

Pedestrian Wind Environment Statement

for the amended design submitted with the
Section 75W modification for the
Sydney Showground Main Arena,
Sydney Olympic Park

May 20, 2011

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Document Control

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1	20/05/2011	Minor updates for the Section 75W submission.	AB	

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1.0 Introduction

This report is in relation to the proposed redevelopment of the Sydney Showground Main Arena, located at Sydney Olympic Park in Homebush Bay, and presents an opinion on the likely impact of the amended design submitted with a Section 75W modification 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. Note that currently three design options are proposed for the redevelopment, and the effect of each design option on the expected wind conditions for the local wind conditions is discussed in this report.

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 Populous, dated May 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 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.

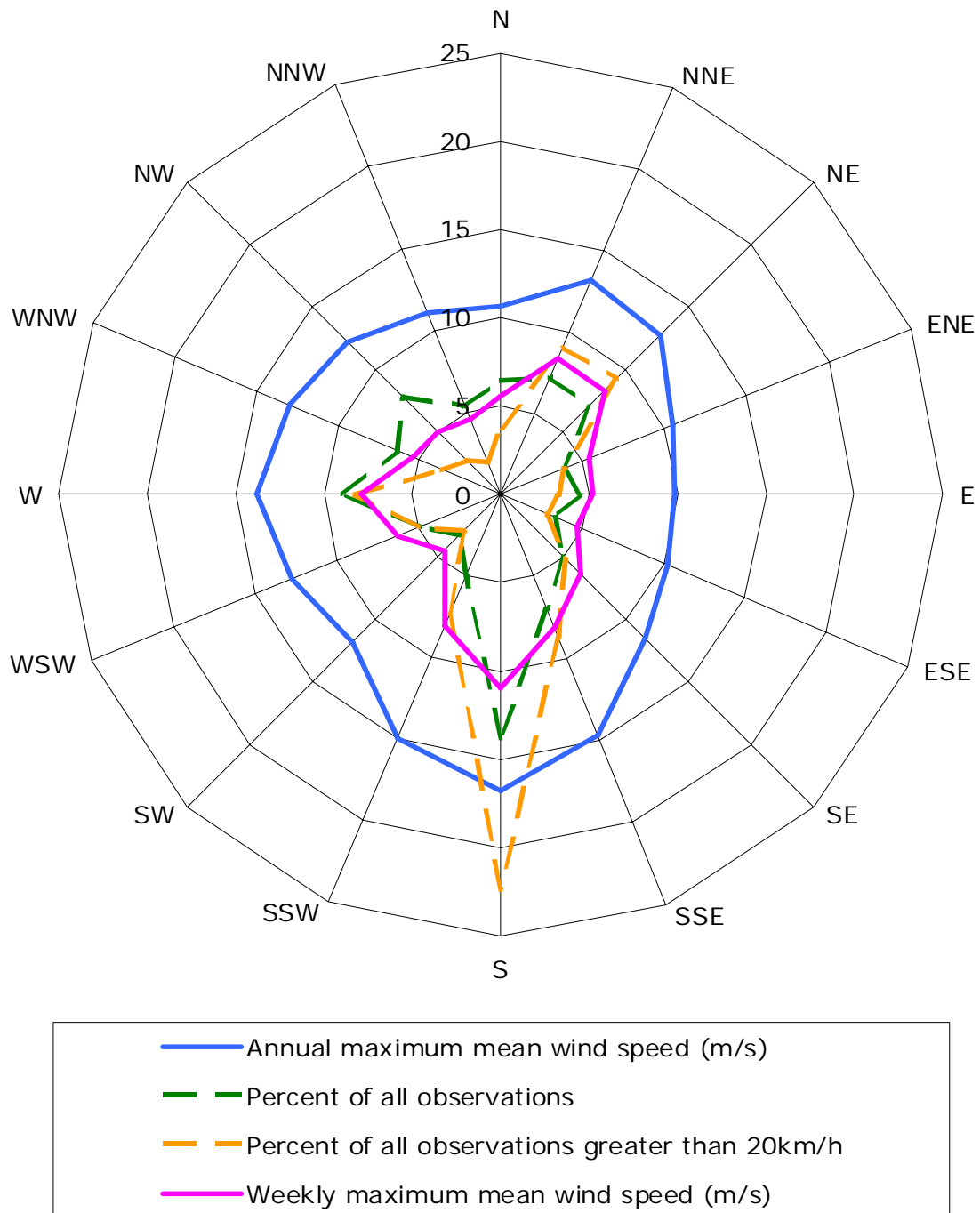


Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

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	Hourly 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.

4.0 Description of the Site and the Proposed Redevelopment

4.1 Description of the Site Location and Surrounds

The site location for the amended design submitted with a Section 75W modification is located within the Sydney Olympic Park precinct of Homebush Bay. The site bounded by Grand Parade to the south, and neighbouring buildings along the northern, eastern and western site boundaries which range in heights of one or two stories above ground. Further to the east of the site is Australia Boulevard, to the north is Kevin Coombs Avenue, and to the west is Olympic Boulevard. To the south-west of the redevelopment site, on the western side of Olympic Boulevard, is the Sydney Olympic Stadium. It is noted that many trees currently line the perimeter of the redevelopment site which may assist in mitigating adverse pedestrian winds. Figure 2 below shows an aerial image of the site location.



Figure 2a: Aerial Image of the Site Location

4.2 Description of the Amended Design of the Redevelopment

The existing Main Arena has a permanent grandstand built around the south-western half of the playing field, which includes two main tiered sections of spectator seating. Corporate viewing areas are located between the two tiers of spectator seating.

The north-eastern half of the arena currently only has a sloped grass embankment for spectator seating, and temporary grandstand seating is located atop the grass embankment for the eastern half of this area. Scoreboard screens are currently located behind the temporary grandstand seating areas at the north-eastern end of the arena.

The amended design submitted with a Section 75W modification for the redevelopment is to have permanent spectator seating around the entire north-eastern half of the arena in-line with the existing lower-tier seating of the existing grandstand around the south-western end of the arena. A large scoreboard is proposed at the north-eastern end of the arena. A second tier of spectator grandstand seating is proposed on the south-eastern and north-western sides of the playing field. Permanent roofs are also proposed over the two upper-tier grandstands on the north-western and south-eastern sides of the playing field.

The area atop/behind the lower-tier of grandstand seating is to be used as a pedestrian thoroughfare for spectators around the ground and to and from the upper and lower tier grandstand seating areas.

The ground level perimeter of the site around the north-eastern half of the arena is to remain trafficable by pedestrians. The many existing trees around the perimeter of the site are proposed to be retained for the redevelopment. Note that trees can be effective in mitigating otherwise potentially adverse winds for pedestrians in those areas.

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.

The proposed upper-tier grandstands and the large scoreboard will provide effective shielding and/or stagnation from the prevailing north-easterly winds to most trafficable areas within the amended redevelopment, including to most of the grandstand seating areas. The built form of the lower-tier grandstand seating around the north-eastern end of the playing field will also provide shielding to the lower-tier grandstand seating areas at that end of the ground. Hence adequate wind conditions are expected within the proposed grandstand seating areas of the amended redevelopment.

Within the existing grandstand seating areas, the wind conditions are expected to be either similar to, or better than, the existing wind conditions for those areas. Furthermore, the existing grandstand seating areas benefit from the significant stagnation effect created by the existing grandstand and the existing roof overhead, which does not have a gap under the roof and hence does not encourage wind to flow through the grandstand seating areas.

Wind conditions for the pedestrian accessible ground level areas around the amended redevelopment are expected to remain similar to the existing conditions, and will be suitable for pedestrian activities. The retention of the many existing trees around the site will assist in mitigating adverse ground level winds. The neighbouring buildings to the north-east and east of the arena also assist in mitigating adverse ground level north-easterly winds. The redevelopment is not expected to cause any adverse wind effects for the pedestrian accessible ground level areas around the site.

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. Conveniently, since the proposed redevelopment is located around the north-eastern half of the arena, most outdoor areas of the amended redevelopment will be quite well shielded from the prevailing southerly winds by the existing grandstand around the south-western half of the arena. This includes the spectator seating associated with the amended redevelopment.

Atop the upper-tier of the proposed north-western grandstand, it is noted that there is a screen that blocks most of the gap between the top row of seating

and the underside of the roof. This will effectively block southerly winds from being accelerated underneath the roof and over the spectator seating areas, and is hence recommended to be retained in the design.

Wind conditions for spectators in the existing grandstand around the south-western half of the arena will be unaffected by the amended redevelopment. The existing seating areas are well shielded from the prevailing southerly winds.

Wind conditions for the pedestrian accessible ground level areas around the amended redevelopment are expected to remain similar to the existing conditions, and will be suitable for pedestrian activities. The retention of the many existing trees around the site will assist in mitigating adverse ground level winds. The neighbouring buildings on the southern side of Grand parade also assist in mitigating adverse ground level southerly winds. The redevelopment is not expected to cause any adverse wind effects for the pedestrian accessible ground level areas around the site.

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.

Most outdoor areas of the amended redevelopment will be quite well shielded from the prevailing westerly winds by the existing grandstand around the south-western half of the arena. This includes the spectator seating associated with the amended redevelopment, which will also benefit from the shielding provided by the proposed upper-tier of the north-western grandstand of the redevelopment.

Atop the upper-tier of the proposed south-eastern grandstand, it is noted that there is a screen that blocks most of the gap between the top row of seating and the underside of the roof. This will effectively block westerly winds from being accelerated underneath the roof and over the spectator seating areas, and is hence recommended to be retained in the design.

Wind conditions for spectators in the existing grandstand around the south-western half of the arena will be unaffected by the amended redevelopment. The existing seating areas are well shielded from the prevailing westerly winds.

Wind conditions for the pedestrian accessible ground level areas around the amended redevelopment are expected to remain similar to the existing conditions, and will be suitable for pedestrian activities. The retention of the many existing trees around the site will assist in mitigating adverse ground level winds. The neighbouring buildings to the north and north-west of the arena also assist in mitigating adverse ground level westerly winds. The amended redevelopment is not expected to cause any adverse wind effects for the pedestrian accessible ground level areas around the site.

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 amended design submitted with a Section 75W modification of the Sydney Showground Main Arena, located at Sydney Olympic Park in Homebush Bay.

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 Populous, dated May 2011. 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 wind conditions within and around the amended redevelopment will be suitable for the intended uses. Wind conditions for the pedestrian accessible ground level areas around the site will remain similar to the existing conditions due to the retention of the many trees surrounding the site, and the shielding provided by the various neighbouring buildings around the redevelopment for ground level winds.

Wind conditions for the seating areas within the existing grandstand around the south-western half of the arena are expected to be relatively unaffected by the amended redevelopment. The existing grandstand seating areas benefit from the shielding provided by the existing grandstand to the southerly and westerly winds, and the overhead roof provides effective stagnation to the north-easterly winds since there is no gap underneath the roof.

All of the spectator areas of the amended redevelopment are relatively well shielded from the prevailing winds, either from the existing grandstand around the south-western end of the playing field, or from the stagnation effect provided by the roofs over the proposed upper-tier grandstand seating areas on the north-western and south-eastern sides of the ground. It is noted that, atop the upper-tier of the proposed north-western and south-eastern grandstands, there is a screen that blocks most of the gap between the top row of seating and the underside of the roof. This will effectively block some of the prevailing winds from being accelerated underneath the roof and over the spectator seating areas, and is hence recommended to be retained in the design.

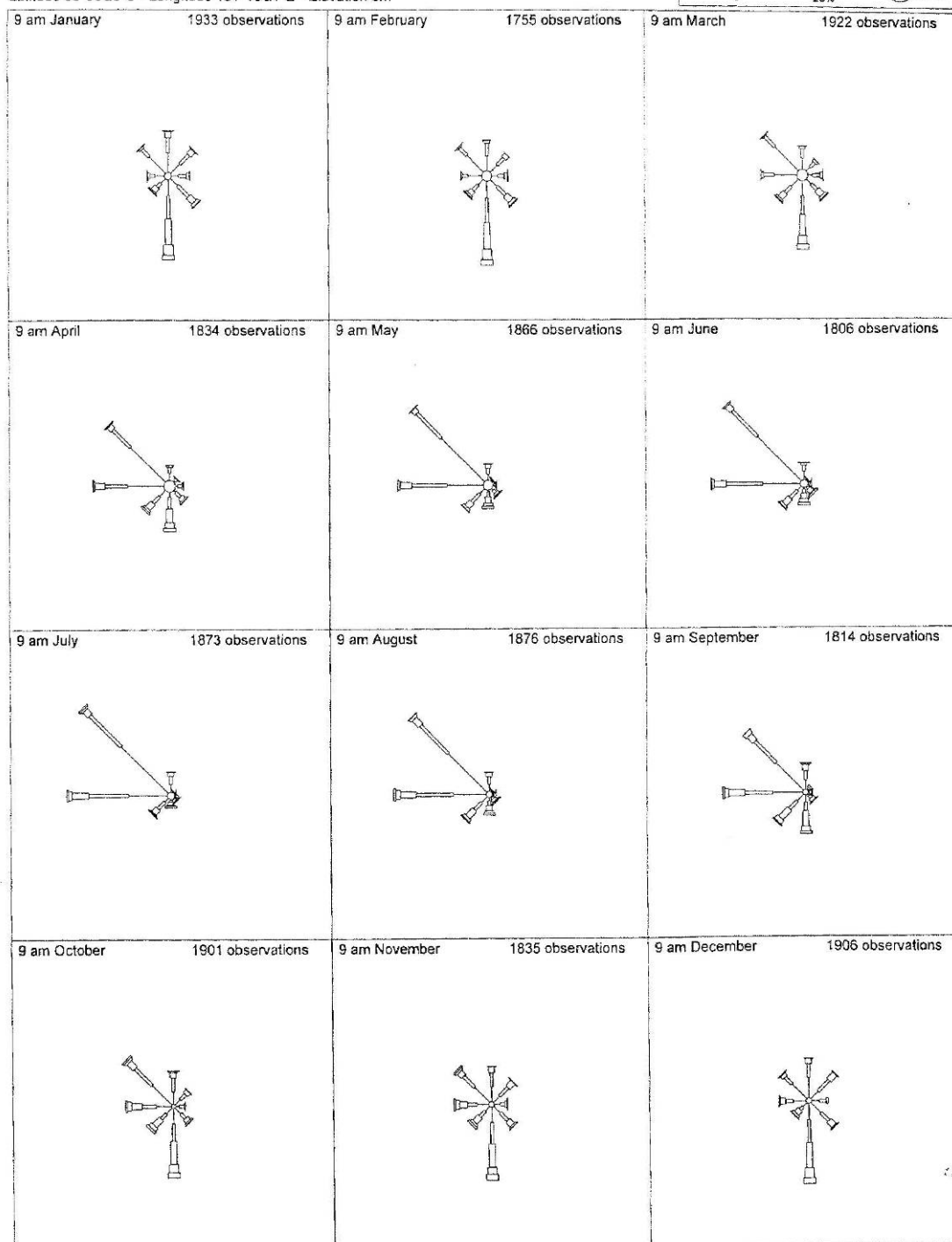
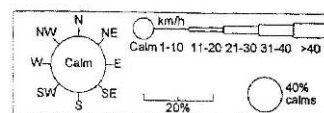
Hence wind conditions for all outdoor areas within and around the amended redevelopment will be suitable for the intended uses, and the amended redevelopment is not expected to have any adverse impacts with regards to wind effects to the local surrounding area.

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

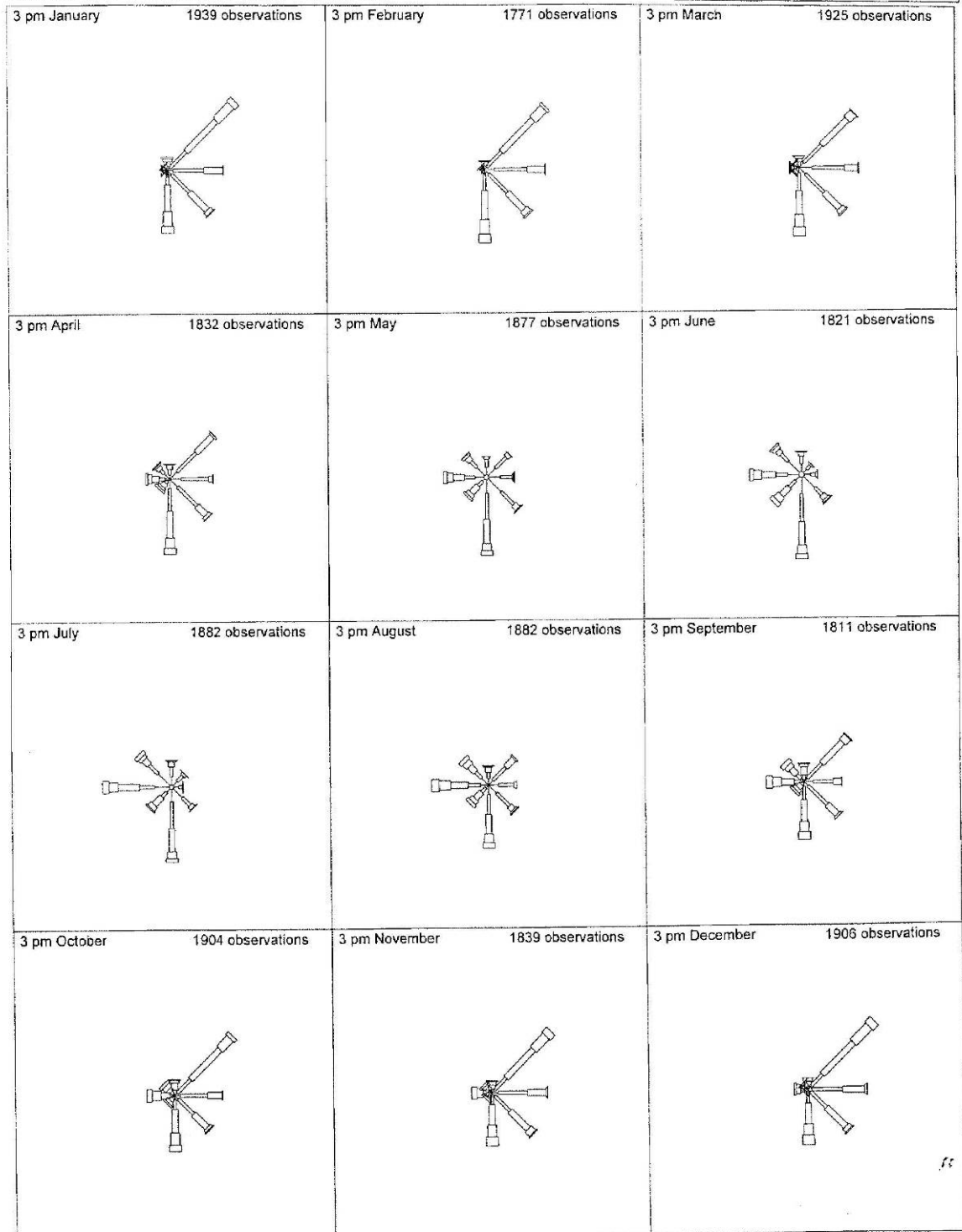
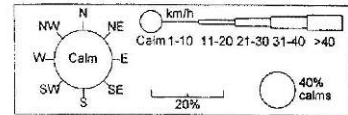


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Prepared by Climate and Consultancy Section in the New South Wales Regional Office of the Bureau of Meteorology
Contact us by fax 02 9296 1567, or by email on regnsw@bom.gov.au
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