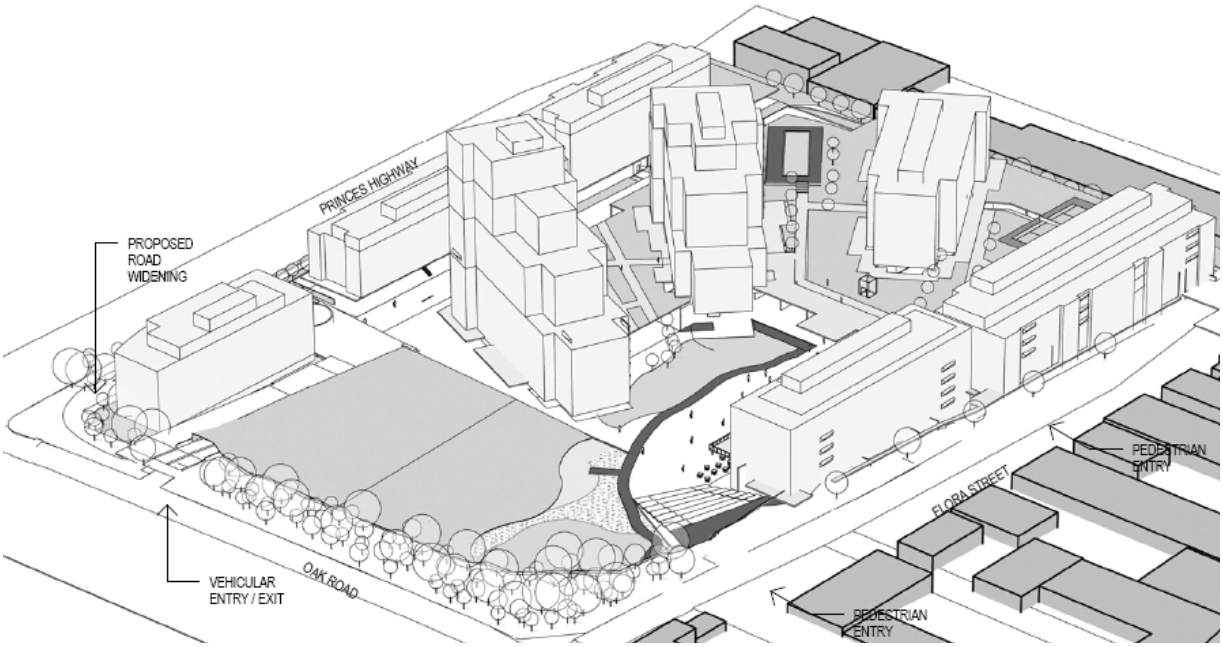

Pedestrian Wind Environment Statement

for the proposed redevelopment of the

Kirrawee Brick Pit, Kirrawee

November 11, 2010

Report Reference No. WA951-01F02(rev2)- WS Report

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Document Control

Revision Number	Date	Revision History	Prepared By (initials)	Reviewed & Authorised By (initials)
0	08/10/2010	Initial	NT	AB
1	18/10/2010	Client Comments	NT	AB
2	11/11/2010	Correction to Heights	NT	AB

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1.0 Introduction

This report is in relation to the proposed redevelopment of the Kirrawee Brickpit, located at the intersection of the Princes Hwy and Oak Road Kirrawee, 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 redevelopment.

The effect of wind activity within and around the proposed redevelopment 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 architect Woodhead, received October 2010. No wind tunnel tests have been undertaken for the subject development. As such, 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.

This Pedestratian Wind Environment report has been prepared in support of an application for Concept Plan approval under Part 3A of the Environmental Planning and Assessment Act at 566-594 Princes Highway Kirrawee, otherwise known as the former Kirrawee Brick Pit (Reference MP 10_0076). The application seeks approval for a mixed use development comprising residential, retail and commercial uses and building envelopes of between 5 and 15 storeys. The proposal also involves basement car parking and includes commuter parking, landscaping, services and the provision of a major new public park. Specifically, this report addresses issue number 6 as detailed in the Director General's Requirements (DGR's) issued by the Department of Planning on 24 August 2010.

2.0 Regional Wind Climate for Sydney

The Sydney region is governed by three principle wind directions, and these can potentially affect the subject redevelopment. 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 an analysis of wind rose data obtained by the Bureau of Meteorology from Kingsford Smith Airport between 1939 and 2000. The wind roses are attached in the appendix of this report.

Table 1: Principal Time of Occurrence of Winds for Sydney

Month(s)	Prevailing Wind Direction		
	North-Easterly	Southerly	Westerly
January through to March	X	X	
April		X	X
May through to August			X
September		X	X
October through to December	X	X	

A directional plot of the annual and weekly recurrence winds for the Sydney region is shown in Figure 1 below. The frequency of occurrence of these winds is also shown in Figure 1. This plot has been produced based on an analysis of recorded wind speed data obtained from Kingsford Smith Airport from 1939 to 2008.

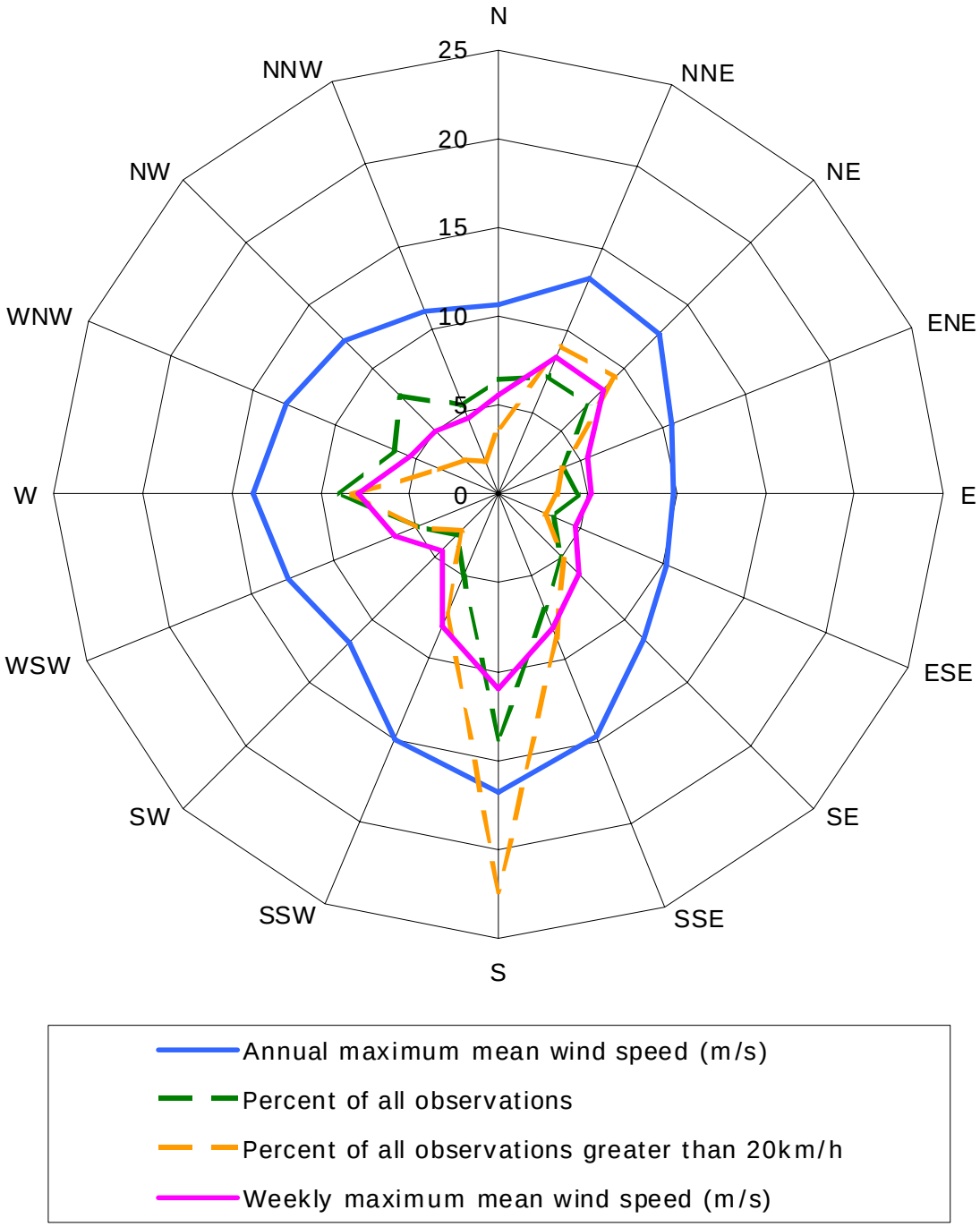


Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

3.0 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.

The following table, developed by Penwarden (1975), 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 1: Summary of Wind Effects on People (after Penwarden, 1975)

Type of Winds	Gust 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.

4.0 Description of the Site and the Proposed Redevelopment

4.1 Description of the Site Location and Surrounds

The proposed redevelopment site is located at the intersection of Princes Highway and Oak Road, Kirrawee.

The site bounded by Princes Highway to the North, Oak Road to the West and Flora Street to the South. There are low rise light industrial / commercial buildings which are one or two stories in height running along the eastern site boundaries and to the north and south of the development. To the west of the site are low rise residential buildings which are two to three stories in height. Further away from the site in most directions are low rise residential buildings.

Currently the site is vacant and it is dominated by a large water filled pit. Several large trees are presently located nearby to the south-western corner. Figure 2 below shows an aerial image of the site location.

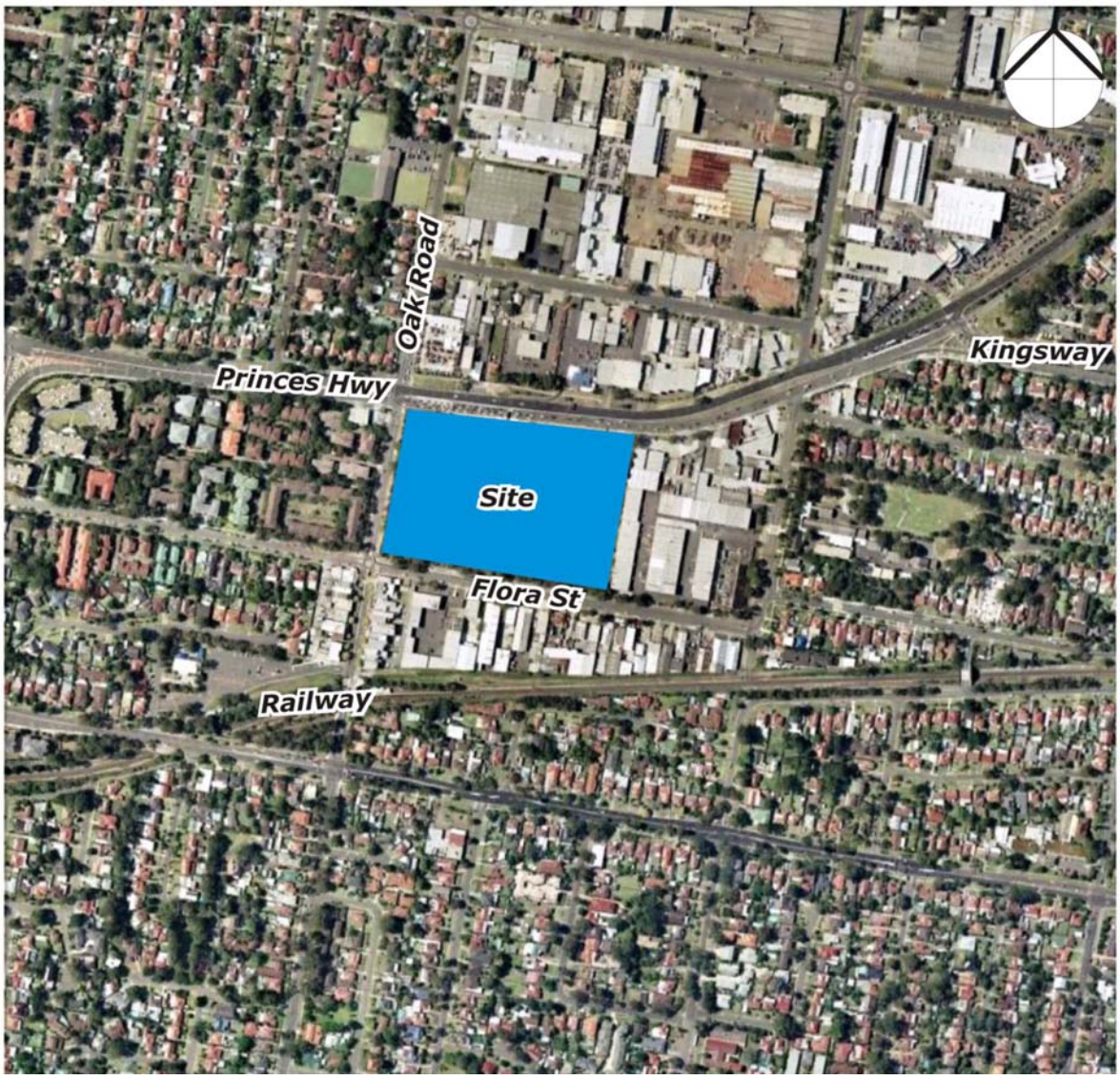


Figure 2: Aerial Image of the Site Location

4.2 Description of the Proposed Development

The proposed development is a mixed used commercial, retail and residential development. There is a single level podium with retail space on the lower level and landscaping above. Pedestrian thoroughfares link the Piazza area with the retail and open spaces.

There are eight main buildings with the following maximum number of Levels:

- **Building A** – 6 to 15 storeys above piazza level
- **Building B** – 6 to 10 storeys above podium
- **Building C** – 6 storeys above podium
- **Building D** – 5 storeys
- **Building E** – 4 storeys
- **Building F** – 5 storeys
- **Building G** – 5 storeys
- **Building H** – 5 storeys

The podium is one storey in height.

A site plan of the proposed development is shown in Figure 3.

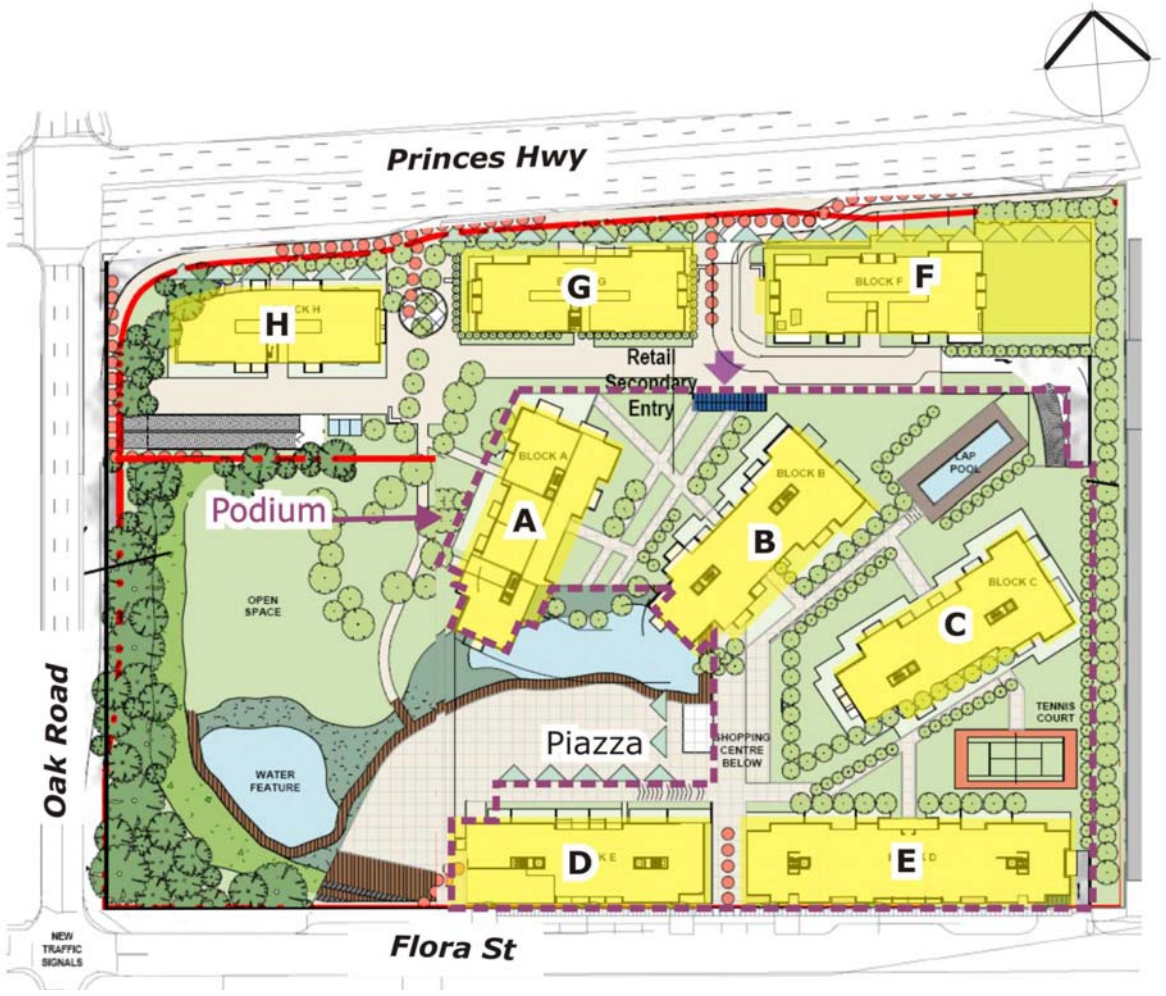


Figure 3: Site Plan of the Proposed Development

5.0 Results of the Analysis

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. Important features taken into account include the distances between the proposed building forms, their overall heights and bulk, as well as the landform. Only the potentially critical wind effects are discussed in this report.

5.1 North-Easterly Winds

North-easterly winds occur most frequently during the warmer months of the year for the Sydney region. They are typically not as strong as the southerly winds, and are usually welcomed within outdoor seating areas since they typically occur when it can be quite warm during the summer.

It is expected that the existing surrounding buildings will shield portions of the ground level areas of the site to the prevailing north-easterly winds.

Pedestrian Accessible Lower Ground Level Areas

Most lower ground level areas of the developments are protected by the proposed development and the proposed landscaping plan. The road way between Buildings F and G may be subject to adverse north-easterly winds. With the addition of densely foliating trees on the eastern side of the roadway similar to those proposed on the western side of the roadway, it is expected that this area will be suitable for its intended use. These trees, and the proposed trees to be retained, are shown in Figure 4.

Pedestrian Accessible Upper Ground Level Areas

Wind conditions on the upper ground level podium are generally expected to be suitable for their intended use due to the low height of the podium. The north-easterly winds will be funneled between Buildings B and C and may cause adverse conditions nearby to these buildings on the podium. With the addition of scattered densely foliating trees between these buildings (Figure 5) wind conditions are expected to be suitable for their intended use.

Buildings

Upper level corner balconies, non-recessed balconies and terraces may be subject to adverse wind conditions. With the addition of impermeable balustrades around the complete perimeter of these areas, or full height screening at either end of these areas, it is expected that they will be suitable for their intended use. It is recommended that this be investigated in more detail at a more detailed design stage.

5.2 Southerly Winds

As shown in Figure 1 of this report, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. It is expected that the existing surrounding buildings will shield portions of the ground level areas of the site to the prevailing southerly winds.

Pedestrian Accessible Lower Ground Level Areas

Most lower ground level areas of the developments are protected by the proposed development and the proposed landscaping plan.

The retail mall entrance on Flora Street may be subject to adverse southerly winds. With the retention of the proposed awning above the retail entrance it is expected that wind conditions within the entrance to the mall will be suitable for use as a pedestrian thoroughfare. The stairs linking the Piazza and Flora Street may be subjected to southerly winds being deflected around the south-westerly corner of building D. With the addition of further trees nearby to this corner it is expected that wind conditions will be suitable for use as a pedestrian thoroughfare, alternatively the proposed awning along Flora St may be extended around this corner. These trees and awnings are shown in Figures 4 and 5.

Pedestrian Accessible Upper Ground Level Areas

Wind conditions on the upper ground level podium are generally expected to be suitable for their intended use due to the low height of the podium. The southerly winds will be funneled between Buildings A and B and may cause adverse conditions nearby to these buildings on the podium, although this effect will be partially offset by the setback levels of buildings B and C. With the addition of scattered densely foliating trees between these buildings (Figure 5) wind conditions are expected to be suitable for their intended use.

Buildings

Upper level corner balconies, non-recessed balconies and terraces may be subject to adverse wind conditions. With the addition of impermeable balustrades around the complete perimeter of these areas, or full height screening at either end of these areas, it is expected that they will be suitable for their intended use. It is recommended that this be investigated in more detail at a more detailed design stage.

5.3 Westerly Winds

Westerly winds occur most frequently during the winter season for the Sydney region. 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 seating areas.

It is expected that the existing surrounding buildings and trees will provide some shielding to the prevailing westerly winds for the ground level areas of the site.

Pedestrian Accessible Lower Ground Level Areas

Most lower ground level areas of the developments are protected by the proposed development and the proposed landscaping plan. The existing trees

along the western edge of the site will also provide shielding to the western landscaped areas and should be retained in the final landscaping plan.

Although the Piazza area is partially protected by the existing trees and is approximately 10m below Oak Road, it will be subject to adverse direct westerly winds. With the addition of scattered densely foliating trees it is expected that the Piazza area will be suitable for its intended use. The outdoor dining area below Building D will have similar wind conditions. However, with the retention of the awning, it is expected that wind conditions will be suitable for their intended use. These trees and awnings have been highlighted in Figure 4.

The open space at the western base of Building A will be subject to westerly winds that have been deflected downwards by the building façade above. With the retention of a landscaping plan similar to that currently proposed it is expected that this area will be acceptable for its intended use. The pedestrian walkway to the south of Buildings F, G and H may be subject to adverse westerly winds. With the implementation of a landscaping plan similar to that currently proposed it is expected that the wind conditions in these areas will be suitable for use a pedestrian thoroughfare. These trees have been highlighted in Figure 4.

Pedestrian Accessible Upper Ground Level Areas

Wind conditions on the upper ground level podium are generally expected to be suitable for their intended use due to the low height of the podium. The southerly winds will be funneled between buildings C and E and may cause adverse conditions nearby to these buildings on the podium. With the addition of scattered densely foliating trees between these buildings (Figure 5) wind conditions are expected to be suitable for their intended use.

Buildings

Upper level corner balconies, non-recessed balconies and terraces may be subject to adverse wind conditions. With the addition of impermeable balustrades around the complete perimeter of these areas, or full height screening at either end of these areas, it is expected that they will be suitable for their intended use. It is recommended that this be investigated in more detail at a more detailed design stage.

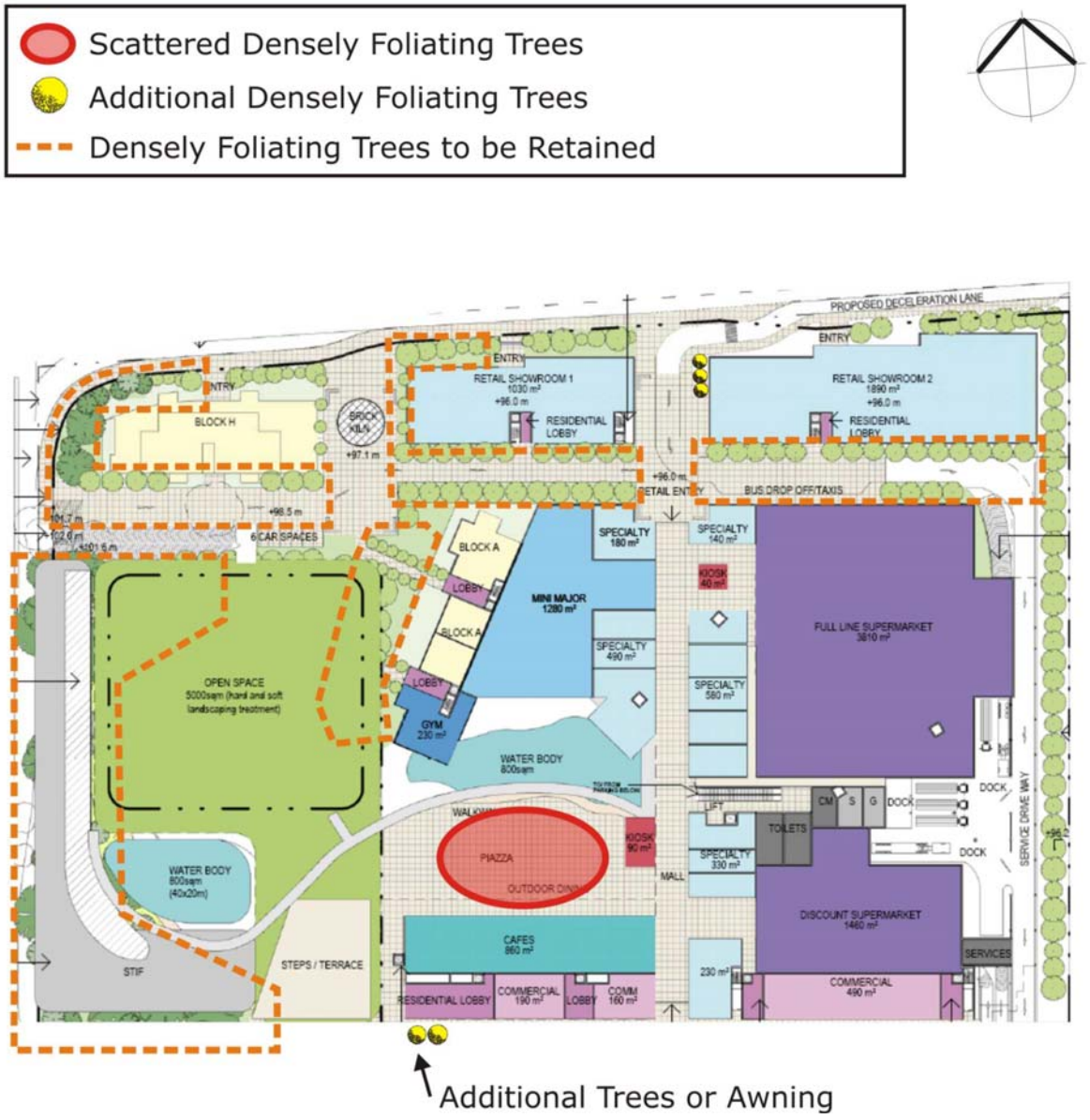


Figure 4: Lower Ground Level – Treatments

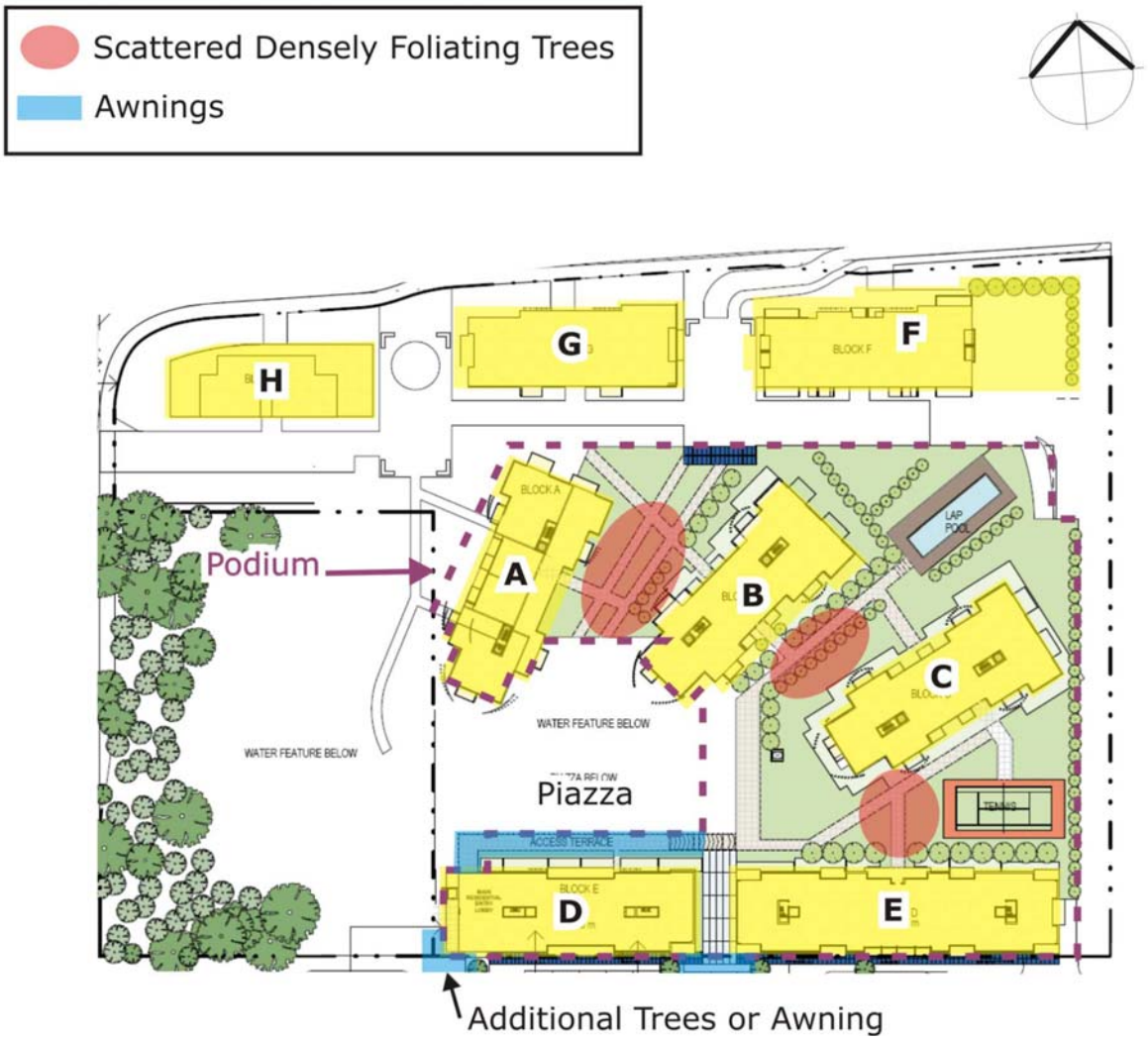


Figure 5: Upper Ground Level - Treatments

6.0 Conclusions

An analysis of the wind environment impact with respect to the three principal wind directions for the Sydney region has been completed for the proposed development of the Kirrawee Brickpit, located at the intersection of the Princes Hwy and Oak Road, Kirrawee.

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 architect Woodhead, received October 2010. No wind tunnel tests have been undertaken for the subject redevelopment. As such, 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.

The results of this study indicate that generally the expected wind conditions for around the site will be suitable for their intended use. With the implementation of the following treatments wind conditions around the entire site are expected to be suitable for their intended use:

- Retention of a landscaping plan similar to that proposed
- Strategic planting of trees on the Princes Hwy road entrance
- Retention of the existing trees on the western edge of the site
- Scattered densely foliating trees in the Piazza area
- Retention of the proposed awning below Building D partially covering the Piazza
- Retention of the proposed Flora Street awning above the entrance to the retail mall
- Additional planting of trees on the Flora Street or the extension of the proposed Flora Street awning.
- Scattered densely foliating trees strategically planted on the upper ground level podium
- Inclusion of impermeable balustrades around the complete perimeter or full height screens at either end of upper level corner balconies, non-recessed balconies or terraces. It is recommended that this be investigated in more detail at a more detailed design stage.

Wind conditions on the upper ground podium will be further enhanced with additional landscaping.

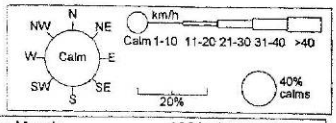
Note that for trees to be effective in wind mitigation for the whole year they must be of a densely foliating evergreen variety.

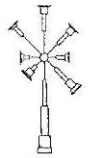
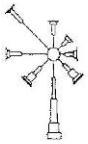
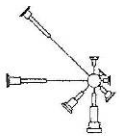
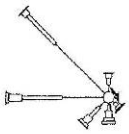
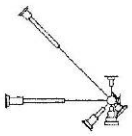
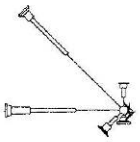
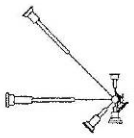
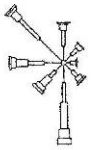
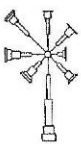
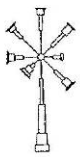
Appendix

Wind Roses for the
Sydney Region

Wind Roses using available data between 1939 and 2000 for SYDNEY AIRPORT AMO

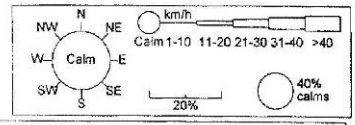
Site Number 066037 • Locality: SYDNEY AIRPORT • Opened Jan 1929 • Still Open
Latitude 33°56'28"S • Longitude 151°10'21"E • Elevation 6m



9 am January 1933 observations	9 am February 1755 observations	9 am March 1922 observations
		
9 am April 1834 observations	**9 am May 1866 observations**	**9 am June 1806 observations**
		
9 am July 1873 observations	**9 am August 1876 observations**	**9 am September 1814 observations**
		
9 am October 1901 observations	**9 am November 1835 observations**	**9 am December 1906 observations**
		

Wind Roses using available data between 1939 and 2000 for SYDNEY AIRPORT AMO

Site Number 066037 • Locality: SYDNEY AIRPORT • Opened Jan 1929 • Still Open
Latitude 33°56'28"S • Longitude 151°10'21"E • Elevation 6m



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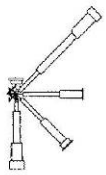

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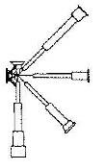
3 pm March 1925 observations



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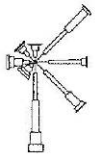

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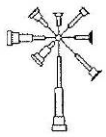

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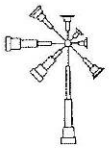

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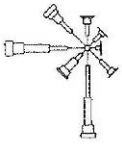

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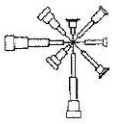

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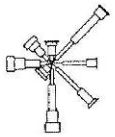

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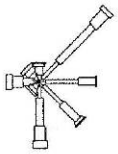

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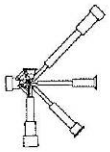

3 pm December 1906 observations