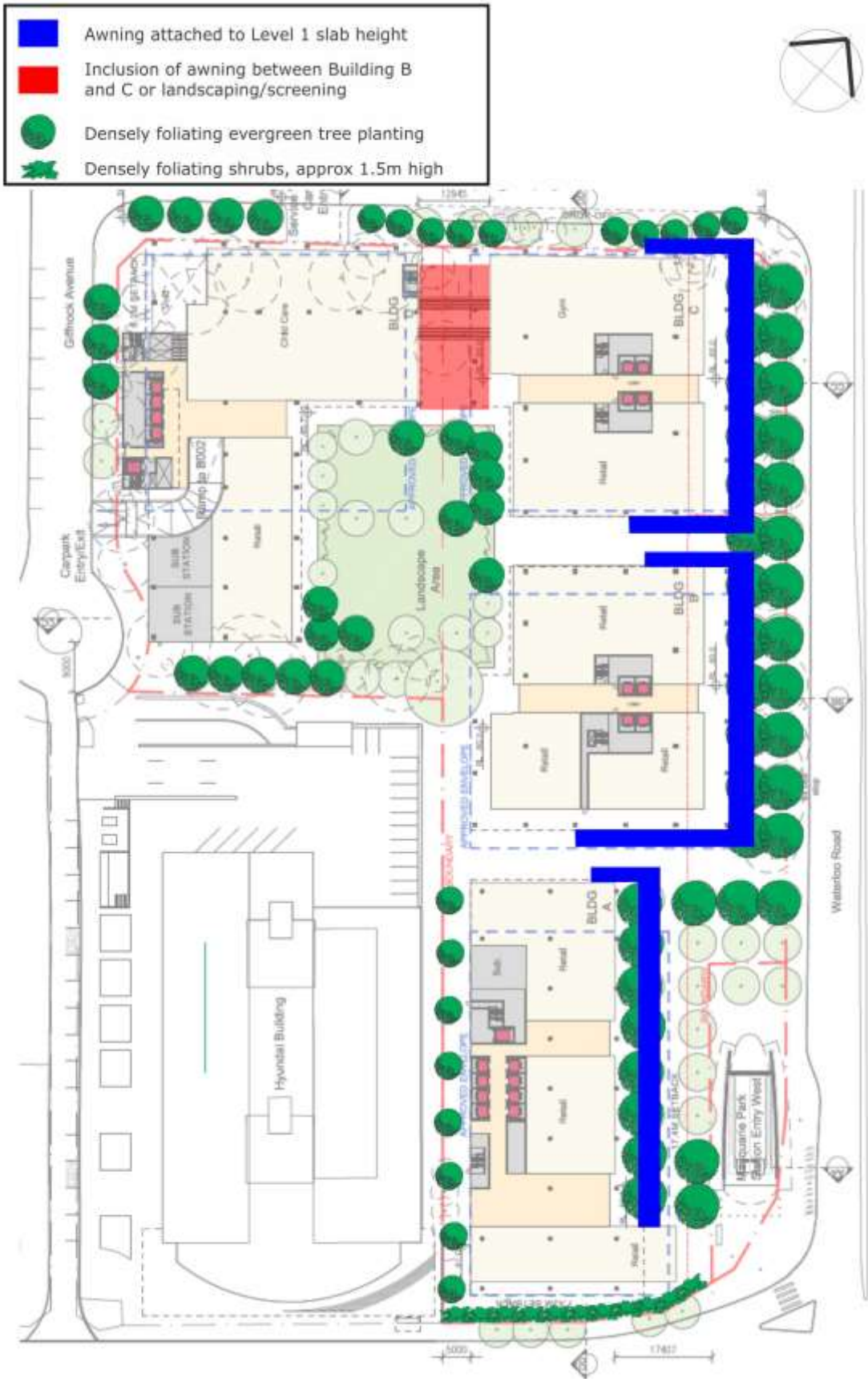

Figure 3: Recommended Treatments on an Indicative Ground Floor Plan