Pedestrian Wind Environment Statement

for the proposed development at

88 Christie Street, St Leonards

July 12, 2010

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Document Control

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0	07/05/2010	Initial	DYF, AL	TR
1	12/05/2010	Agreed Amendments	TR	
2	12/07/2010	Updated Drawing Date	TH	

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1.0 Introduction

This report is in relation to the proposed development at 88 Christie Street, St. Leonards, located in North Sydney, and presents an opinion on the likely impact of proposed design on the local wind environment within and around the site.

The effect of wind activity within and around the proposed development is examined for the three predominant wind directions for Sydney, i.e. north-east, south and west. 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 prepared by Bates Smart Pty Ltd, dated June, 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.

2.0 Local Wind Climate

Three principal wind directions potentially affect the development. These winds prevail from the north-east, south and west; Table 1 is a summary of the principal time of occurrence of these winds. This summary is based on data obtained by the Bureau of Meteorology from Sydney Airport between 1939 and 2000. 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.

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	

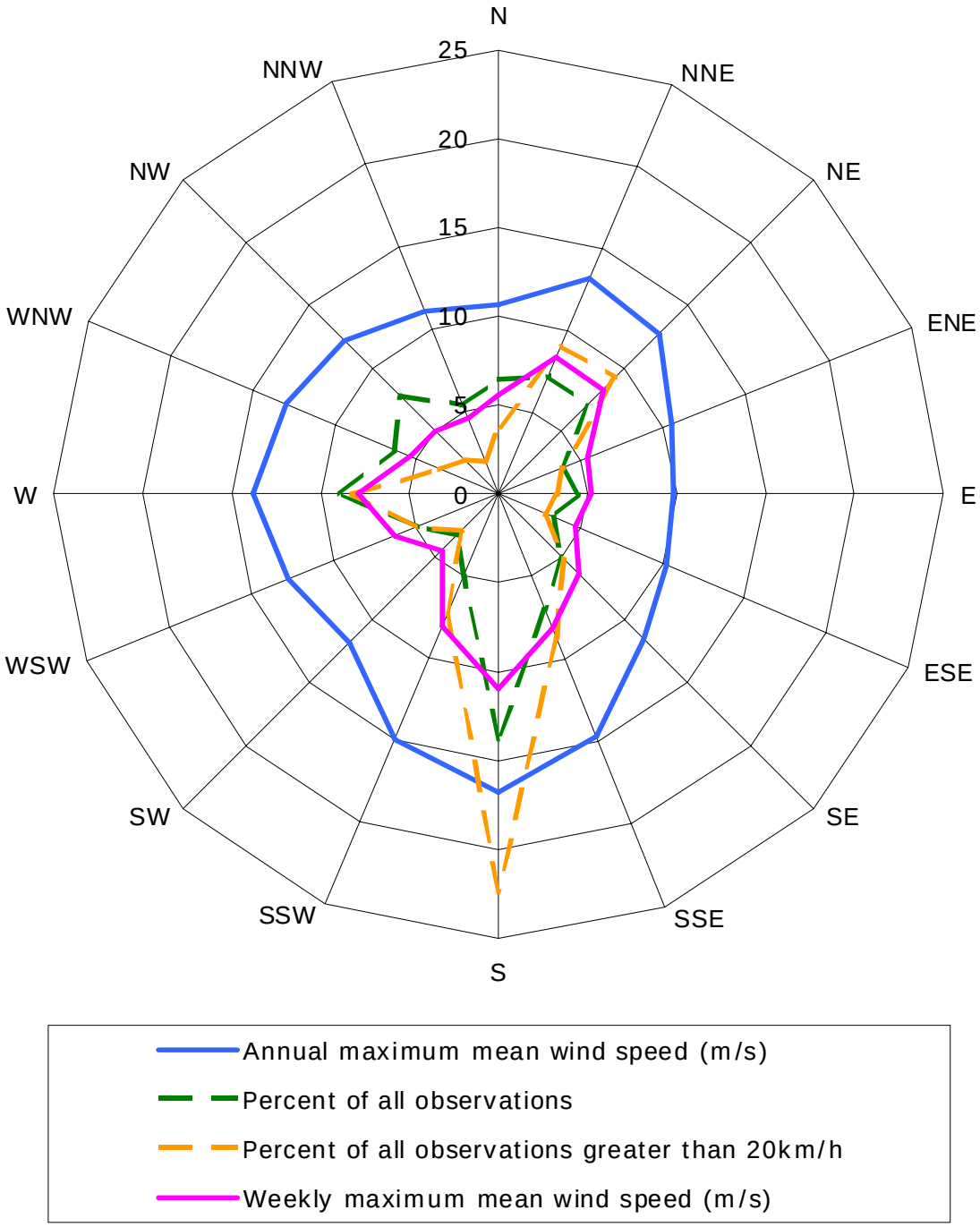


Figure 1: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10 minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

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), is a modified version of the Beaufort Scale, and describes the effects of various wind intensities on people. Note that the applicability column related to 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	Beaufort Number	Gust Speed (m/s)	Effects	Applicability
Calm, light air	1	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	2	1.6 - 3.3	Wind felt on face	
Gentle breeze	3	3.4 - 5.4	Hair is disturbed, Clothing flaps	
Moderate breeze	4	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	5	8.0 - 10.7	Force of wind felt on body	Acceptable as a main pedestrian thoroughfare
Strong breeze	6	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	7	13.9 - 17.1	Inconvenience felt when walking.	
Gale	8	17.2 -20.7	Generally impedes progress, Great difficulty with balance.	Unacceptable as a public accessway.
Strong gale	9	20.8 - 24.4	People blown over by gusts.	Completely unacceptable.

4.0 Description of the Site and the Proposed Development

The proposed development site is bounded by Christie Street to the east, Lithgow Street to the west and Christie Lane to the north. Figure 2 shows an aerial image with the location of the site.

The adjacent buildings to the west of the site vary between 1 to 4 levels in height above ground. The adjacent buildings to the north and east of the site vary between 6 to 9 levels in height above ground. The adjacent buildings to the south of the site vary between 3 to 5 levels in height above ground. There are no large changes in the local land topography around the site, with the exception of a slight drop of to the south of the site.

The outdoor areas of interest analysed in this statement include all ground level pedestrian footpaths, the ground level walkthrough/arcade and Level 15 Roof Terrace. It is assumed that the terrace area on Plant Level 17 is accessible to maintenance personnel only and not to the general public.

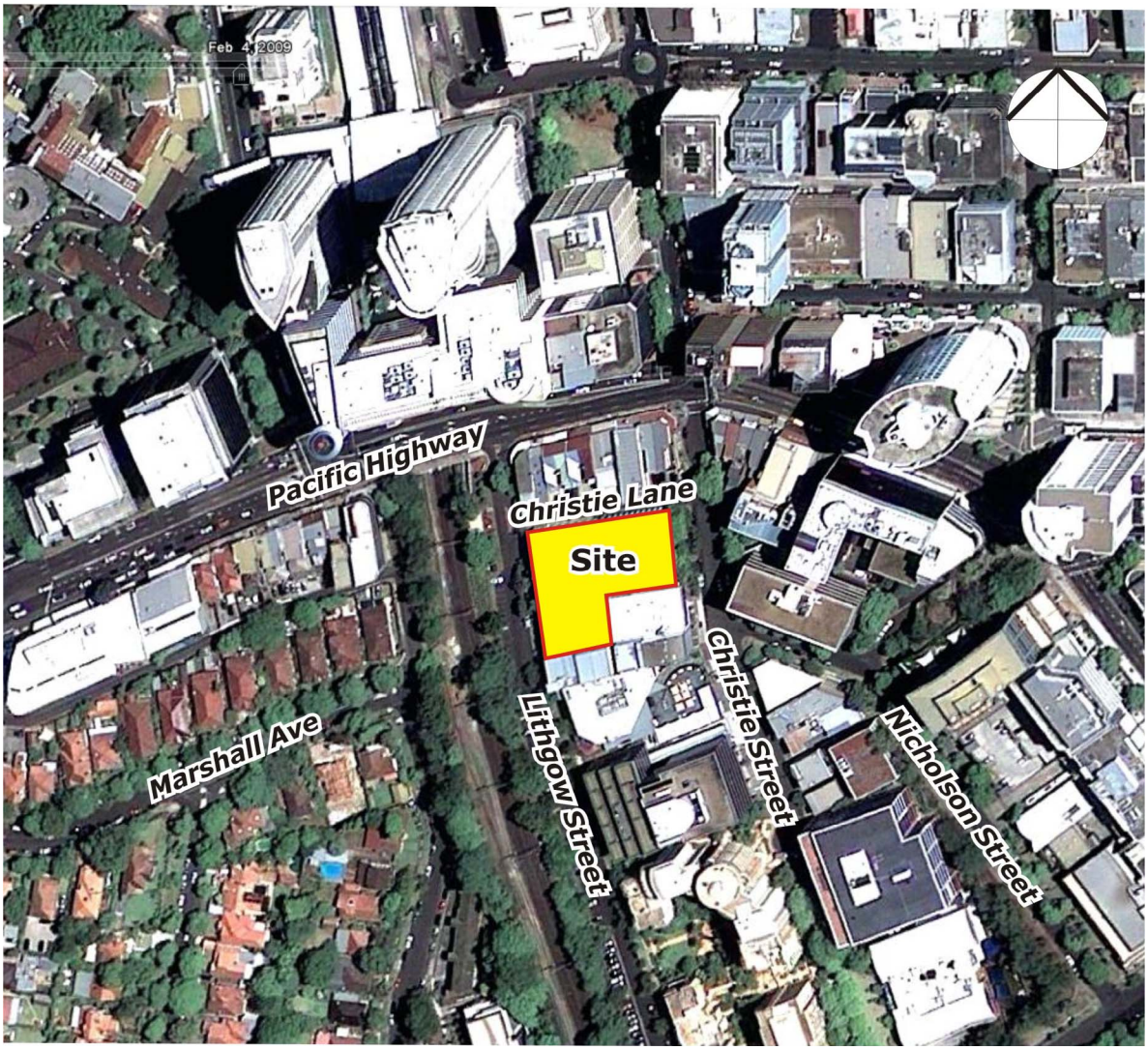


Figure 2: Aerial Image of the Site Location

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

The ground level areas within or around the site are relatively well shielded by the proposed development and the local surrounding buildings to the north-east of the site. It is therefore not expected that the ground level areas including the pedestrian footpaths around the site, will be adversely affected by the north-easterly winds. It is noted that the architectural drawings include the strategic planting of trees along Lithgow Street and Christie Street adjacent to the site. Retaining these trees in the final landscaping plan in combination with the retention of any existing trees along Lithgow Street and Christie Street pedestrian footpaths adjacent to the site will serve to improve wind conditions at all ground level areas. Note that for trees to be effective in improving adverse wind conditions they must be of a densely foliating variety.

North-easterly winds are not expected to funnel though the Thru Link and Level 0 Terrace due to the effective shielding of north-easterly winds by the sounding buildings to the north east of the site. Therefore the Thru Link and Level 0 Terrace are expected to be suitable for its intended use.

Level 15 Roof Terrace is relatively well shielded by the proposed development to north-easterly winds. It is therefore expected that wind conditions at Level 15 Roof Terrace are acceptable for its intended use. It is noted that the architectural drawings include the strategic planting of trees within the Level 15 Roof Terrace. Retaining these trees in the final landscaping plan in combination with an impermeable balustrade 1.2m in height surrounding the terrace will serve to improve wind conditions in this area.

It is not expected that the proposed development will have any adverse impact on the wind conditions in other local surrounding streets, pedestrian footpaths and thoroughfares.

5.2 Southerly Winds

The ground level pedestrian footpath adjacent to the site along Christie Street is relatively well shielded by the proposed development and surrounding buildings to the south of the site. The ground level pedestrian footpath adjacent to the site along Lithgow Street is somewhat exposed to southerly winds funneling north bound along the Lithgow Street. It is noted that the architectural drawings include the strategic planting of trees along Lithgow Street adjacent to the site.

Retaining these trees in the final landscaping plan in combination with the retention of any existing trees along Lithgow Street pedestrian footpath adjacent to the site will aid in mitigating potential adverse wind conditions in this area. Note that for trees to be effective in improving adverse wind conditions they must be of a densely foliating variety.

The Thru Link and Level 0 Terrace are relatively well shielded by the proposed development. Therefore wind conditions within the Thru Link and Level 0 Terrace are expected to be suitable for their intended use.

Level 15 Roof Terrace may be exposed to southerly winds. It is noted that the architectural drawings include the strategic planting of trees within the Level 15 Roof Terrace. Retaining these trees in the final landscaping plan in combination with an impermeable balustrade 1.2m in height surrounding the terrace will aid in mitigating potential adverse wind conditions in this area.

It is not expected that the proposed development will have any adverse impact on the wind conditions in other local surrounding streets, pedestrian footpaths and thoroughfares.

5.3 Westerly Winds

The ground level pedestrian footpath adjacent to the site along Christie Street is relatively well shielded by the proposed development. The ground level pedestrian footpath adjacent to the site along Lithgow Street is somewhat exposed to westerly. It is noted that the architectural drawings include the strategic planting of trees along Lithgow Street adjacent to the site. Retaining these trees in the final landscaping plan in combination with the retention of any existing trees along Lithgow Street pedestrian footpath adjacent to the site will aid in mitigating potential adverse wind conditions in this area. Note that for trees to be effective in improving adverse wind conditions they must be of a densely foliating variety.

The Thru Link and Level 0 Terrace are exposed to westerly winds funneling through the areas. It is recommended that an airlock at the western entrance to Thru Link/Level 0 be used to prevent westerly winds from funneling through these areas. Three alternative airlock arrangements are presented in Figure 3, below. For the air-locks that do not involve a revolving door solution, it is important that the openings are at different orientations or staggered and as far apart as possible. Alternatively a full length canopy or sunscreen at the same level as Level 0 slab on the western aspect of the development may be used to capture downwashed westerly winds funneling through the Thru Link and Level 0 Terrace areas, as shown in Figure 3. Any of the above recommendations are expected to mitigate the funneling of the westerly winds through Thru Link and Level 0 Terrace areas. Note that should the sunscreen option be adopted, the louvres blades in the sunscreen will need to be designed so as to be able to deflect the downwashed winds, which will require them to overlap and have the louvre blades slope down towards the west.

Level 15 Roof Terrace is somewhat exposed to westerly winds. It is noted that the architectural drawings include the strategic planting of trees within the Level 15 Roof Terrace. Retaining these trees in the final landscaping plan in combination with an impermeable balustrade 1.2m in height surrounding the terrace will aid in mitigating potential adverse wind conditions in this area.

It is not expected that the proposed development will have any adverse impact on the wind conditions in other local surrounding streets, pedestrian footpaths and thoroughfares.

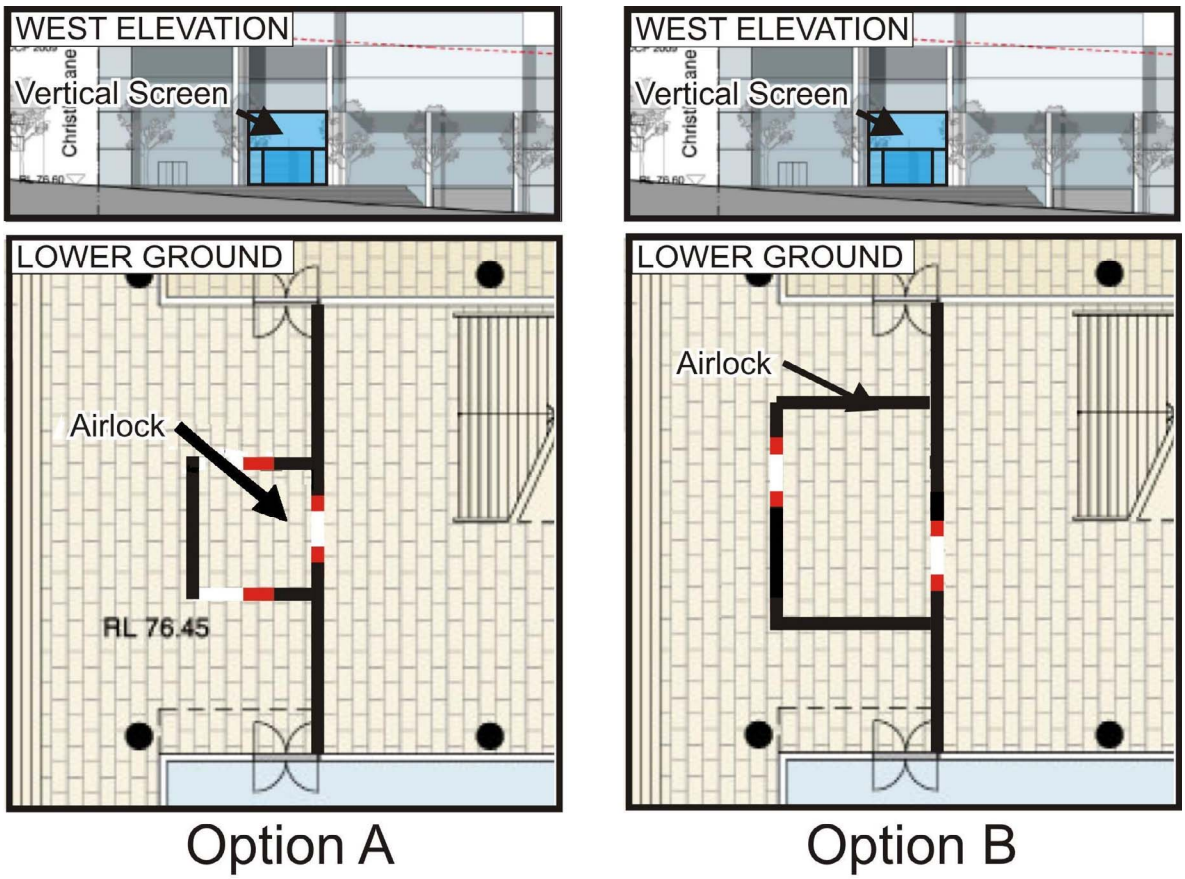


Figure 3: Recommended Treatment Options

6.0 Conclusions

An analysis of the wind environment impact with respect to the principal wind directions for the Sydney region has been completed for the proposed development at 88 Christie Street, St Leonards, located in North Sydney.

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 Bates Smart Pty Ltd, dated on June, 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. It is recommended that a wind tunnel testing be conducted once the design of the development is more established. This will make sure all proposed outdoor accessible areas within and around the development site are examined and the effectiveness of the recommended treatments can be confirmed.

Wind conditions for most of the various outdoor areas within and around the site are expected to be acceptable for their intended uses without the need for additional ameliorative treatments. It is recommended that the proposed trees along Lithgow Street and Christie Street are retained in the final landscape plan to aid in militating potential adverse winds from the south and west.

The Thru Link and Level 0 Terrace areas are exposed to westerly winds funneling through these areas. It is recommended that either an airlock arrangement be implemented at the western entrance to Thru Link/Level 0. Alternatively a full length canopy or sunscreen at the same level as Level 0 slab on the western aspect of the development may be used to capture downwashed westerly winds funneling through the Thru Link and Level 0 Terrace areas. Note that should the sunscreen option be adopted, the louvres blades in the sunscreen will need to be designed so as to be able to deflect the downwashed winds, which will require them to overlap and have the louvre blades slope down towards the west.

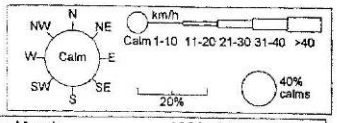
Level 15 Roof Terrace is somewhat exposed to southerly and westerly winds. It is noted that the architectural drawings include the strategic planting of trees within the Level 15 Roof Terrace. Retaining these trees in the final landscaping plan in combination with an impermeable balustrade 1.2m in height surrounding the terrace will aid in mitigating potential adverse wind conditions in this area.

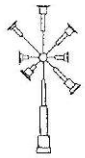
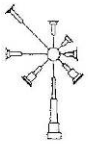
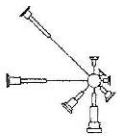
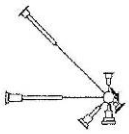
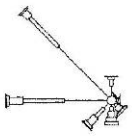
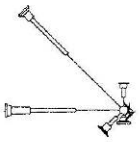
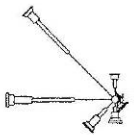
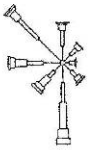
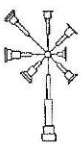
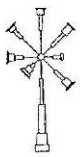
Appendix

Wind Roses for Sydney Airport
1939-2000

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**
		

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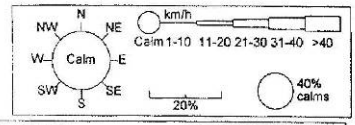

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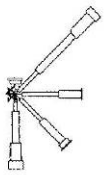		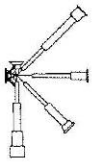
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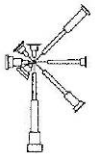	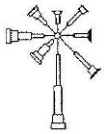	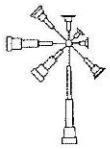
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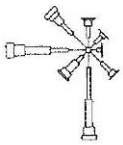	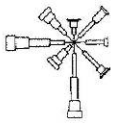	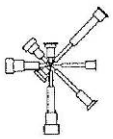
3 pm October 1904 observations	**3 pm November 1839 observations**	**3 pm December 1906 observations**