PEDESTRIAN WIND ENVIRONMENT STATEMENT

NEPEAN GREEN, PENRITH

WB389-02F02(REV0)- WS REPORT

31 MAY 2013

Prepared for:

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DOCUMENT CONTROL

Date	Revision History	Non-Issued Revision	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
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EXECUTIVE SUMMARY

This report is in relation to the proposed development known as Nepean Green, located in Penrith, 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 development site.

The effect of wind activity within and around the proposed development is examined for the three prevailing winds for the Penrith region; north to north-easterly, south to south-easterly 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 architects Turner Associates and Leffler Simes Architect, received May 2013. 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 the wind conditions the various central landscaped communal areas within the site are expected to be suitable for its intended uses due to the shielding provided by the surrounding proposed buildings. However, the remaining outdoor trafficable areas, within and around the subject site, are potentially exposed to the prevailing wind directions due to the alignment of the roads and proposed buildings that provides minimal wind interference. The following recommendations have been made to help mitigate against potential adverse wind conditions and are as follows:

- The inclusion of proposed densely foliating trees along Station Street, Jamison Road, Woodriff Street and the proposed roads within the development. These trees should be capable of growing to a height of at least 5m with a 4m wide canopy. They should also be of an evergreen variety to ensure their effectiveness in wind mitigation during the winter period.

- The inclusion of the proposed densely foliating trees and vegetation within the outdoor public plaza, the various central landscape communal areas and retail car-parking site. To be effective in wind mitigation during the winter period, these trees should be of an evergreen variety.

- The inclusion of impermeable balustrades along the perimeter of the corner balconies within the site.

- The inclusion of full-height impermeable end screens on one end of the corner balconies, preferably those that face the north to north-easterly, western or south to south-easterly directions.

Note that the wind conditions within the remaining balconies of the site would be further enhanced with the inclusion of impermeable balustrades along the perimeter.

With these recommended treatments included in the final design, it is expected that wind conditions within and around the subject development will be acceptable for their intended uses. Furthermore, the proposed development is not expected to cause any adverse wind effects to the local surrounding areas.

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List of Tables

1 REGIONAL WIND CLIMATE FOR PENRITH

The Penrith region is governed by three principle wind directions, and these can potentially affect the subject development. These winds prevail from the north to north-easterly, south to south-easterly and west directions. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1. This summary is based on an analysis of wind rose data obtained by the Bureau of Meteorology from Penrith lakes AWS between 1995 and 2010. The wind roses are attached in the appendix of this report.

For the Penrith region, the north to 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 south to south-easterly winds are by far the most frequent wind for the Penrith region, and are also the strongest. Westerly winds occur most frequently during the winter season for the Penrith region. These are usually a cold wind since they occur during the winter, and hence can be a cause for discomfort for outdoor areas.

Table 1: Principal Time of Occurrence of Winds for Penrith

Month	***Wind Direction***		
	North to North-Easterly	***South to South-Easterly***	***Westerly***
January		*X*	
February		*X*	
March	*X*	*X*	
April	*X*	*X*	
May	*X*		
June		*X*	*X*
July			*X*
August	*X*		*X*
September	*X*		*X*
October	*X*	*X*	
November	*X*	*X*	
December	*X*	*X*	

2 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 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	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.

3 DESCRIPTION OF THE SITE AND SURROUNDS

The proposed development site is located at 164 Station Street, Penrith. The proposed development site is bounded by the Station Street to the north and west, Jamison Road to the south, Woodriff Street to the east and the Centro Nepean Shopping Complex to the north-east. An aerial image of the site and the surroundings is shown in Figure 1.

To the north-east to south-west of the site are several sporting complexes including the Penrith Showground, Penrith Stadium and Howell Oval. To the east and south are low-rise residential developments and to the south-east is Jamison Park consisting of large areas of relatively flat terrain. The land topography is relatively flat with no major geological features close to the site.

Figure 1: Aerial Image of the Proposed Development Site

4 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The concept plan of the proposed development consists of a Masters Home Improvement Store with its associated ground level car parking and nine residential buildings split across 6 stages, with a total of approximately 570 residential units. A retail space and tavern are proposed along the northern boundary within the Stage 3 development. The residential building heights vary from between 4 to 10 storeys in height and car parking is accommodated within basement levels under the various residential developments of the site. An image of the proposed development site is illustrated in Figures 2a and 2b below.

The various outdoor trafficable area of the development subject to analysis in this report are summarised as follows:

- The trafficable areas on Ground Floor including the pedestrian footpaths within and around the site.
- Central landscape communal areas within and around the site.
- Public Plaza located at the northern corner of the site.
- The various private terraces and balcony areas associated with the residential apartments on all aspects of the subject developments.

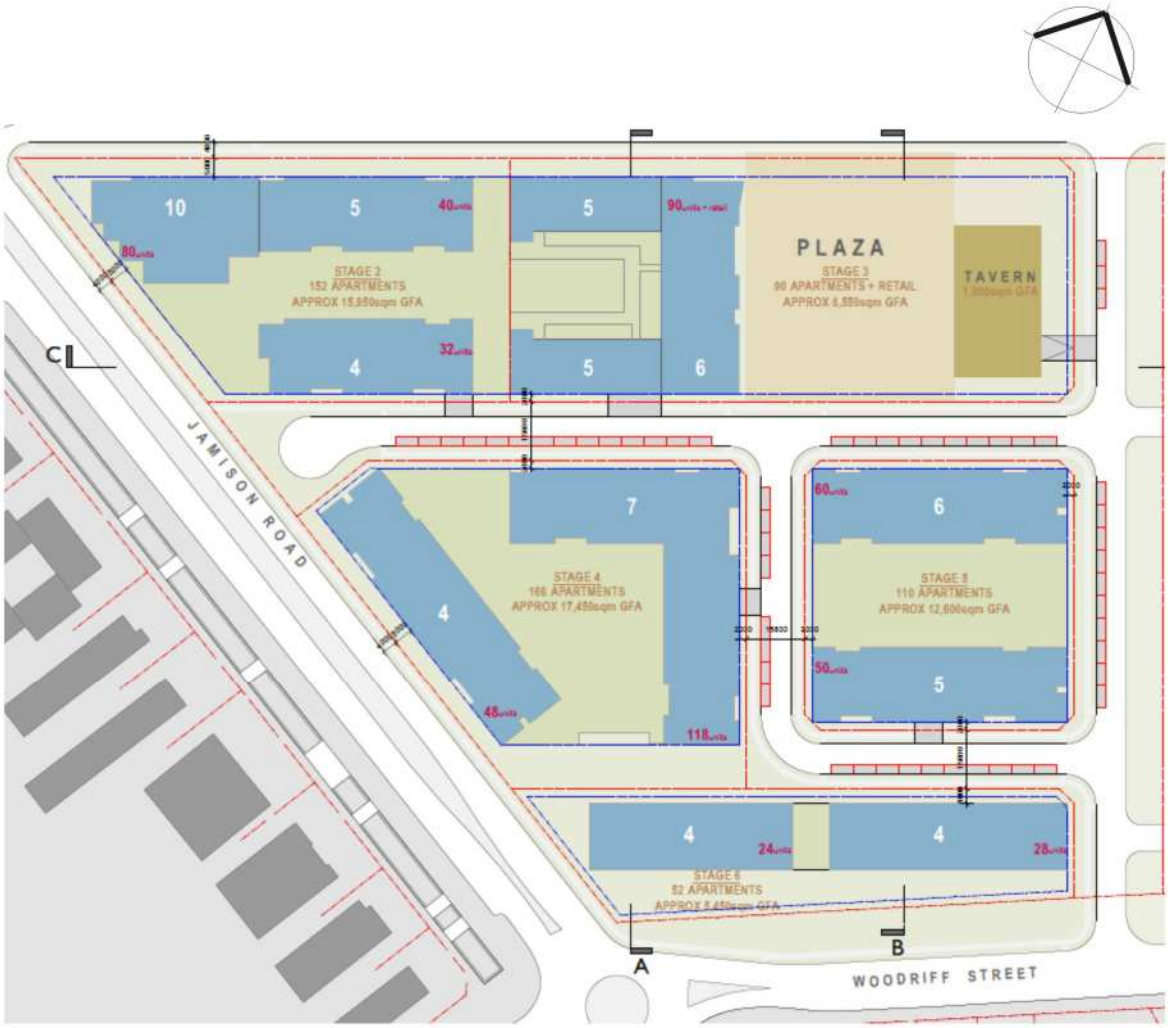

Figure 2a: Site Plan of the Proposed Development Site (Residential Component)

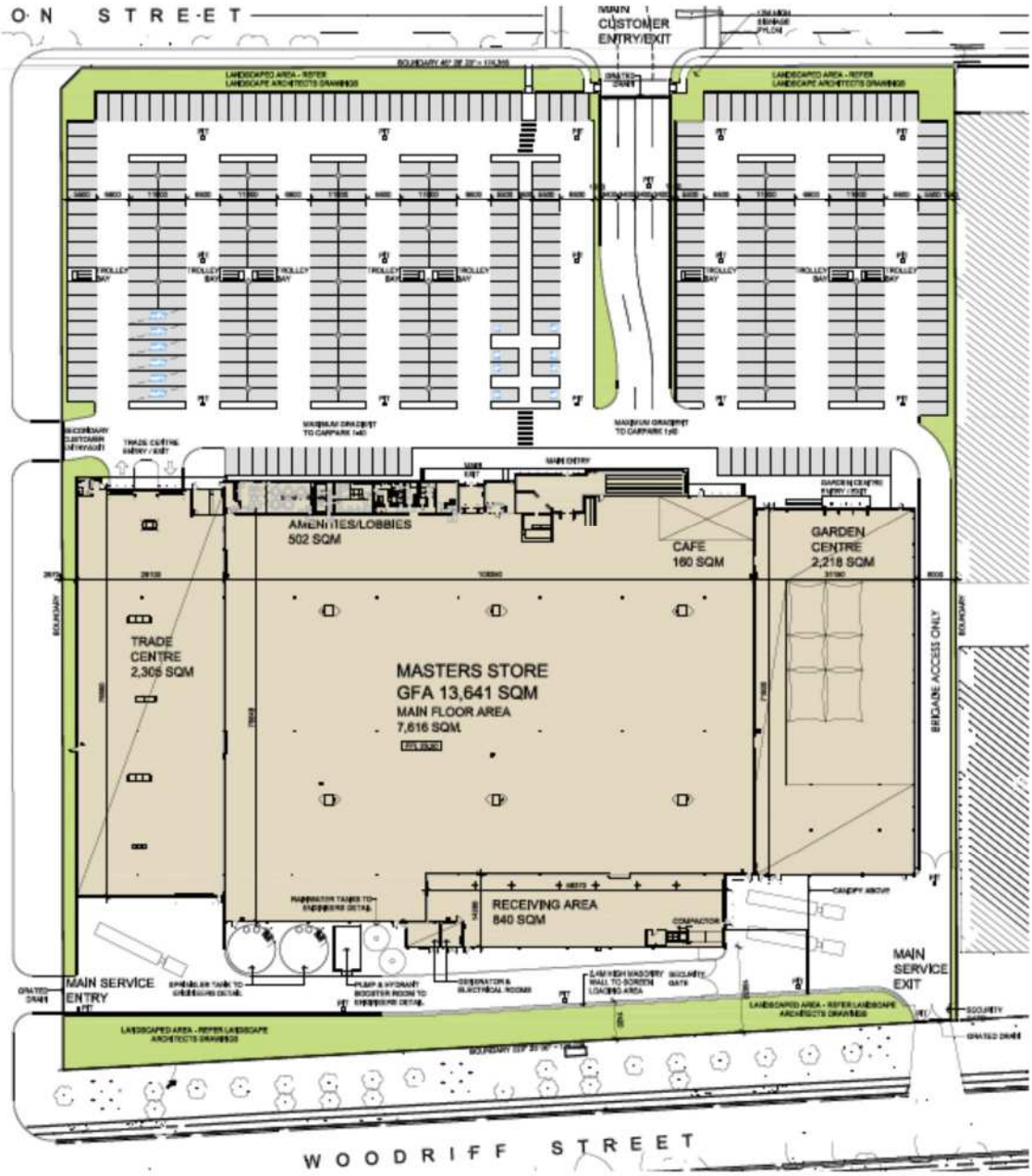

Figure 2b: Site Plan of the Proposed Development Site (Residential Component)

5 RESULTS OF THE ANALYSIS

For each of the three predominant wind directions for the Penrith 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 Pedestrian Footpaths around the Site

The pedestrian footpath along Station Street is exposed to all three prevailing wind directions due to the north-east to south-west alignment of the street and exposure to the open areas of Howell Oval west of the site. The existing wind conditions along this street will not be exacerbated by the proposed development.

The pedestrian footpath along Woodriff Street benefits from the shielded provided by the subject development from the prevailing westerly winds, however are exposed to the north-easterly and westerly winds due to the street alignment.

Similarly, the pedestrian footpath along Jamison Road is shielded from the north-easterly winds by the proposed residential developments of the site. It is however, exposed to the southerly and westerly winds due to its east-west alignment.

It is expected the wind conditions within the abovementioned pedestrian footpaths will be acceptable for its intended use with the inclusion of the proposed densely foliating street trees along Station Street, Woodriff Street and Jamison Road as indicated in the landscape drawings of the site and in Figures 3 and 4. These street trees should be capable of growing to a height of 5m, with a 4m wide canopy and are to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year.

5.2 Ground Level Trafficable Areas within and around the Site

5.2.1 Public Plaza

The Public Plaza, located at the northern corner of the site within Stage 3 is well shielded from the adverse south to south-easterly winds by the proposed residential buildings of the site. The plaza however, is exposed to the westerly and north to north-easterly winds travelling around Penrith Park and Penrith Showground respectively. It is expected the wind conditions within the public plaza will be acceptable for its intended uses with the inclusion of the proposed densely foliating trees within and around the public plaza site as indicated in landscape drawings and in Figure 3. It should be noted that for trees to be effective all year round, they should be densely foliating and of an evergreen variety.

5.2.2 Various Central Landscaped Communal Areas within the Site

The various central landscaped communal areas within the site, primarily located between the residential complexes of development site are generally well shielded from the predominant winds by the various tower developments and the acoustic wall between the Masters Home Improvement Store and the residential complexes. The landscaped drawings for the site and highlighted in Figure 3, shows there are several densely foliating trees and low lying vegetation within these landscaped communal areas. It is recommended the proposed landscape scheme is included in the final design of the development and the wind conditions within these areas are expected to be acceptable for its intended uses.

5.2.3 Car Parking Site along the North-Eastern Boundary

The ground level car parking site located along the north-eastern boundary of the site is exposed to the adverse westerly and north to north-easterly winds travelling around Penrith Park and Penrith Showground respectively. The proposed Masters development is expected to be effective in shielding the car park areas from the southerly winds. The proposed densely foliating evergreen trees along Station Street as indicated in Figure 3 are expected to be effective in mitigating the adverse winds conditions within the car park site. Hence they are recommended to be retained in the final design of the development and wind conditions are expected to be acceptable for its intended uses. Note that the inclusion of additional densely foliating trees within the car park site as indicated in Figure 4 are expected to further enhance the wind conditions within these areas.

5.2.4 Various pedestrian footpaths along the Proposed New Roads within the Site

The various pedestrian footpaths along the proposed new roads within the site are directly aligned with the north-easterly and south-easterly wind directions. The incident winds travel over the relatively open surrounds and funnelled into the roads by the proposed tower developments of the site. The landscape drawings for the site and indicated in Figure 3, shows avenues of large trees alongside the pedestrian footpaths throughout the site and capable of growing to a height of 5m with a 4m wide canopy. It is expected with the inclusion of the above-mentioned treatment scheme, the wind conditions along the pedestrian footpaths of the site will be acceptable for its intended uses.

5.3 Private Balconies Associated with the Various Residential Complexes

Wind conditions on the single-aspect balconies, which account for most of the balconies within the subject development site, are expected to be suitable for their intended uses due to the stagnation provided by surrounding proposed buildings, and from the effect of the various privacy screens and blade walls that protrude out from the building facades. Similarly any balconies that are recessed into the overall building form will also experience ideal wind conditions.

However, the private corner balconies located of the various residential complexes may be exposed to adverse winds being accelerated around the corners of the building. To provide

adequate wind conditions within these areas, it is recommended that impermeable balustrades are used on the perimeter of the balcony area. It is also recommended to include a full-height screen along the short edge of the various corner balconies to mitigate the effect of accelerated corner winds. Hence, with the inclusion of the impermeable balustrades and end-screens on the corner balconies, the wind conditions are expected to be acceptable for its intended uses.

Note that the inclusion of impermeable balustrades along the perimeter of the remaining balconies of the development site will further enhance the wind conditions within these areas.

Figure 3: Recommended Treatments – Ground Level of the Residential Development

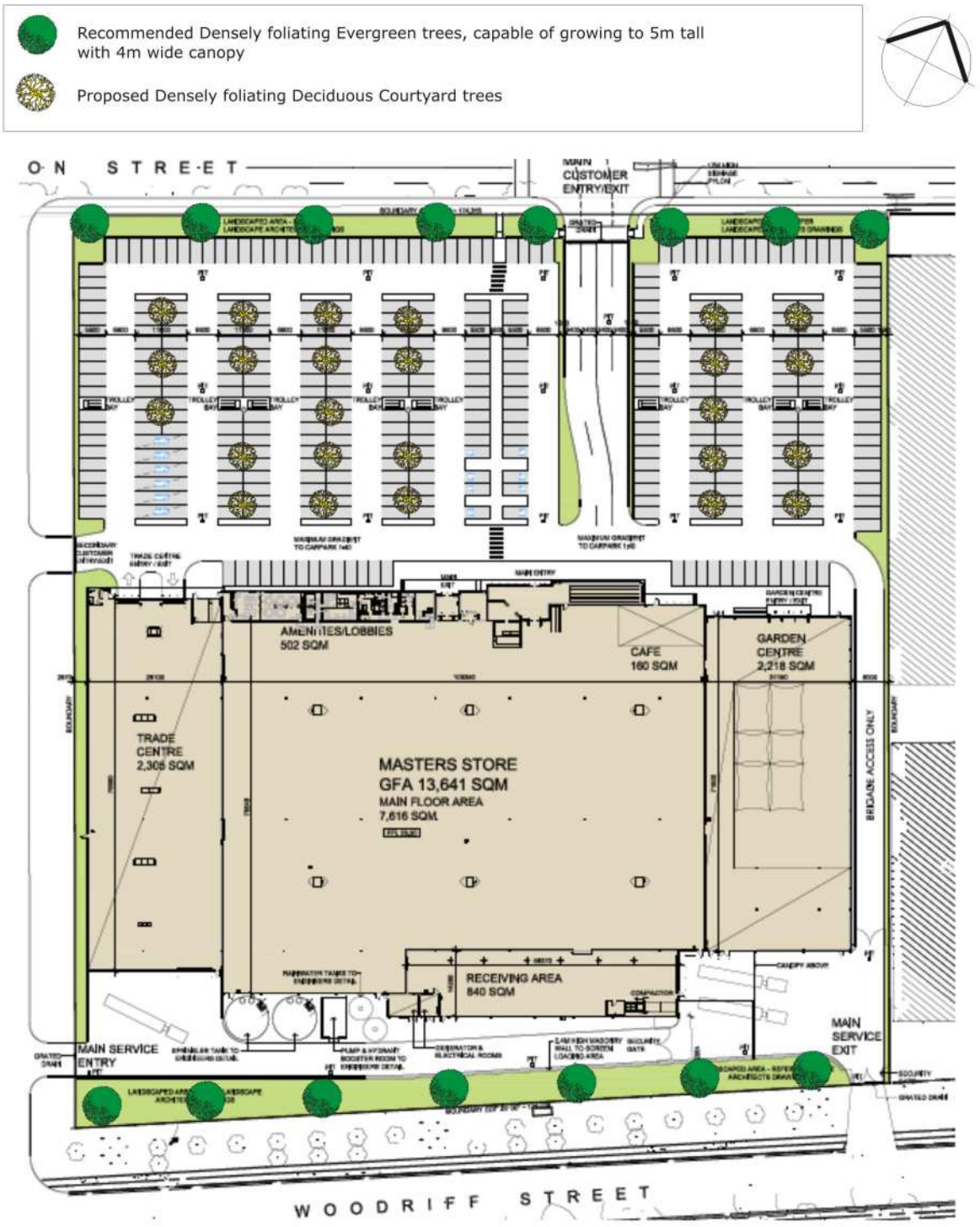

Figure 4: Recommended Treatments – Ground Level of the Masters Development

6 CONCLUSION

An analysis of the wind environment impact with respect to the three principal wind directions for the Penrith region has been completed for the proposed development known as Nepean Green, located in Penrith. 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 architects Turner Associates and Leffler Simes Architect, received May 2013. 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.

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- The inclusion of the proposed densely foliating trees and vegetation within the outdoor public plaza, the various central landscape communal areas and retail car-parking site. To be effective in wind mitigation during the winter period, these trees should be of an evergreen variety.

- The inclusion of impermeable balustrades along the perimeter of the corner balconies within the site.

- The inclusion of full-height impermeable end screens on one end of the corner balconies, preferably those that face the north to north-easterly, western or south to south-easterly directions.

Note that the wind conditions within the remaining balconies of the site would be further enhanced with the inclusion of impermeable balustrades along the perimeter.

With these recommended treatments included in the final design, it is expected that wind conditions within and around the subject development will be acceptable for their intended uses. Furthermore, the proposed development is not expected to cause any adverse wind effects to the local surrounding areas.

APPENDIX A - WIND ROSE FOR THE PENRITH REGION

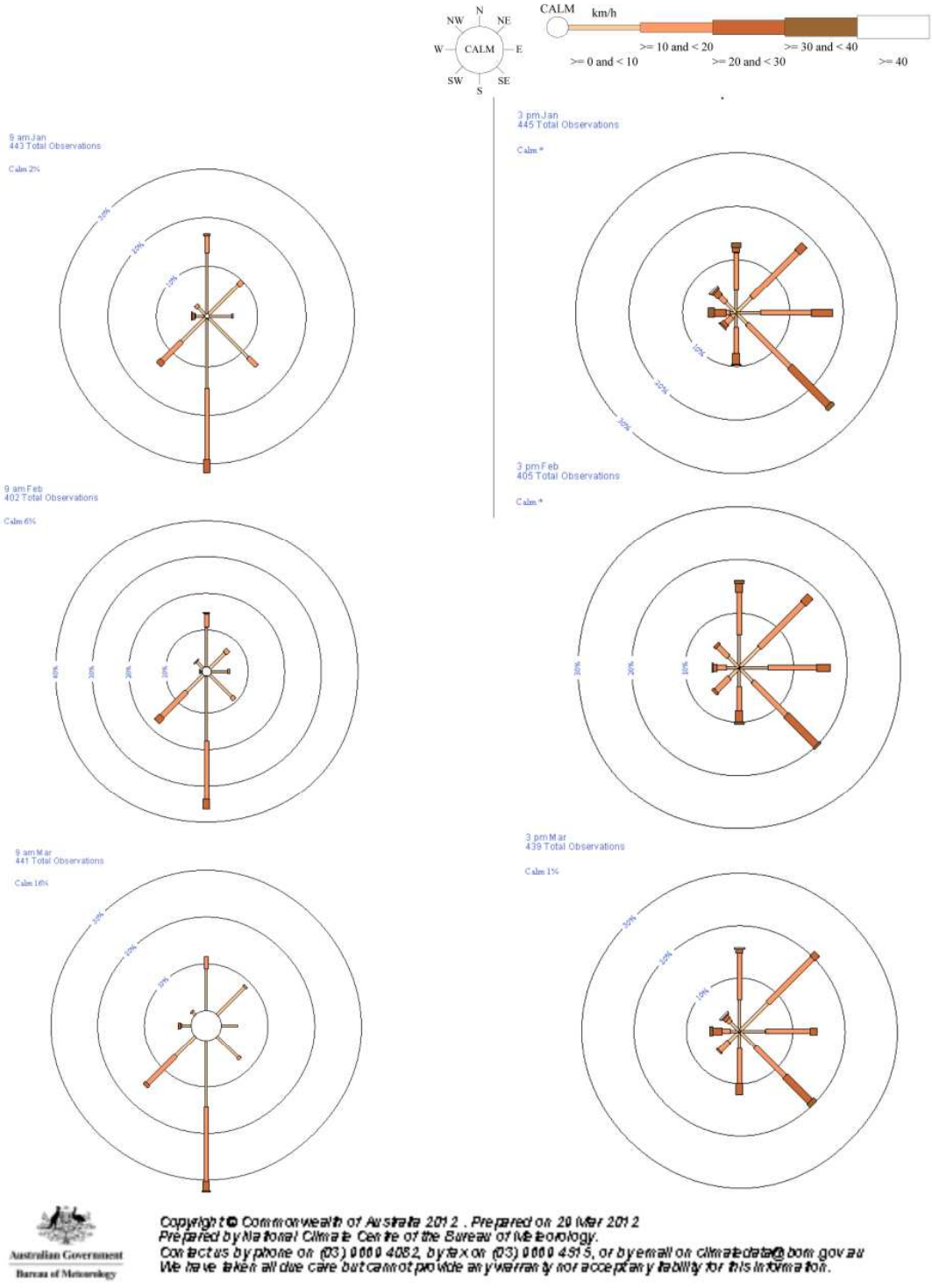
Rose of Wind direction versus Wind speed in km/h (15 Sep 1995 to 30 Sep 2010)

Custom times selected, refer to attached note for details

PENRITH LAKES AWS

Site No: 067113 • Opened Aug 1995 • Still Open • Latitude: -33.7195° • Longitude: 150.6783° • Elevation 24.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



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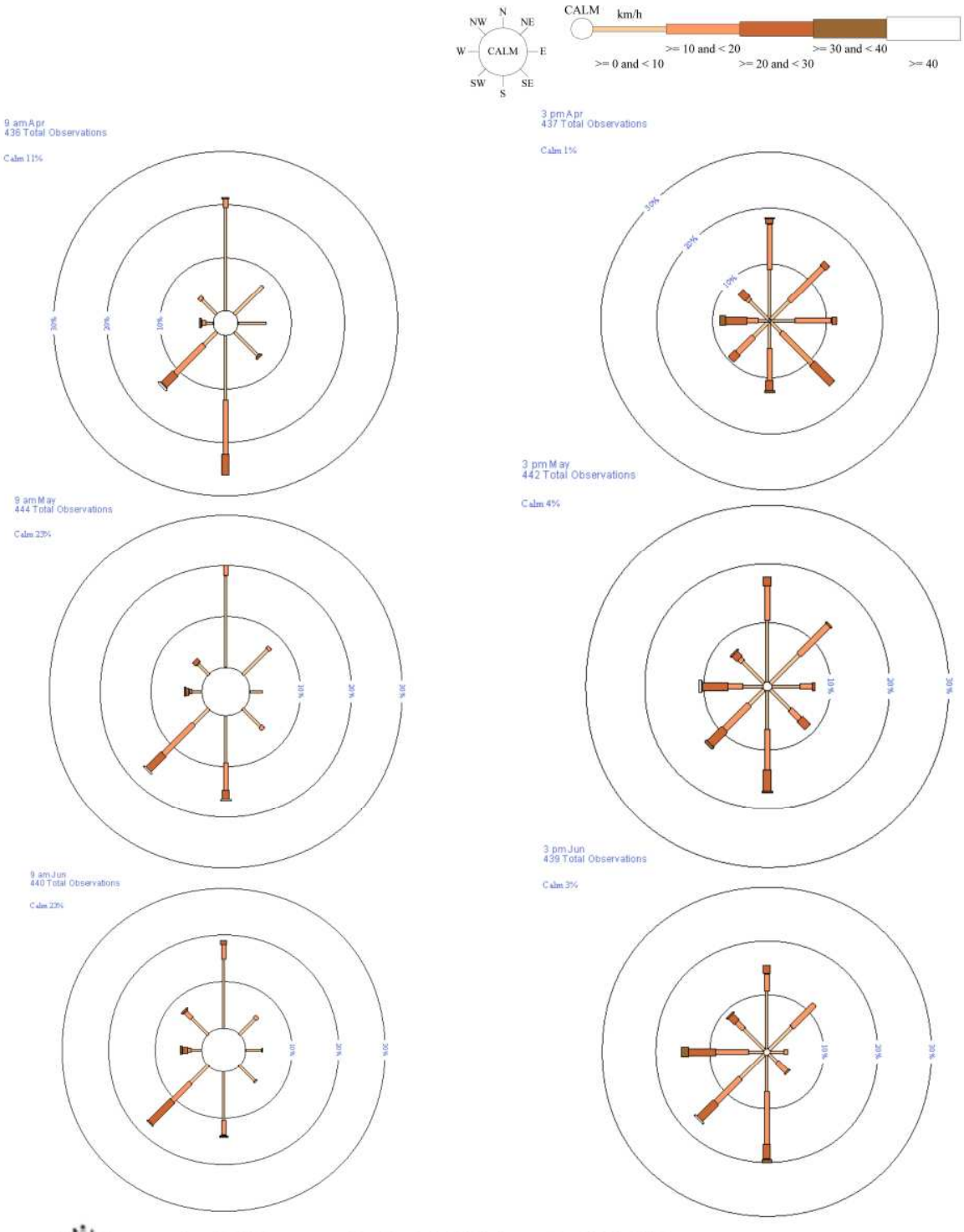

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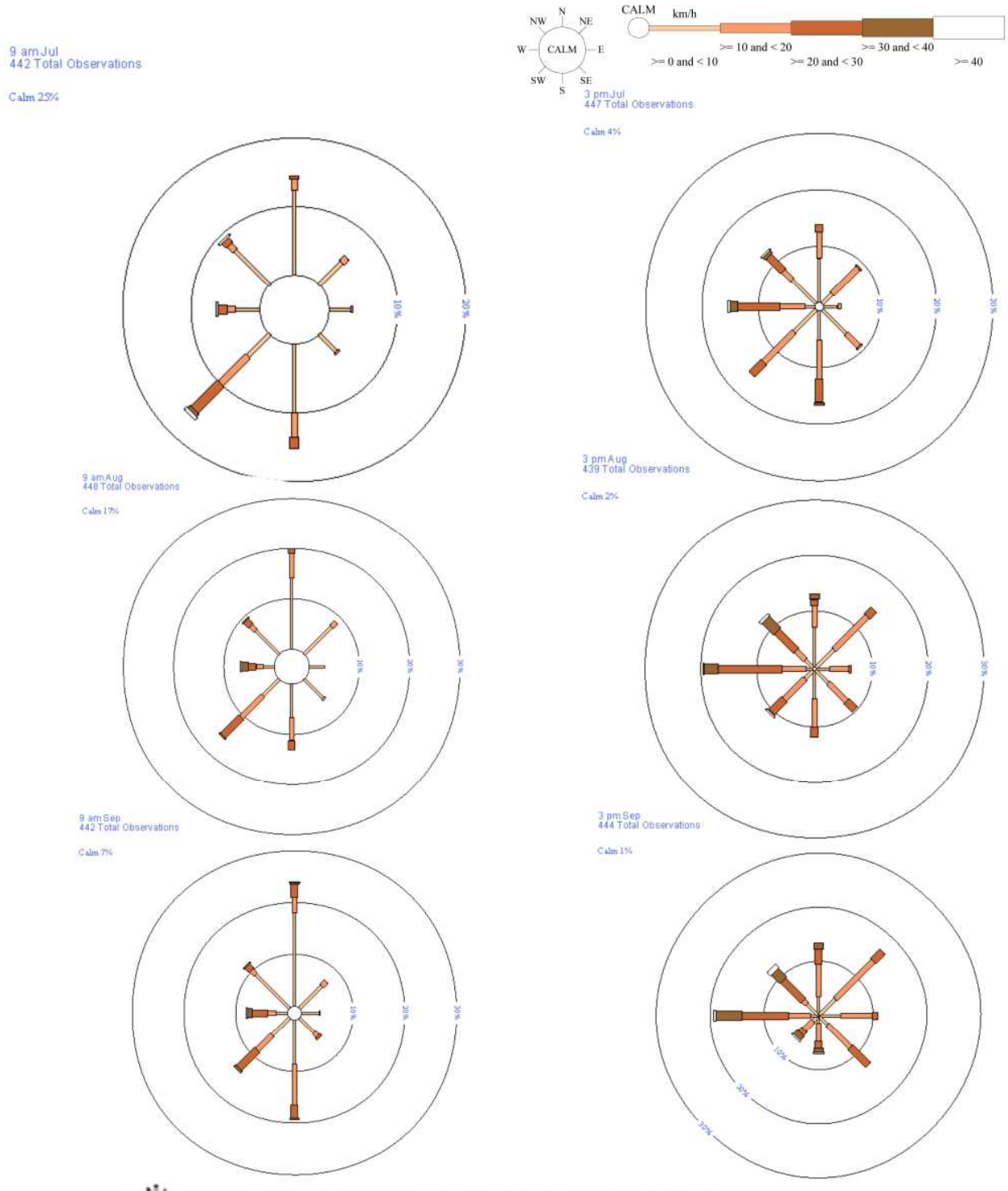

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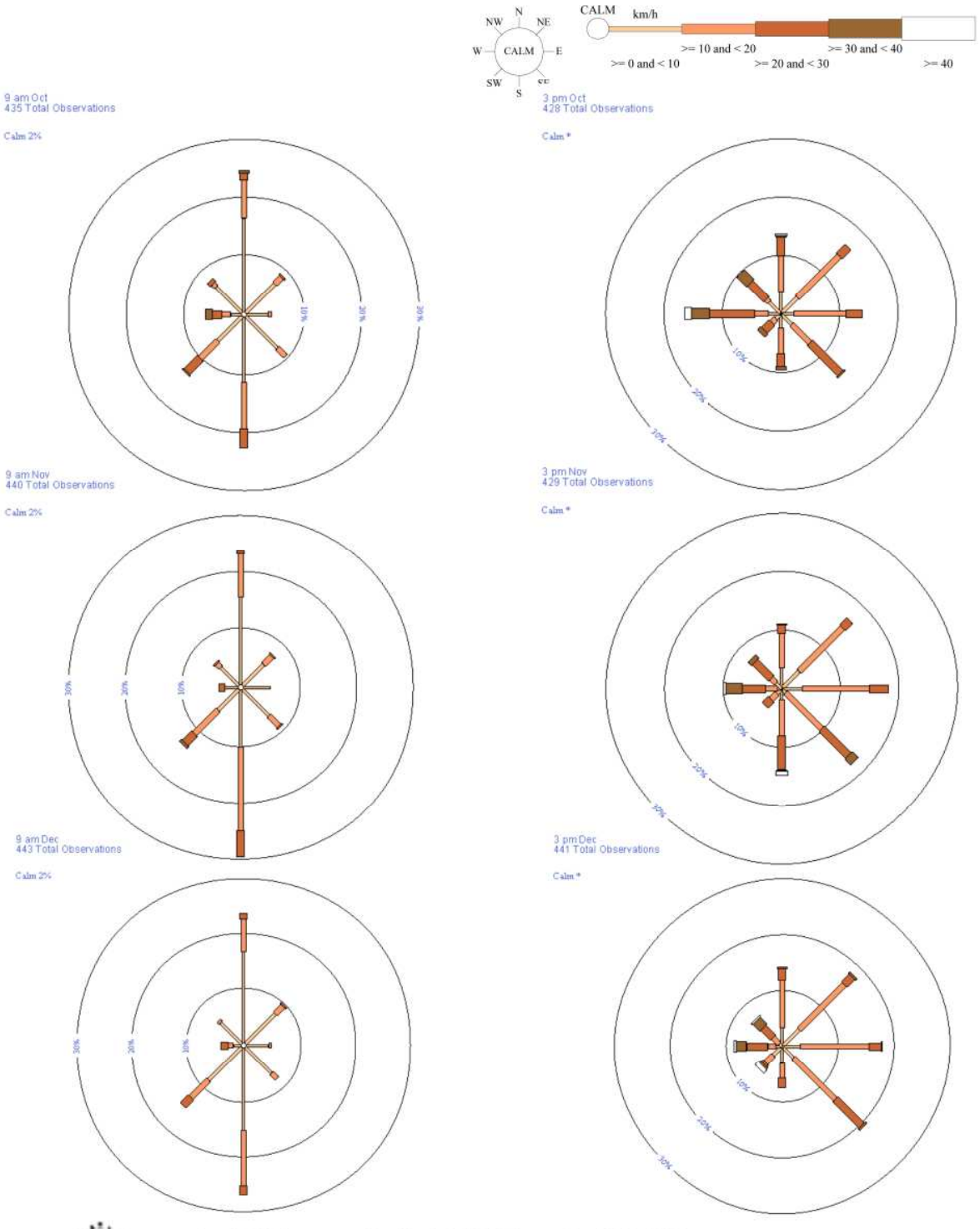

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