



PEDESTRIAN WIND ENVIRONMENT STATEMENT

12-24 STANLEY STREET KOGARAH

WD979-01F02(FINAL)-WS REPORT

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Prepared for:

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DOCUMENT CONTROL

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EXECUTIVE SUMMARY

This report is in relation to the proposed development located at 12-24 Stanley Street, Kogarah, 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 subject development. 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 project architect Scott Carver, the latest of which were received during April, 2018. 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 may experience potentially adverse wind conditions. However, it is expected that suitable wind conditions can be achieved for all trafficable outdoor areas within and around the site with the treatments recommended within this report, which are summarised as follows:

Ground level outdoor areas:

- Inclusion of a canopy or planting over each of the Ground Level private outdoor areas. The planting must be 2-3 metres in height and densely foliating.
- Retention of entry lobby airlock and planter boxes.

Ground level pedestrian walkways:

- Inclusion of trees and/or other planting within the south-western deep soil section.
- Retention of proposed planting located within or around the site.

Central connecting bridge:

- Retention of impermeable planter boxes and planting along the central connecting bridge for all levels. Planting should be of a densely foliating and evergreen variety.

Other private balconies throughout the residential apartments:

- Inclusion of a 2 metre high impermeable screen to be implemented on the eastern edge of the balcony for apartment 4.06.

- Inclusion of a 2 metre high for apartments 4.04, 4.05, 4.07, 4.08. The screen should be placed along the edges which are closest to the connecting bridge passageway.
- Retention of all other screens and balustrades.

Communal roof garden:

- Retention of communal garden roof feature
- Inclusion of a canopy, pergola feature or trees over seated areas within the communal roof garden.
- Inclusion of a 2 metre high impermeable perimeter.

Note that these treatments are in-principle only, and the size and extent of these treatments can be quantified through wind tunnel testing. With the inclusion of the abovementioned recommendations in the final design, it is expected that wind conditions for all trafficable outdoor areas within and around the development will be acceptable for their intended uses.

1 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

The proposed development site is located in Kogarah and is bound by Stanley Street to the north and Stanley Lane to the south. The subject development consists of an 11-storey high residential tower. It is located within a primarily residential district and is partially shielded by several low to mid-rise developments to the east.

A survey of the local land topography around the site indicates that the site is relatively flat along the eastern and western façade of the development. A moderate descent can be observed along Stanley Street and Stanley Lane with a drop of approximately 3 metres in height throughout the length of the development site. The slope has a gradient of less than 1/20 and thus is expected to have an insignificant influence on the flow along Stanley Street or Stanley Lane. An aerial image of the site and the local surroundings is shown in Figure 1.

The critical trafficable areas associated with the proposed development, which are the focus of this assessment with regards to wind effects, are detailed as follows:

- The ground level private outdoor areas,
- Ground level pedestrian walkways,
- The central connecting bridge,
- Other private balconies throughout the residential apartments,
- The communal roof garden.

It should be noted that, the impact of various future developments located near the site have been considered within the report. These include:

- 2-10 Stanley Street, located directly east of the site,
- 18-24A Victoria Street, located directly west of the site,
- 56-68 Regent Street, located directly south of the site
- 70-78 Regent Street, located directly south of the site,
- 11 & 28-36 Stanley & Victoria Street, located directly north of the site.



Figure 1: Aerial Image of the Site Location

2 WIND CLIMATE OF THE SYDNEY REGION

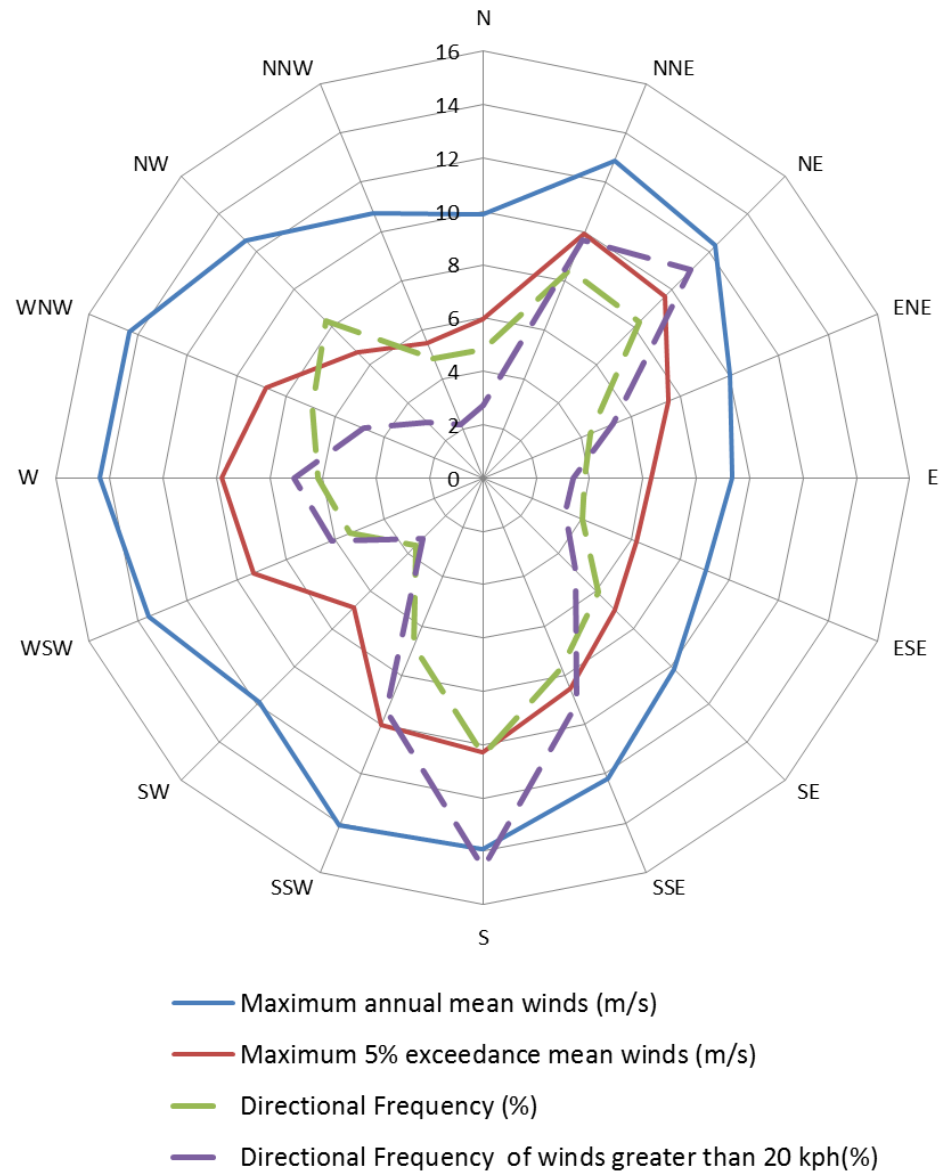
The Sydney region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary 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 (Sydney Airport) by the Bureau of Meteorology. The data has been collected from this station from 1995 to 2016, and corrected so that it represents winds over standard open terrain at a height of 10m above ground level. 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: 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	

**Hourly Mean Windspeeds and Frequencies for
Sydney (Obtained from Sydney Airport between
6am to 10pm and 1995 to 2016 corrected to open
terrain, at 10m height)**



**Figure 2: Directional Hourly Mean Wind Speeds, and Frequencies of Occurrence,
for the Sydney Region (for probabilities of exceedance of 0.1% and 5%, 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 Davenport, Lawson, Melbourne, 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 adopted elements of some of these into their planning control requirements in Australia.

The following table is an example, which was developed by 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 (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 critical trafficable outdoor areas within and around the subject development for each of the three predominant wind directions for the Sydney region. 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, their overall heights and bulk, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report.

4.1 Ground Level Private Outdoor Areas

The low-rise buildings around the site provide some shielding against low level direct winds originating from each of the three principal directions for the Sydney region. The north-easterly and southerly winds are expected to deflect off the development and downwash onto the private outdoor areas along the ground floor. As a result of this wind effect, it is recommended that a canopy be included over each of the private outdoor areas to the north and south. A canopy will redirect the flow away from occupants below and is expected to be effective in the reduction of adverse winds. Planting is also an effective measure in the reduction of downwashing winds. The planting should be 2-3 metres tall and of a densely foliating and evergreen variety to ensure their effectiveness throughout the year.

The entryways on the northern and southern aspects of the building leading to the entry lobby can experience a high pressure-driven flow. The built form can cause a large pressure differential and funnelling effect through this passageway. The entry lobby implements an airlock system with the two sets of double doors which is an effective way of stagnating the flow. In addition, planter boxes have been observed in the architectural drawings. Planting provides the effect of absorbing and/or decelerating wind flow. Retention of these two features is expected to mitigate the adverse wind flow.

4.2 Ground Level Pedestrian Walkways

Pedestrians walking along Stanley Street can potentially experience discomfort as a result of the downwash from the development. The proposed planting located within or around the site should be retained.

Westerly winds deflecting off the western aspect will accelerate around the south-western corner of the development, by the deep soil zone. In order to mitigate the adverse effects of this accelerated flow, it is suggested that trees and/or other planting be included in the deep soil section. The planting should be of a densely foliating and evergreen variety to ensure their effectiveness throughout the year. In addition, the planting will also help in mitigating any downwash from the western façade.

4.3 Central Connecting Bridge

The central connecting bridge is expected to experience adverse wind conditions as the northern and southern aspects are exposed to direct winds which funnel through the gap. Retention of the impermeable planter boxes and planting is recommended. The planting should be of a densely foliating and evergreen variety.

4.4 Other Private Balconies throughout the Residential Apartments

The majority of balconies throughout the apartment are expected to benefit from the shielding provided by the effective use of full-height impermeable privacy screens, blade walls, and their recessed design into the overall building footprint. The wind conditions experienced on balconies with these features are expected to be suitable for the intended use.

The balcony of apartment 4.06 will experience accelerated flow from southerly winds. A 2 metre high impermeable screen is recommended to be implemented on the eastern edge of the balcony.

In addition, a 2 metre high screen should be placed for apartments 4.04, 4.05, 4.07, 4.08. The screen should be placed along the edges which are closest to the connecting bridge passageway. The screens will be effective in reducing the flow through the connecting bridge passageway and thus minimise the magnitude of the adverse winds produce by funnelling, as well as the corner accelerations expected to affect these balconies.

It is recommended that all screens and balustrades currently in place be retained and be made impermeable (if not already).

4.5 Communal Roof Garden

Southerly and north-easterly winds are expected to cause winds to upwash on the southern and northern aspects of the site, as the wind can potentially reattach onto the communal roof garden on Level 10. The roof feature shown on the architectural drawings is expected to be effective in reducing the discomfort caused by wind upwash and should be retained. A canopy or pergola feature can also be implemented to mitigate this effect.

Dense planting within and around are recommended to further improve conditions, and a 2 metre high impermeable perimeter is recommended to reduce the effect of direct winds and push the upwashed winds over this space.

4.6 Impact of Future Developments on the Site

It should be noted that, the impact of various future developments located near the site have been considered within the report. These include:

- 2-10 Stanley Street, located directly east of the site,
- 18-24A Victoria Street, located directly west of the site,
- 56-68 Regent Street, located directly south of the site

- 70-78 Regent Street, located directly south of the site,
- 11 & 28-36 Stanley & Victoria Street, located directly north of the site.

Future developments around the site are between 10 and 12 storeys in height and will provide substantial shielding against direct wind impact for the lower levels of the proposed development. It is recommended that treatments be retained for the communal garden as the area is expected to be affected by the predominant winds from the north-easterly direction.

The through-site link is directly aligned with the southerly prevailing winds, where the winds will funnel between the proposed development and the proposed future development of 18-24A Victoria Street. However, the implementation of densely foliating evergreen planting within the deep soil zone should be effective in the reduction of this adverse wind.

Similarly, the north-easterly winds are expected to funnel between the eastern façade of the proposed development and the proposed future development of 2-10 Stanley Street.

Apartment balconies located along the southern façade have been shown to include blade walls along the exposed edges and thus, the retention of these blade walls are necessary to prevent adverse wind effect.

Winds are expected to funnel between the future developments of 58-68 Regent Street and 70-78 Regent Street. It is recommended that all screens and balustrades currently in place be retained and be made impermeable.