



**PEDESTRIAN WIND ENVIRONMENT STATEMENT**  
**LOT 4, 158-164 HAWKESBURY ROAD AND 2A DARCY**  
**ROAD, WESTMEAD**

**WC963-01F03(REV0)- WS REPORT**  
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## DOCUMENT CONTROL

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## EXECUTIVE SUMMARY

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This report is in relation to the Lot 4 development, located at 158-164 Hawkesbury Road and 2A Darcy Road in Westmead, and presents an opinion 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; namely the north-easterly, southerly and westerly winds. The analysis of the wind effects relating to the proposed 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 latest architectural drawings prepared by Turner, received December, 2016. No wind tunnel testing has 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. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects. It should be noted that the provided drawings are early design drawings, and the recommendations and results provided may be required to be adapted where practical.

The results of this study indicate that the wind conditions for the majority of the trafficable private balcony areas within the site will be acceptable for its intended uses due to the shielding provided by the surrounding developments, and effective use of wind mitigating devices such as balustrades, blade walls, louvers, full-height screens and recessed setback incorporated into the design of the developments. These wind mitigating devices are recommended to be retained in the final design of the development.

There are however outdoor trafficable areas that are exposed to potentially adverse wind effects such as exposure to the direct winds due to the lack of shielding from the up-stream developments or the alignment of the roads to the prevailing wind directions, accelerating flows around the corners of the development, or potential down-wash effects off the building façade. The inclusion of the following treatments is expected to be effective in enhancing the wind conditions on the various outdoor trafficable areas within and around the site. The treatments are summarised as follows:

#### Ground Level areas:

- The retention of the densely foliating trees along the pedestrian footpaths surrounding the site as indicated in the architectural drawings. The densely foliating trees near the corners of the building; in particular along the southern boundary of the site, are recommended to be closely spaced, ideally with interlocking foliage.

#### Podium Communal Courtyard:

- The retention of the proposed densely foliating trees and shrubs/hedge planting as indicated in the landscape scheme.

**Private Balcony areas:**

- **Building D1 – South-west private corner balcony on Levels 4 to 19:** The inclusion of full-height louvers or impermeable screens along either of the western or southern perimeter edge. The full-height louvers or impermeable screens can be fixed or operable.

With the inclusion of the abovementioned treatments, wind conditions for all trafficable outdoor areas within and around the development are expected to be suitable for their intended uses. The densely foliating trees and shrubs/hedge planting along the western boundary of the podium communal courtyard and ground level pedestrian footpaths is recommended to be of an evergreen species to ensure their effectiveness in mitigating the prevailing westerly winds that primarily occur during the winter periods of the year.

Note the inclusion of additional wind mitigation elements such as baffle screens, pergolas and densely foliating vegetation within the various outdoor trafficable areas is expected to be effective in further enhancing the localised wind conditions.

Furthermore the use of loose glass-tops and light-weight sheets or covers (including loose BBQ lids) is not appropriate on high-rise outdoor terraces and balconies. Hence the use of lightweight furniture is not recommended unless it is securely attached to the balcony or terrace floor slab.

## **1 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS**

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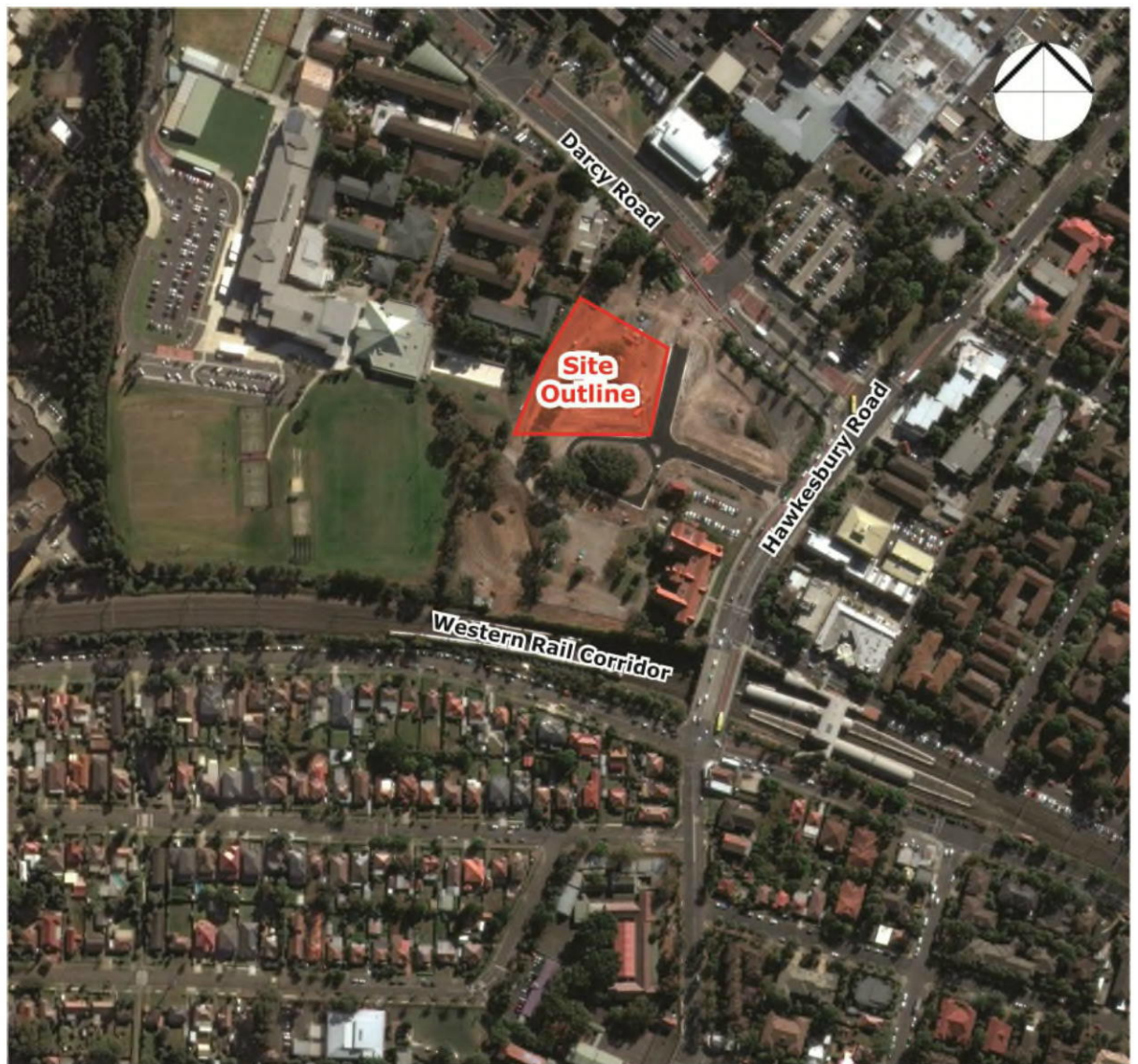
The development site is bounded by Parramatta Marist High School to the west and new internal roads of the WSU redevelopment along the remaining boundaries. Along these new internal roads are the various buildings of the WSU redevelopment varying from 6 to 24 storeys in height. Directly to the north is the proposed Lot 3 development to the north, the Lot 2 development to the east and a proposed communal reserve with the Lot 5 development to the south. St Vincent's (Lot 1) is located directly to the east of the site, with Wisteria Gardens and Parramatta Park located further beyond to the east of the site. Surrounding the site are predominantly low-rise private residential housing with Parramatta Stadium and a mix of low to mid-rise buildings are located further east and Westmead Hospital to the north. An aerial image of the subject site and the local surroundings is shown in Figure 1.

The proposed development consists of three adjoining buildings in a horse-shoe arrangement atop a common single storey podium. The various buildings of the subject development are summarised as follows:

- Building D is comprised of two sections; Building D1 and D2 around the two common lobbies within the building. Both Buildings D1 and D2 are located along the southern boundary of the site with Building D1 having an overall height of 21 storeys and Building D2 with an overall height of 7 storeys respectively.
- Building E is comprised of two sections; Building E1 and E2 around the two common lobbies within the building. Building E1 has an overall height of 10 storeys and is located along the eastern boundary of the site. Building E2 also has an overall height of 10 storeys and is located along the northern boundary of the site.
- Building F has an overall height of 9 storeys and is located along the northern boundary of the site.

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:

- The pedestrian footpaths along the new internal road frontages of the development site.
- The central communal courtyard located on the podium roof.
- Private balconies of the various buildings throughout the development.



**Figure 1: Aerial Image of the Site Location**

## 2 WIND CLIMATE OF THE SYDNEY REGION

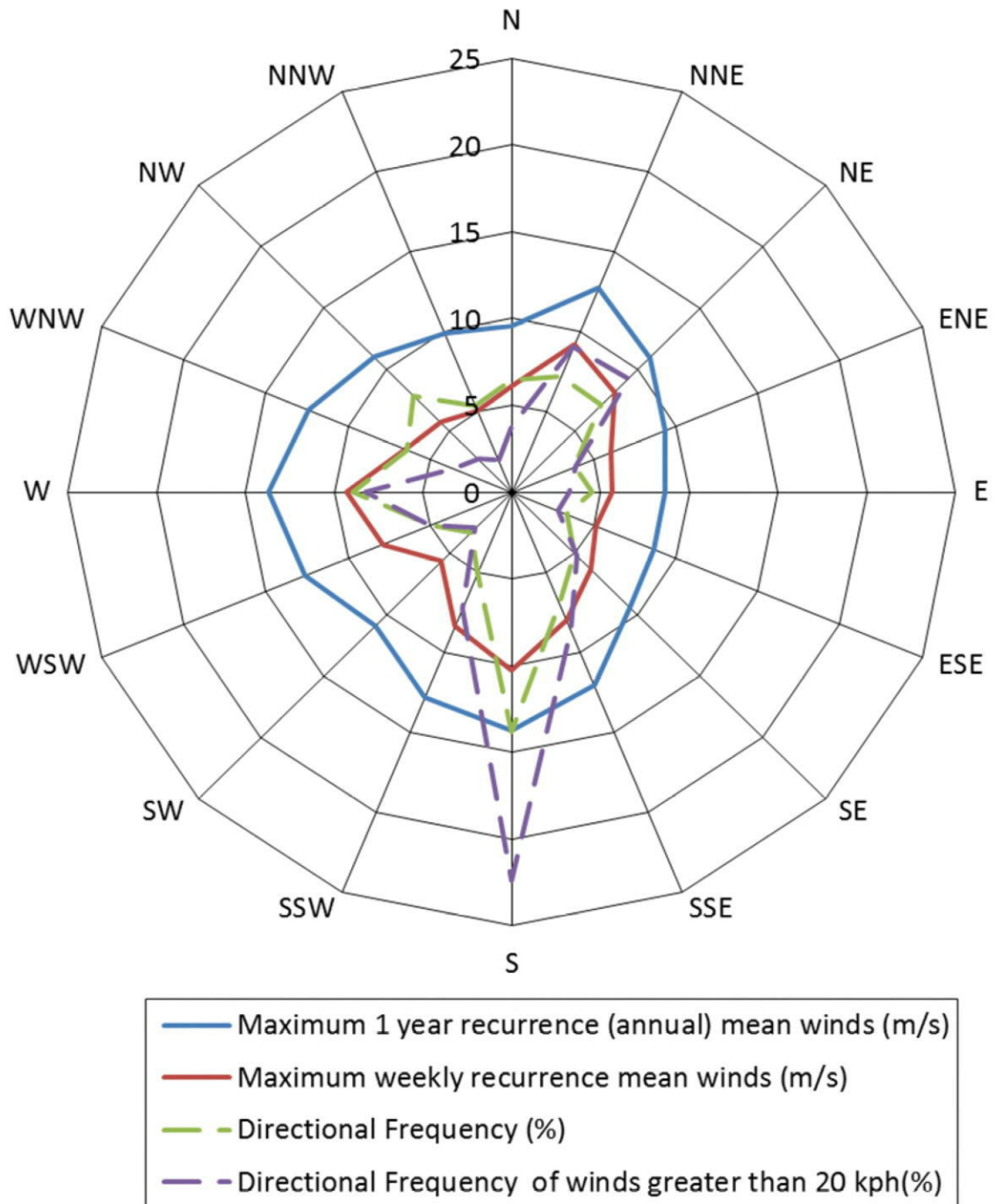
The Sydney region is governed by three principle wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary 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 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**

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The expected wind conditions are discussed in the following sub-sections of this report 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 is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, their overall heights and bulk, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report.

### **4.1 Pedestrian Footpaths Surrounding and Within the Site**

The pedestrian footpaths along the proposed internal roads on the northern, eastern and southern boundaries of the development site benefits from the shielding provided by the medium to high rise buildings of neighbouring Lots 2, 3 and 5 of the WSU redevelopment and the densely foliating trees of the reserve along the southern boundary. However, due to the north-south and east-west alignment of the internal roads, they are inherently exposed to the prevailing winds travelling along the roads, accelerating flows around the corners of the buildings and potential down-wash effects captured off the tower façade and redirected onto the pedestrian footpaths below. It is expected the inclusion of the proposed densely foliating trees along the pedestrian footpaths as indicated in the architectural drawings to be effective in enhancing the local wind conditions along the footpath. Furthermore, the proposed densely foliating trees corners of the building; in particular along the southern boundary of the site, are recommended to be closely spaced ideally with interlocking foliage to be effective in ameliorating the corner accelerations flows around the buildings. Hence with the inclusion of the densely foliating trees, the wind conditions along the various pedestrian footpaths are expected to be acceptable for its intended uses. Note the inclusion of additional densely foliating vegetation is expected to be effective in further enhancing the localised wind conditions.

Note the densely foliating trees along the western boundary is recommended to be of an evergreen species to ensure their effectiveness in mitigating the prevailing westerly winds that primarily occur during the winter periods of the year.

### **4.2 Podium Communal Courtyard**

The wind conditions on the communal courtyard is expected to be acceptable for its intended uses with the inclusion of the proposed densely foliating trees and shrubs/hedge planting within the landscape scheme and the shielding provided by the buildings of the subject development site.

Note the densely foliating trees and shrubs/hedge planting along the western boundary of the communal courtyard is recommended to be of an evergreen species to ensure their

effectiveness in mitigating the prevailing westerly winds that primarily occur during the winter periods of the year.

### **4.3 Private Balconies**

Wind conditions for the majority private balconies and terraces of the proposed development are expected to be tolerable for their intended use due to the shielding provided by the subject development and the effective use of wind mitigating devices into the design of the development such as recessing the private balcony areas into the building form and the inclusion of full-height privacy screens and blade walls along the various private balconies. The inclusion of the proposed balustrades along the perimeter of the balconies is expected to further enhance the wind conditions. Hence these features are recommended to be retained in the final design of the development.

However the private corner balconies located along the south-western corner of Building D1 is exposed to the accelerating flow around the corner of the building and the direct southerly and westerly winds. It is expected the inclusion of full-height louvers or impermeable screens are included along either the southern or western perimeter edge of the private corner balcony to be effective in mitigating these adverse wind effects. The full-height louvers or impermeable screens can be fixed or operable.

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.

Note the use of loose glass-tops and light-weight sheets or covers (including loose BBQ lids) is not appropriate on high-rise outdoor terraces and balconies. Hence the use of lightweight furniture is not recommended unless it is securely attached to the balcony or terrace floor slab.