



## PEDESTRIAN WIND ENVIRONMENT STATEMENT COFFS HARBOUR CIVIC CENTRE

WE747-01F02(REV0)- WS REPORT

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Prepared for:

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## **EXECUTIVE SUMMARY**

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This report is in relation to the proposed development of the Coffs Harbour Civic Centre and presents an opinion on the likely impact of the proposed design on the local wind environment on the critical outdoor areas within and around the subject development. The effect of wind activity is examined for the two predominant wind directions for the Coffs Harbour region; namely the north-north-easterly and south-westerly winds. The analysis of the wind effects relating to the proposed development 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 latest architectural drawings. No wind tunnel testing has been undertaken for the subject development, and hence 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 assessment indicate that the subject development is relatively well placed and well designed in regards to the predominant wind directions. As a result, only minor modification are recommended to reduce the impact on the wind comfort within certain areas on the Ground Level and at the External Events Space. It is expected that the wind effects identified in the report can be ameliorated with the consideration of the following treatment strategies into the design of the development:

### **Ground Level**

- The retention of the existing vegetation and trees to the north of the building along Riding Place and to the south of the building along Gordon Street. In particular, the retention of the large fig tree that stands opposite the development on Riding Place.

### **External Events Space**

- The retention of the large fig tree that stands to the north-west of the development on the opposite side of Riding Place. The top of the tree needs to be roughly level with the highest point of the development

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## **1 INTRODUCTION**

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An opinion on the likely impact of the proposed design on the local wind environment affecting pedestrians within the critical outdoor areas within and around the subject development is presented in this report. The analysis of wind effects relating to the proposed development has been carried out in the context of the predominant wind directions for the region, building morphology of the development and nearby buildings, and local land topography. The conclusions of this report are drawn from our extensive experience in the field of wind engineering and studies of wind environment effects.

No wind tunnel testing has been undertaken for this assessment. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made only in-principle.

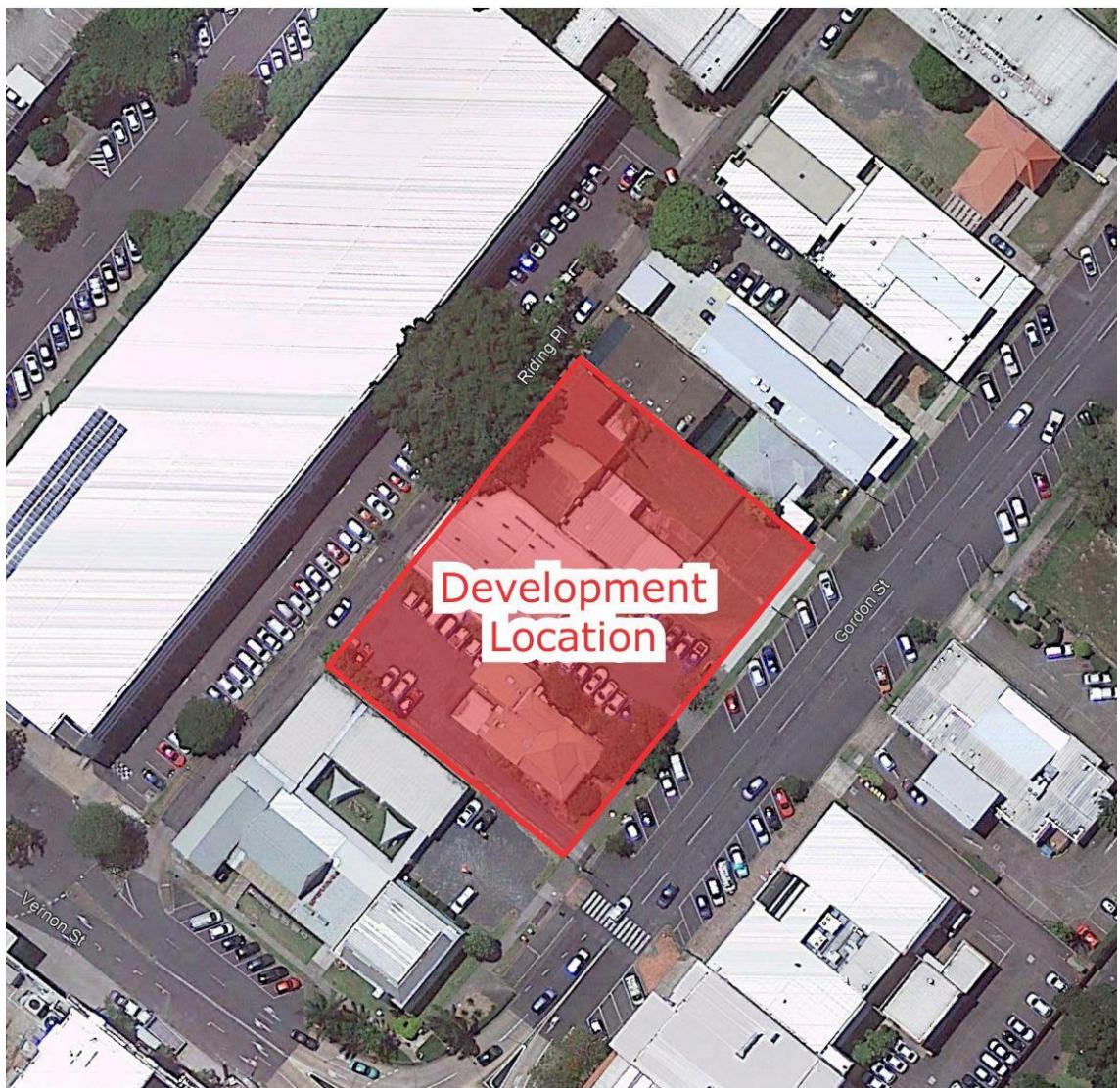
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## DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

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The development site is bounded by Riding Place to the north-west, Gordon Street to the south-east, the Coffs Harbour United Church to the south-west and low rise residential buildings abutting the site on the north-eastern boundary. Surrounding the site are predominantly low rise retail/residential buildings with intermittent medium-rise buildings. Some shielding is expected for the lower levels of the subject development from the shopping mall to the south-west and from the abutting buildings to the north-east and south-west. A survey of the land topography indicates no major elevation changes in the region surrounding the site. An aerial image of the subject site and the local surroundings is shown in Figure 1.

The proposed development includes a gallery, a library, office space, various retail outlets and a stepped amphitheatre (Rooftop Events Space) on the Roof Level. A 2 storey high though-site link runs through the development from south-east to north-west. The overall height of the development is six storeys above ground. The development has a uniquely shaped design with curved façades and a sloping horizontal profile. This assessment covers the various outdoor trafficable areas within and around the proposed development.



**Figure 1: Aerial Image of the Site Location**

### **3 REGIONAL WIND CLIMATE**

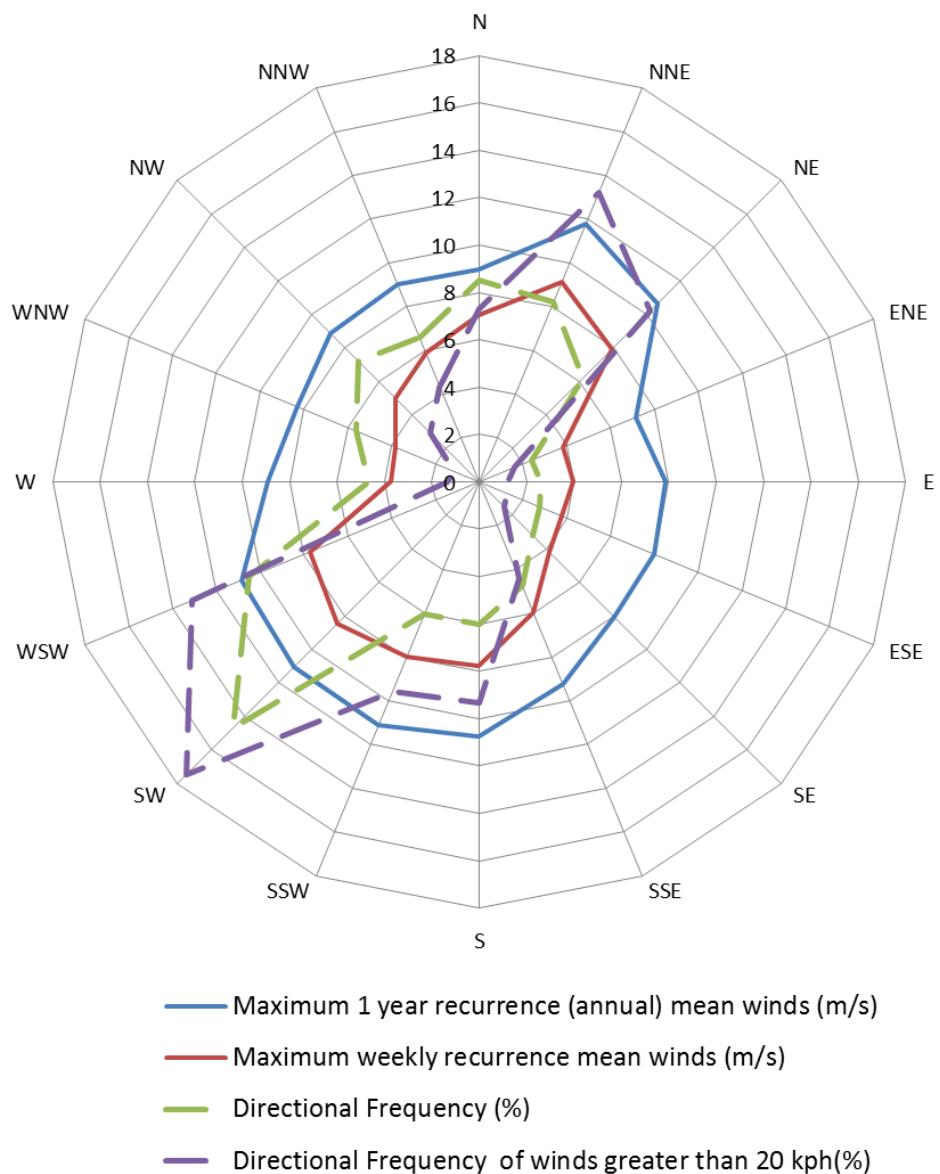
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The Coffs Harbour region is governed by two principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-north-east and south-west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary is based on a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Coffs Harbour Station by the Bureau of Meteorology (recorded from 1995 to 2014). From this analysis, directional probabilities of exceedance and directional wind speeds for the region are determined. The directional wind speeds and corresponding directional frequencies of occurrence are presented in Figure 2.

As shown in Figure 2, the south-westerly winds are the most frequent wind for the Coffs Harbour region, while the north-north-easterly winds are the strongest. The south-westerly winds occur predominantly in the morning and year-round, while the north-north-easterly winds occur in the afternoons and most frequently during the warmer months of the year, dropping off slightly in the winter, and hence are usually welcomed within outdoor areas.

**Table 1: Principal Time of Occurrence of Winds for the Coffs Harbour Region**

Season	NNE Winds		SW Winds	
	Morning	Afternoon	Morning	Afternoon
Summer		X	X	
Autumn		X	X	
Winter		X	X	X
Spring		X	X	



**Figure 2: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Coffs Harbour Region (referenced to 10m above ground in standard open terrain)**

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. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 2 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

**Table 2: Summary of Wind Effects on People (A.D. Penwarden, 1973)**

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm	0	Less than 0.3	Negligible.
Calm, light air	1	0.3 – 1.6	No noticeable wind.
Light breeze	2	1.6 – 3.4	Wind felt on face.
Gentle breeze	3	3.4 – 5.5	Hair is disturbed, clothing flaps, newspapers difficult to read.
Moderate breeze	4	5.5 – 8.0	Raises dust, dry soil and loose paper, hair disarranged.
Fresh breeze	5	8.0 – 10.8	Force of wind felt on body, danger of stumbling
Strong breeze	6	10.8 – 13.9	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant.
Near gale	7	13.9 – 17.2	Inconvenience felt when walking.
Gale	8	17.2 – 20.8	Generally impedes progress, difficulty balancing in gusts.
Strong gale	9	Greater than 20.8	People blown over.

It should be noted that wind speeds can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection and the acceptability of the conditions for outdoor areas are determined based on their intended use (rather than referencing specific wind speeds). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

## **5 RESULTS AND DISCUSSION**

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The expected wind conditions are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report.

### **5.1 Ground Level Areas**

The ground plane will be used primarily for circulation. However there are potential seating areas such as in the area adjacent to the café. The recommended criterion for wind conditions for the circulation area is 7.5m/s with a 5% probability of exceedance, whereas the proposed seating areas will need to satisfy a more stringent comfort criterion of 5.5m/s with a 5% probability of exceedance. Although this assessment is of a qualitative nature, the abovementioned criteria are considered when assessing the wind environment impacts.

Due to the angle of the predominant wind directions (north-north-east and south-west) in relation to the orientation of the development, significant winds are not expected to funnel through the through-site link that runs through the development on Ground Level and Level 1. North-north-easterly winds are expected funnel along Riding Place, where the significant number of trees are expected to ameliorate these winds to comfortable levels. Similarly, the presence of multiple trees to the south of the development along Gordon Street will help to ameliorate winds funnelling along the street. Additionally, the through-site link will be shielded from north-westerly winds by the warehouse across the street to the north-west.

The café on Ground Level will benefit from the shielding effects of various existing trees, in particular the large fig tree on Riding Place. It is recommended that these trees be retained. It is assumed that the through site link is only for circulation. If seating is proposed within the through site link then it also recommended that either a set of baffle screens be provided at either end or densely foliating evergreen trees planted along the footpath along the Gordon Street site boundary to the south-east.

The concave shape of the upper portion of the south-western façade is expected to be effective in preventing winds siding streaming around this façade. The effect of down washing winds from south-western façade onto the pedestrian walkway along the south-western edge of the development is expected to be mitigated by the stepped form of the south-west aspect. A similar scenario is expected at the north-eastern side of the building in relation to the north-north-easterly winds.

### **5.2 Rooftop Events Space**

This space is expected to be largely shielded from the south-westerly winds due to the difference in elevation between the south-western and north-eastern aspects of the

development. The south-westerly winds are expected to be deflected upwards by the lip of the south-western aspect of the development and are not expected to reattach before bypassing the development.

The north-north-easterly winds may result in an unfavourable wind conditions at the top of the southern section of the tiered seating, noting the more stringent criterion required for seating areas/ stationary activities. Winds are expected to be deflected over the north-western screen and reattach at the abovementioned zone. Presuming that the existing large fig tree opposite the development on Riding Place has sufficient elevation (the top of the tree needs to be roughly level with the highest point of the development), it can act as an effective ameliorating device against the north-north-easterly winds and is expected to provide sufficient shielding for the entire space from these winds. Should the fig tree be removed or lack the sufficient height, it is recommended that the north-western screen be increased in height to so that it is level with the lip of the south-western aspect of the building and that a canopy be included for the upper section of the tiered seating.

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