

Pedestrian Wind Environment Statement

for the proposed development known as
Precinct 3 Pemulwuy, Redfern

December 7, 2011

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Document Control

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Table of Contents

	Page
Table of Contents	3
1.0 Introduction	4
2.0 Regional Wind Climate for the Sydney Region	4
3.0 Wind Effects on People	6
4.0 Description of the Site and Surrounds	7
5.0 Description of the Proposed Development	9
6.0 Results of the Analysis	10
6.1 Pedestrian Footpaths Around The Site	10
6.2 North-Easterly Winds	10
6.3 Southerly Winds	11
6.4 Westerly Winds	11
7.0 Conclusions	13

Appendix: Wind Roses for the Sydney Region

1.0 Introduction

This report is in relation to the proposed residential development known as Precinct 3 Pemulwuy, Redfern, and presents an opinion on the likely impact of the local wind environment to the critical outdoor areas within and around the development.

The effect of wind activity within and around the proposed development 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 Concept Plan design massing drawings which have been prepared by the project architect Nordon Jago Architects, dated 2nd December 2011. 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.

2.0 Regional Wind Climate for the Sydney Region

The Sydney region is governed by three principle wind directions which 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 an analysis of wind rose data obtained by the Bureau of Meteorology from Kingsford Smith Airport between 1939 and 2004. The wind roses are attached in the appendix of this report.

For the Sydney region, north-easterly winds occur most frequently during the warmer months of the year. They are typically not as strong as the southerly winds, and are usually welcomed within outdoor areas since they typically occur when it can be quite warm during the summer. The southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. 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 areas.

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

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	

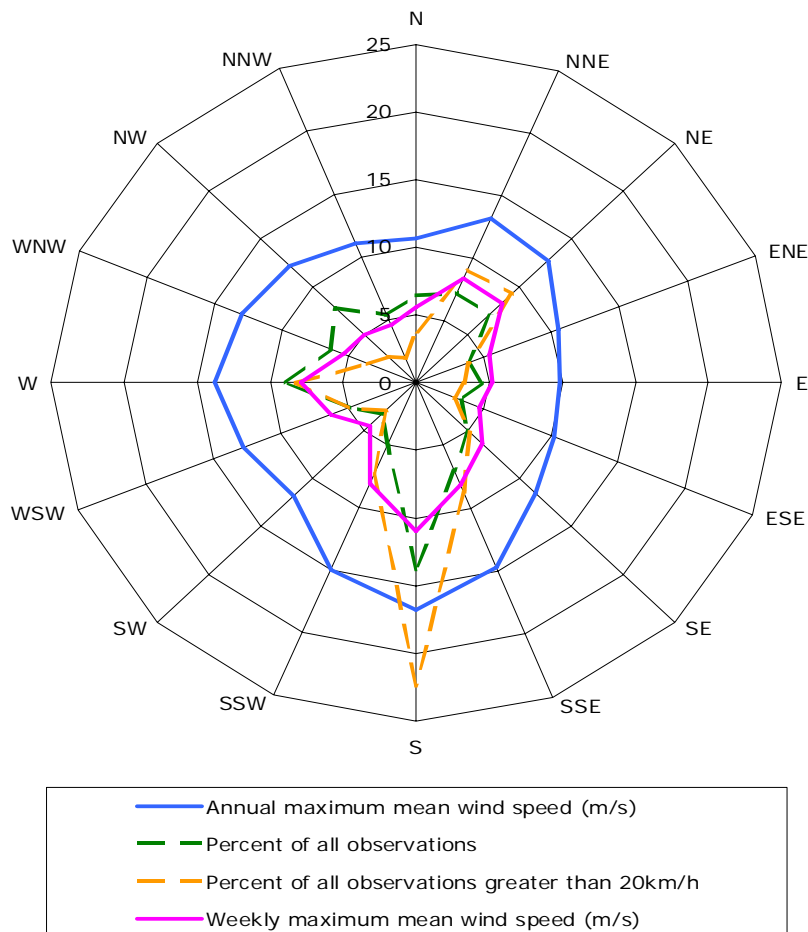


Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

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 2: 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 Surrounds

Precinct 3 of the Pemulwuy development is located within Redfern, and is bounded by Eveleigh Street to the west, existing surrounding buildings to the north and Redfern Station to the south-east. The Precinct 3 development is one of three development precincts, with Precinct 1 and 2 located east across Eveleigh Street.

The proposed Precinct 1 development to the east, range between 2 to 5 levels in height above ground. Precinct 2 to the east of the subject development is proposed to be 4 levels in height.

The land gradually slopes down to the north-east and there are no major topographical changes to the further away from the site. Aerial images of the site are shown in Figures 2a to 2c.



**Figure 2a: Aerial Image of the Site Location
(view from the south, facing north)**



**Figure 2b: Aerial Image of the Site Location
(view from the west, facing east)**



Figure 2c: Aerial Image of the Site Location

5.0 Description of the Proposed Development

The proposed Precinct 3 development is a 7 level mixed development with an art gallery and residential dwellings.

The various outdoor trafficable area of the development, which are areas subject to this analysis are summarized as follows:

- Pedestrian footpath along Eveleigh Street
- Common open space on ground level, at the north-eastern aspect of the proposed precinct 3 development.
- Egress path adjacent to railway corridor and north-eastern aspect of the site
- Public Open Space southwest of the proposed Precinct 3 development adjacent to the Pemulwuy Place.

It can be assumed that the roof on level 6 & 7 of the proposed precinct 3 development are not accessible to the general public, hence these area will not be examine as a critical outdoor trafficable area in this assessment.

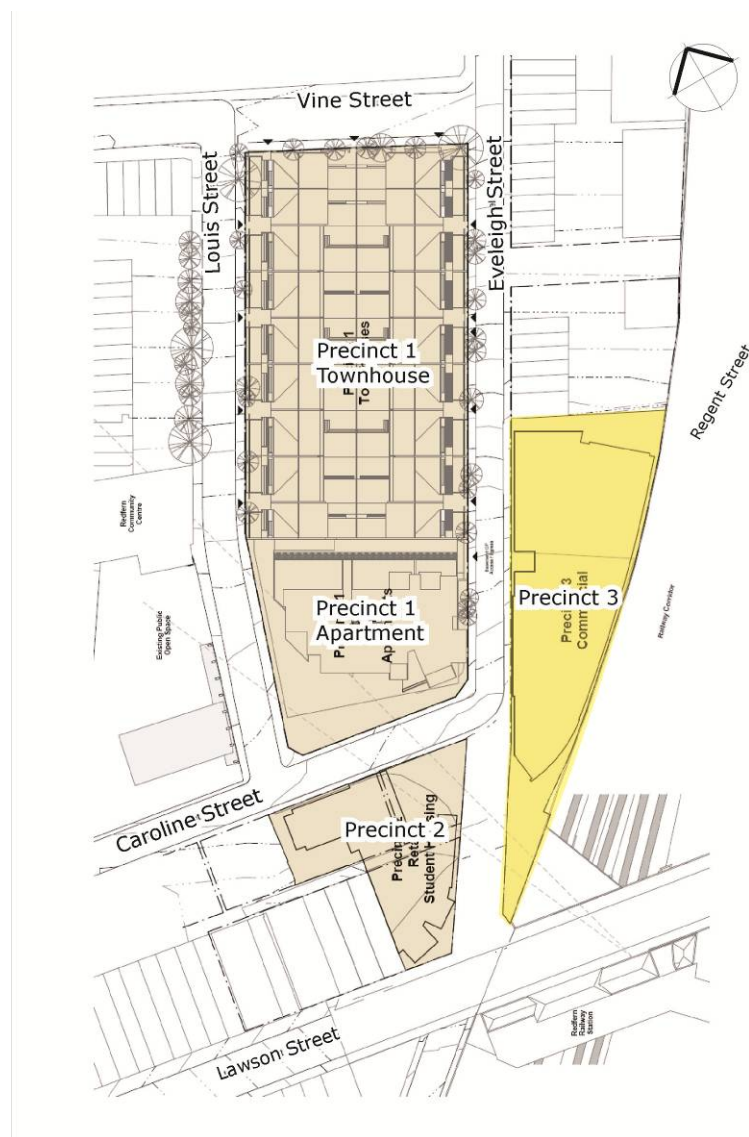


Figure 3: Site Plan Proposed Development Site

6.0 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. The expected wind conditions for the various critical outdoor trafficable areas within and around the site are discussed in the following sub-sections of this report.

6.1 Pedestrian Footpaths Around The Site

Generally the pedestrian footpath along Eveleigh Street is relatively well shielded from the prevailing wind by the proposed development itself, the proposed precinct 1 & 2 development and the existing buildings north-east of the development site. Hence wind condition along Eveleigh Street adjacent to Precinct 3 development site is expected to remain suitable for pedestrian activity.

6.2 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 areas since they typically occur when it can be quite warm during the summer.

Trafficable Ground Level Outdoor Area within the Site

The proposed Common Open Space located to the east of the site and the proposed Egress Path running adjacent to the Railway Corridor and northeast aspect of the development site is relatively well shielded from the prevailing north-easterly wind due to the effective use of building setback which provide a stagnation effect to the prevailing north-easterly wind and by the existing building to the northeast of the site. Thus the wind condition within the proposed Common Open Space and the proposed Egress Path are expected to be suitable for its intended use. It is noted in the landscaping plans there is densely foliating vegetation proposed within the Common Open Space and a high impermeable boundary screen along the Railway Corridor as indicated in Figure 4. It is recommended these the landscaping scheme and the proposed high impermeable boundary screens are retained as they are expected to further enhance the wind conditions within the Common Open Space and along the Egress Path.

The proposed Public Open Space southwest of the site is relatively exposed to the north-easterly wind side-streaming round the south-eastern corner of the proposed development and also due to the relatively wide open Railway Corridor which does not provide any impedance to the prevailing north-easterly wind. Since the proposed Public Open Space is elevated from the Railway corridor, the inclusion of densely foliating trees in the layout similar as shown in Figure 4 are expected to be effective in mitigating the north-easterly winds condition

within the Public Open Space and thus provide adequate wind conditions for pedestrian activity.

With the incorporation of the above mentioned recommendations, the wind conditions within these areas are expected to be acceptable for their intended uses.

6.3 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.

Trafficable Ground Level Outdoor Area within the Site

The proposed Common Open Space located to the east of the site is relatively well shielded from the prevailing southerly wind due to the effective use of building setback which provides a stagnation effect to the prevailing southerly wind and the high impermeable boundary screen proposed along the Railway corridor. Generally the proposed Egress Path adjacent to the Railway Corridor benefit from shielding provided by the proposed high boundary screen as shown in Figure 4. It is recommended to retain the high boundary screen in the final landscape design.

The proposed Public Open Space southwest of the site is relatively well shielded from the southerly wind by the existing Redfern Railway Station south of the proposed precinct 3 development site across Lawson Street. The proposed large densely foliating bottle trees south-west of the site is expected to further enhance the wind conditions, and hence is recommended to be retained in the final design of the development.

With the incorporation of the above mentioned recommendations, the wind conditions within these areas are expected to be acceptable for their intended uses.

6.4 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 areas.

Trafficable Ground Level Outdoor Area within the Site

The proposed Common Open Space located to the east of site and the proposed Egress Path are relatively well shielded from the prevailing westerly by the proposed development itself and the proposed precinct 1 development across Eveleigh Street.

The proposed Public Open Space southwest of the site is relatively well shielded from the westerly wind by the proposed development and existing buildings across Eveleigh Street. Hence these areas are expected to be acceptable for its intended uses.

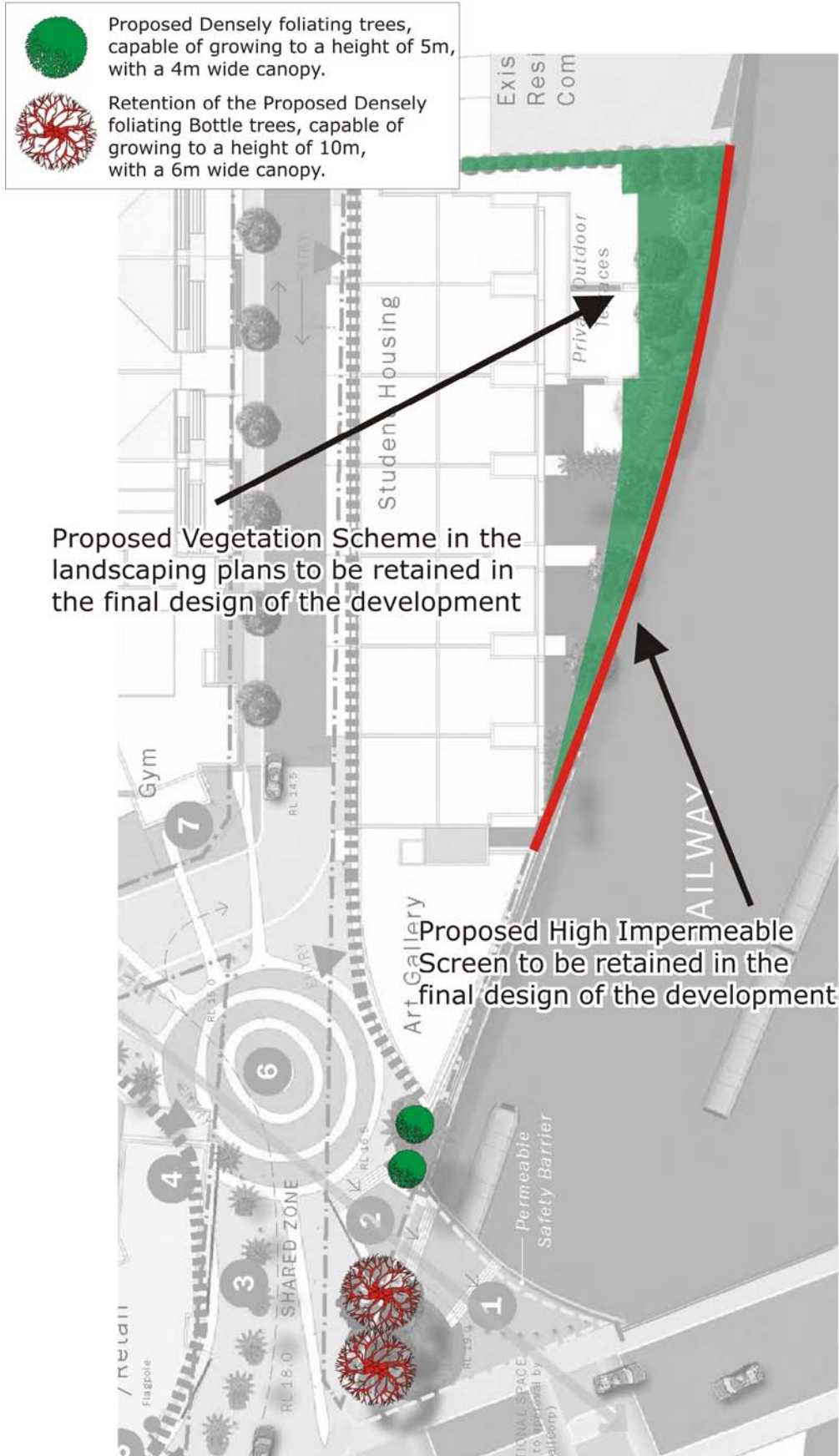


Figure 4: Recommended Treatment for Public Open Space on ground Level

7.0 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 precinct 3 development located at Pemulwuy, Redfern. The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the Concept Plan massing drawings which have been prepared by the project architect Nordon Jago Architects, dated 2nd December 2011. 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.

The results of this study indicate that majority critical outdoor area and pedestrian footpaths associated with the development are suitable for their intended use due to the shielding of the prevailing wind by the proposed development itself and existing buildings northeast of the development site and the effective use of building setback. However, the following in-principle treatments are recommended to help mitigate against potential adverse winds in the following areas:

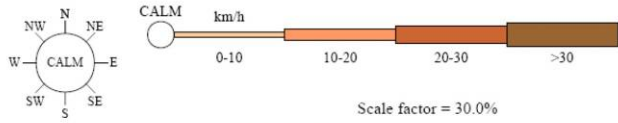
- High boundary screen proposed along the perimeter of the Common Open Space adjacent to the Railway Corridor are recommended to be retained in the final landscape design.
- Proposed vegetation within the Common Open Space along the eastern boundary of the development site is recommended to be retained in the final landscape design.
- The addition of densely foliating trees within the Public Open Space south-west of the site.
- Proposed densely foliating bottle trees south-west of the site is recommended to be retained in the final landscape design.

With the above recommendation incorporated in the final design, wind conditions at all critical outdoor areas are expected to be suitable for their intended use.

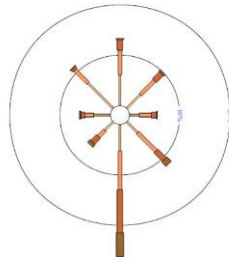
Appendix

Wind Roses for the Sydney Region

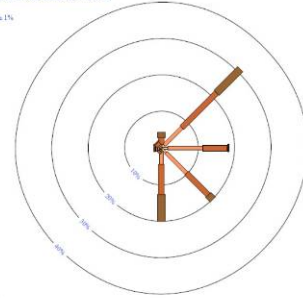
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SYDNEY AIRPORT AMO STATION NUMBER 066037
Latitude: -33.94 ° Longitude: 151.17 °



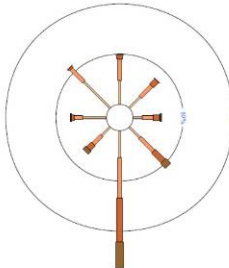
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Calm 9%



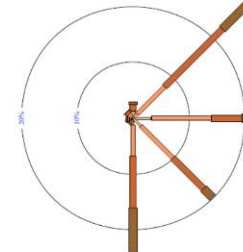
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Calm 1%



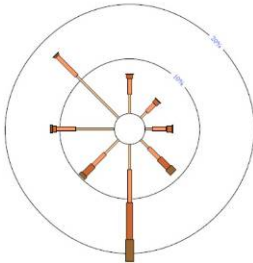
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1760 Total Observations (1939 to 2004)
Calm 13%



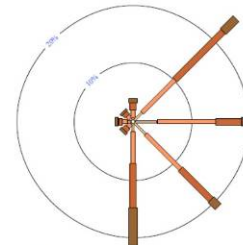
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Calm 1%



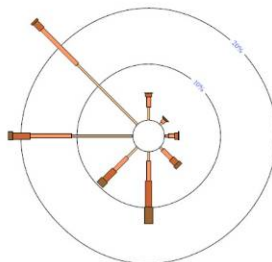
9 am Mar
1968 Total Observations (1939 to 2004)
Calm 14%



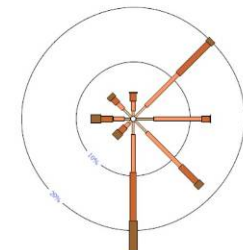
3 pm Mar
1975 Total Observations (1939 to 2004)
Calm 2%



9 am Apr
1963 Total Observations (1939 to 2004)
Calm 14%



3 pm Apr
1963 Total Observations (1939 to 2004)
Calm 2%

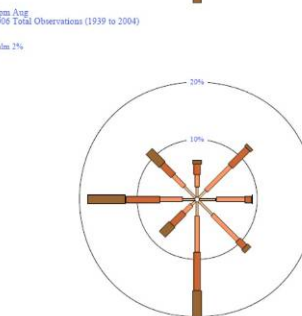
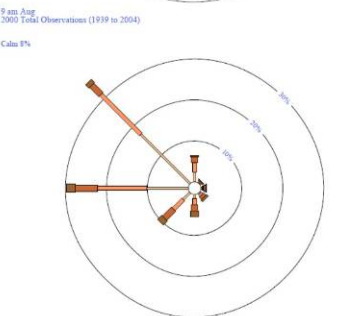
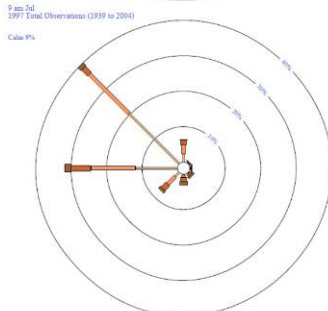
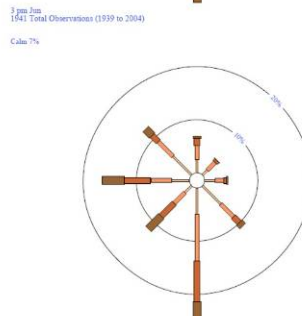
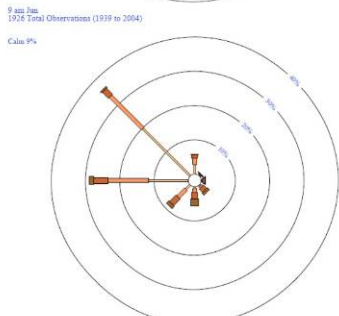
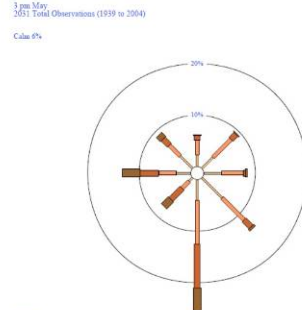
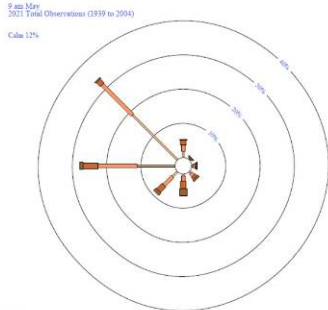
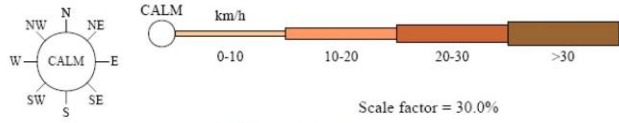


Wind directions are divided into eight compass directions. Calm has no direction.
 An asterisk (*) indicates that calm is less than 1%.
 An observed wind speed which falls precisely on the boundary between two divisions (eg 10km/h) will be included in the lower range (eg 1-10 km/h). Only quality controlled data have been used.



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WIND FREQUENCY ANALYSIS (in km/h)
SYDNEY AIRPORT AMO STATION NUMBER 066037
Latitude: -33.94 ° Longitude: 151.17 °

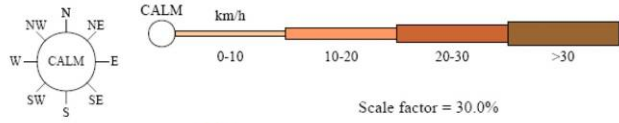


Wind directions are divided into eight compass directions. Calm has no direction.
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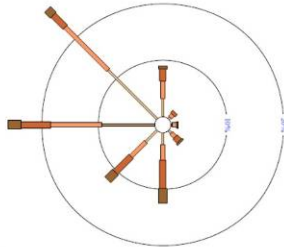


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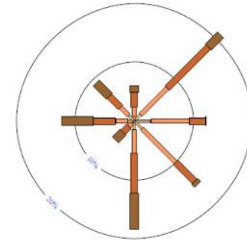
WIND FREQUENCY ANALYSIS (in km/h)
SYDNEY AIRPORT AMO STATION NUMBER 066037
Latitude: -33.94 ° Longitude: 151.17 °



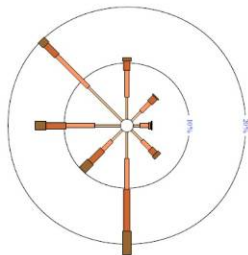
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1934 Total Observations (1939 to 2004)
Calm 7%



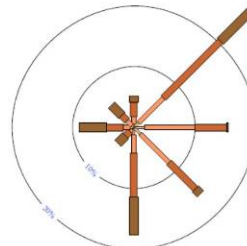
3 pm Sep
1931 Total Observations (1939 to 2004)
Calm 1%



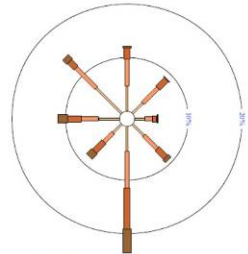
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1993 Total Observations (1939 to 2004)
Calm 6%



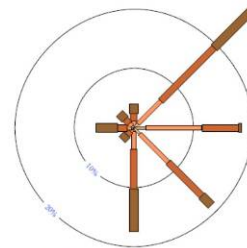
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1997 Total Observations (1939 to 2004)
Calm 1%



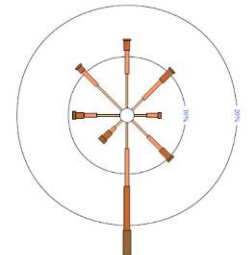
9 am Nov
1897 Total Observations (1939 to 2004)
Calm 7%



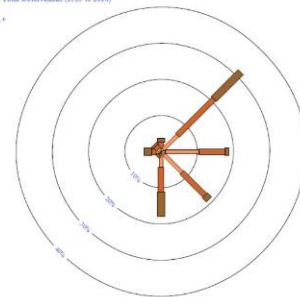
3 pm Nov
1901 Total Observations (1939 to 2004)
Calm 1%



9 am Dec
1937 Total Observations (1939 to 2004)
Calm 7%



3 pm Dec
1939 Total Observations (1939 to 2004)
Calm 9%



Wind directions are divided into eight compass directions. Calm has no direction.
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 An observed wind speed which falls precisely on the boundary between two divisions (eg 10km/h) will be included in the lower range (eg 1-10 km/h). Only quality controlled data have been used.



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