PEDESTRIAN WIND ENVIRONMENT STATEMENT
(PLANNING PROPOSAL SUBMISSION)

601 PACIFIC HIGHWAY, ST LEONARDS

WD859-01F02(REV2)- WS REPORT

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Prepared for:

Stockland

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DOCUMENT CONTROL

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EXECUTIVE SUMMARY

This report is in relation to a planning proposal affecting the site at 601 Pacific Highway, St Leonards, and presents an opinion on the likely impact of the indicative concept design on the local wind environment to the critical outdoor areas within and around the subject site. The effect of wind activity is examined for the three predominant wind directions for the Sydney region; namely the north-easterly, southerly and 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 architectural drawings which have been prepared by Architectus, received in September, 2017. No wind tunnel tests have been undertaken at this stage, and hence this report addresses 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.

An assessment of the indicative built form has been undertaken for consideration of the impact on the surrounding wind conditions around the site. This assessment has included input from wind tunnel testing recently undertaken for a number of nearby development sites currently either under construction or development application phase. Due to the number of nearby developments, consideration has also been also been made of their potential impact and interaction with the subject development. The indicative concept design has incorporated notable built setback at the podium level which will assist in breaking up any downwashed winds to the street below. Furthermore, a step in built form would also assist in breaking up the winds along the façade. Detailed wind tunnel modelling will need to be undertaken as the design further progresses to verify the wind conditions around the site and ensure suitable conditions are provided for pedestrians.

1 DESCRIPTION OF THE SITE AND SURROUNDINGS

The site is located in St Leonards, bounded by Atchison Street to the north, Mitchell Street to the east, Pacific Highway to the south and an existing a 7 storey building to the west. Surrounding the site in all directions are generally medium rise residential and commercial buildings, however it is noted that a number of these sites are either under construction or under planning stage, as noted in Figure 1 below. These future high-rise developments will have a notable effect on the prevailing winds to the subject site. Further away from the site are generally low-rise buildings.

A survey of the local land topography around the site indicates that the site is located atop a ridgeline which continues towards the east and west of the site. The terrain generally slopes downwards to the north and south. An aerial image of the site and the local surroundings is shown in Figure 1.

The indicative concept design proposes a mixed use development consisting of two tower forms 45 and 63 levels above ground to the highest habitable room. A common 7 level podium is indicated with the tower being setback on all aspects of the site, particularly the southern and western aspects.

Figure 1: Aerial Image of the Site Location

2 WIND CLIMATE OF THE SYDNEY REGION

The Sydney region is governed by three principle wind directions, and these can potentially affect the subject site. 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 a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1995 to 2016). From this analysis, a directional plot of the annual and weekly recurrence winds for the Sydney region is also determined, as shown in Figure 2. The frequency of occurrence of these winds is also shown in Figure 2.

As shown in Figure 2, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. The westerly winds occur most frequently during the winter season for the Sydney region, and 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. North-easterly winds occur most frequently during the warmer months of the year for the Sydney region, and hence are usually welcomed within outdoor areas since they are typically not as strong as the southerly or westerly winds.

Table 1: Principle 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	

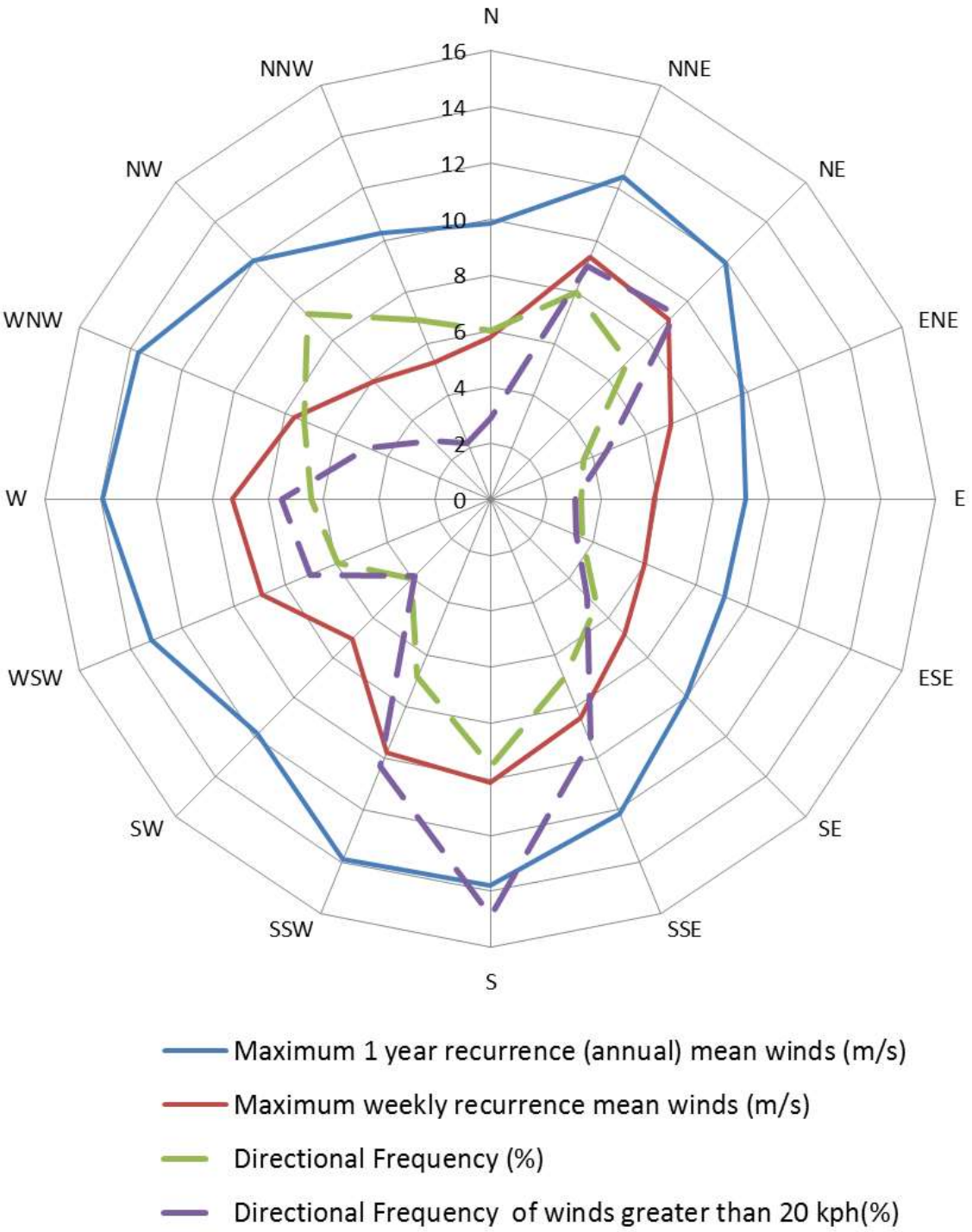

Figure 2: Directional Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (for the annual and weekly return periods, referenced to standard open terrain at a height of 10m above ground)

3 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. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, A.D. Penwarden, etc, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have also adopted elements of some of these into their planning control requirements in Australia. The following table is an example, which was developed by A.D. Penwarden in 1975, 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 (A.D. Penwarden, 1975)

Type of Winds	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.

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.

4 RESULTS AND DISCUSSION

The expected wind conditions are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject site for each of the prevailing wind directions for the Sydney region as outlined in Section 2. The interaction between the wind and the indicative building morphology in the area was considered, and important features taken into account include the distances between the building forms, their overall heights and bulk, as well as the landform. Note that only the potentially critical wind effects that are identifiable by visual inspection are discussed in this report. It is recommended that wind tunnel testing be undertaken at the next planning phase to verify the conclusions presented in this report.

4.1 Ground Level Pedestrian Accessible Areas

The subject site is located within a significant development area of St Leonards, with The Landmark and St Leonards Square by Mirvac currently under construction to the south and a number of proposed high-rise developments located to the west as noted in Figure 1. Hence it is expected that the subject site will benefit considerably from this additional shielding from the prevailing southerly and westerly winds for the region.

Previous wind tunnel testing completed for nearby developments has noted the following:

- The areas along the Pacific Highway were mainly noted to be impacted by the southerly winds which will subsequently be shielded by The Landmark and St Leonards Square by Mirvac to the south.
- The Pacific Highway aspect will also be exposed to the westerly winds. However the proposed inclusion of the developments to the west along the Pacific Highway will provide significant shielding once constructed.
- The area along Atchison Street is somewhat exposed to the north-easterly winds due to the exposure of the site in this direction.

Further to the above noted wind conditions which will affect the subject site, the indicative massing for the subject site includes a number of key aspects, including:

- A notable setback is provided along the southern and western aspects which would significantly capture any downwashed winds from the tower form above.
- Setbacks of at least 3 metres are provided along the eastern and northern aspects, which increases further to the west of the site. This in conjunction with the gap between the tower forms will be beneficial in breaking up the north-easterly winds noted to be affecting Atchison Street aspect of the site.

Consideration will need to be made with regards to the through link along the western aspect of the site between the Pacific Highway and Atchison Street. This may be subject to pressure driven flow and hence co-ordination with the proposed neighbouring site is recommended to

ensure a suitable overall outcome. This may include features such an awning/pergola structure and landscaping within this space. It should however be noted that any setback of the western aspect of the tower built form will be beneficial in reducing wind conditions in this area.

The inclusion of awnings at street level, in particular along the eastern and northern aspects would further enhance conditions in this area should any localised downwash off the podium levels be noted. The inclusion of any landscape around the subject site would further enhance the wind conditions in the surrounding streetscape, including any funnelling of the prevailing winds due to the alignment of the Pacific Highway and Atchison Street to their alignment.

It is expected that the conditions for the various surrounding areas would be further modelled during development application phase to ensure suitable conditions are provided for all areas around the site.

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