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HammondCare Wahroonga Stage 2

4-12 Neringah Avenue South, Wahroonga NSW 2076

Wind Impact Assessment

30N-22-0197-TNT-37679-1

11 November 2022

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Rev. 00	Original issue	15 Jul 22	
Rev. 01	Updated drawings	11 Nov 22	R. Islam

Executive Summary

HammondCare commissioned Vipac Engineers and Scientists Ltd to prepare a statement of wind effects for the ground level areas adjacent to the proposed redevelopment of part of the site at 4-12 Neringah Avenue South, Wahroonga NSW 2076**.** This appraisal is based on Vipac's experience as a wind-engineering consultancy.

Drawings of the proposed redevelopment were provided by Bickerton Masters in November 2022.

The findings of this study can be summarized as follows:

With proposed design:

- Wind conditions in the ground level footpaths and access ways would be expected to be within the **walking** comfort criterion.
- The building entrances would be expected to be within the **standing** comfort criterion
- **With recommendations** the seated areas would be expected to fulfil **sitting** criterion.
- The terraces and balconies would be expected to be within the recommended **walking** comfort criterion.
- Wind conditions would be expected to fulfil safety criterion.

As a general statement, educating occupants about wind conditions at open terrace/balcony areas during high-wind events and fixing loose, lightweight furniture on the terrace are highly recommended.

The assessments provided in this report have been made based on experience of similar situations in Wahroonga and around the world. As with any opinion, it is possible that an assessment of wind effects based on experience and without experimental validation may not account for all complex flow scenarios in the vicinity.

Table of Contents

1 Introduction

Vipac Engineers and Scientists has been commissioned by **HammondCare** to carry out an appraisal of the pedestrian wind effects at the ground level of the proposed redevelopment of part of the site at 4-12 Neringah Avenue South, Wahroonga NSW 2076**.**

Strong winds in pedestrian areas are frequently encountered in central business districts of cities around the world; including Sydney, Melbourne and Brisbane. Wind characteristics such as the mean speed, turbulence and ambient temperature determine the extent of disturbance to users of pedestrian areas. These disturbances can cause both comfort and safety problems and require careful consideration to mitigate successfully.

The proposed redevelopment consists of two 5-storey buildings with a roof height about 17.5 m and 21.6 m from ground level. The site is bounded by Neringah Ave South to the east, Sydney Water Reservoir to the south and the existing development to the remaining directions. A satellite image of the proposed development site and the site section A of the buildings are shown in Figure 1 and Figure 2, respectively.

This report details the opinion of Vipac as an experienced wind engineering consultancy regarding the wind effects in ground level footpath areas adjacent to the development as proposed. No wind tunnel testing has been carried out for this development at this stage. Vipac has carried out wind tunnel studies on a large number of developments of similar shape and having similar exposure to that of the proposed development. These serve as a valid reference for the prediction of wind effects. Empirical data for typical buildings in boundary layer flows has also been used to estimate the likely wind conditions on the ground level areas of the proposed development [2] & [3].

Drawings of the proposed redevelopment were supplied to Vipac by Bickerton Masters in November 2022. A list of drawings supplied is provided in Appendix C of this report.

Figure 1: Aerial view of the proposed redevelopment site (shaded dark red).

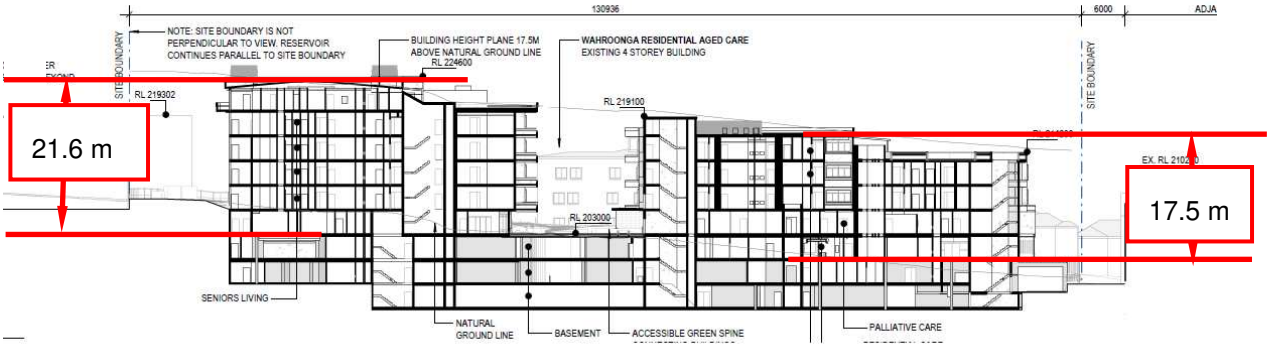


Figure 2: Site Section A of the proposed redevelopment.

2 Analysis Approach

In assessing whether a proposed development is likely to generate adverse wind conditions in ground level footpath areas, Vipac has considered the following five main points:

- The exposure of the proposed development to wind;
- The regional wind climate;
- The geometry and orientation of the proposed development;
- The interaction of flows with adjacent developments; and
- The assessment criteria determined by the intended use of the areas affected by wind flows generated or augmented by the proposed development.

The pedestrian wind comfort at specific locations of ground level footpath areas may be assessed by predicting the annual gust winds and mean wind speeds with a probability of 5% expected at that location. The location may be deemed generally acceptable for its intended use while gust and mean wind speeds are within the threshold values noted in Section 2.5. Where Vipac predicts that a location would not meet its appropriate comfort criterion, the use of wind control devices and/or local building geometry modifications to achieve the desired comfort rating may be recommended. For complex flow scenarios or where predicted flow conditions are well in excess of the recommended criteria, Vipac recommends scale model wind tunnel testing to determine the type and scope of the wind control measures required to achieve acceptable wind conditions.

2.1 Site Exposure

The proposed development is located on a relatively flat terrain. The site is surrounded within an approximately 1.2 km radius predominately by low -rise developments with some spare parklands in south. A satellite image showing these site surroundings is shown in Figure 3.

Considering the immediate surroundings and terrain, for the purposes of this study, the site of the proposed development is assumed to be within Terrain Category 3 for all wind directions (Figure 3).

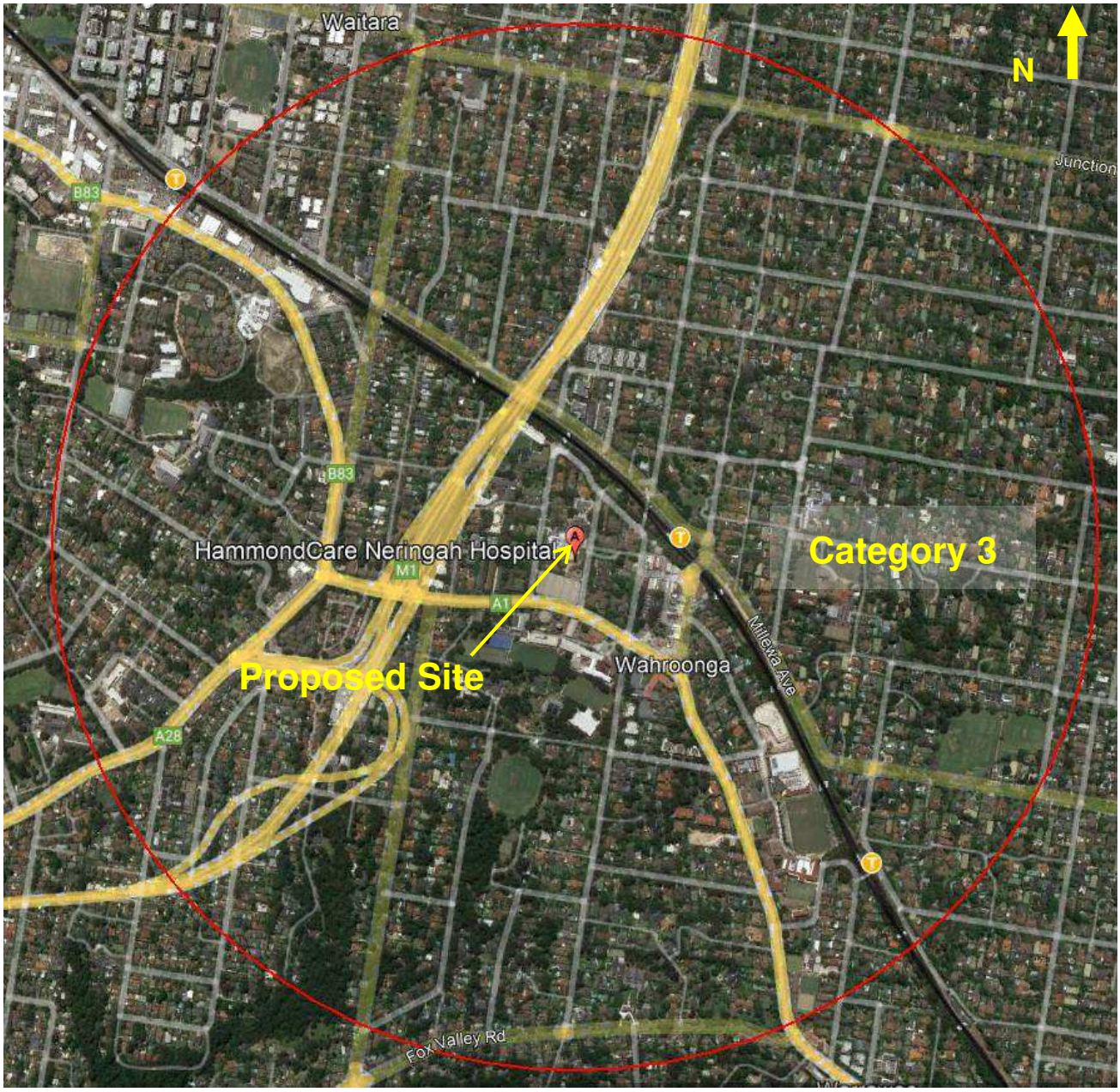


Figure 3: Assumed terrain categories for wind speed estimation.

2.2 Regional Wind Climate

The mean and gust wind speeds have been recorded in the Parramatta North wind station (WS_066124) for over 30 years. This data has been analysed and the directional probability distribution of wind speeds has been determined. The directional distribution of hourly mean wind speed at the gradient height, with a probability of once per a year and 5% of time exceeded are shown in Figure 4. The wind data at this free stream height is common to all sites close to this wind station and may be used as a reference to assess pedestrian level wind conditions at the site of Wahroonga.

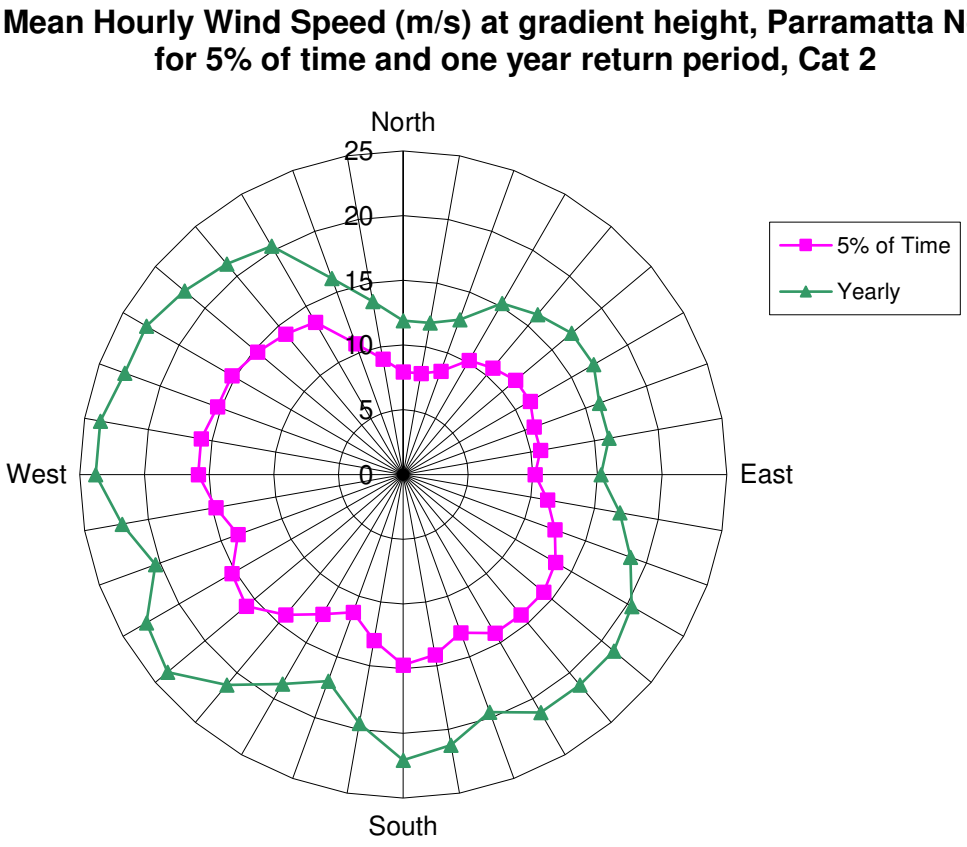


Figure 4: Directional Distribution of Mean Hourly Wind Velocities (m/s) for yearly and 20% of time exceeded at Gradient Height for Parramatta North.

2.3 Building Geometry and Orientation

The proposed redevelopment consists of two buildings (South Building-6 storey and North building-5 storey) with Wahroonga residential aged care (Stage 1) in the west. The overall plan-form dimensions are approximately 35m x 55 m for north building and 36m x 43m for south building as shown in Figure 5. The main entrances are located on Neringah Ave South and the areas between N and S buildings. The development incorporates setbacks from all surrounding street boundaries.

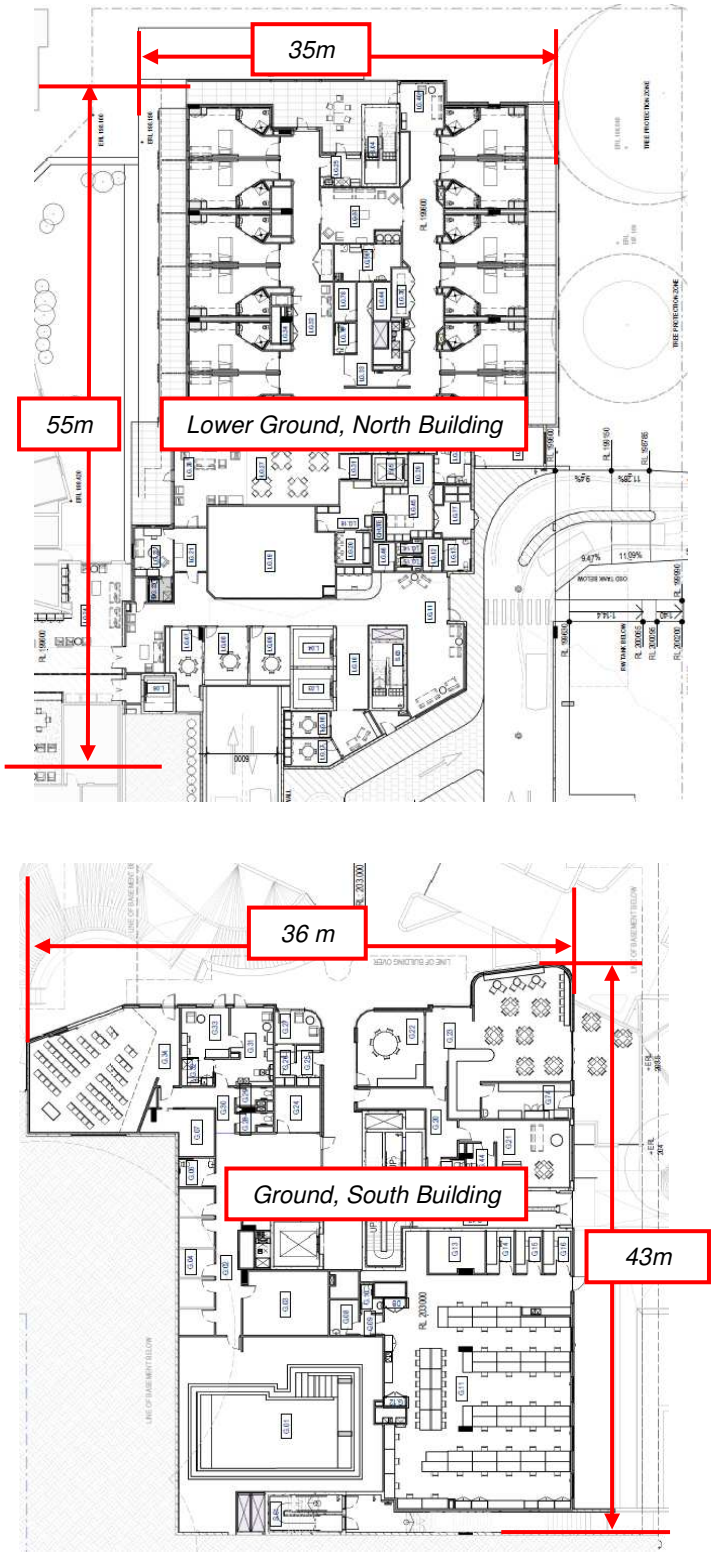


Figure 5: Lower Ground (top) and Ground floor (Bottom) plans with the plan-form dimensions overlaid.

2.4 Flow interactions with Adjacent Developments

The immediately adjacent developments are shown in Figure 6. At ground level, the site is exposed to direct winds from the southerly directions along Neringah Ave South. The building is oriented such that adverse impacts from westerly winds channelling between the two buildings is expected at ground level. The development is taller than the surrounding buildings and so is exposed to winds from most of directions at the upper levels.

Figure 6: Immediately adjacent surroundings and their approximate number of floors (F).

2.5 Assessment Criteria

The wind comfort criteria from the Central Sydney Planning Strategy (Attachment B7: 4 Implementation) has been applied to this study. The document recommends the following wind safety and comfort criteria (Table 1):

Table 1: Wind Criteria summarized from Central Sydney Planning Strategy

Measurements	**Result on Perceived Pedestrian Comfort**
Peak wind speed (0.5 second gust) once per year, **≤24m/sec** for any direction*.	Accepted international criterion for human safety to avoid a healthy pedestrian losing balance
Hourly ***mean*** wind speed, 5% of the time, **≤8m/sec**, for any directions.	Acceptable for **walking** (steady steps for most pedestrians)
Hourly ***mean*** wind speed, 5% of the time, **≤6m/sec,** for any directions.	Acceptable for **standing** (wind shopping, vehicle drop off)
Hourly ***mean*** wind speed, 5% of the time. **≤4m/sec,** for any directions.	Acceptable for **sitting** (outdoor cafes, gardens, park benches)

**Note: Hourly Mean wind speed is the maximum of mathematical mean or Gust equivalent mean (Gust divided by 1.85).*

The wind speed assessment is undertaken for winds occurring between 6am and 10pm (AEST).

2.5.1 Use of Adjacent Pedestrian Occupied Areas & Recommended Comfort Criteria

The following table lists the specific areas adjacent to the proposed development and the corresponding recommended criteria.

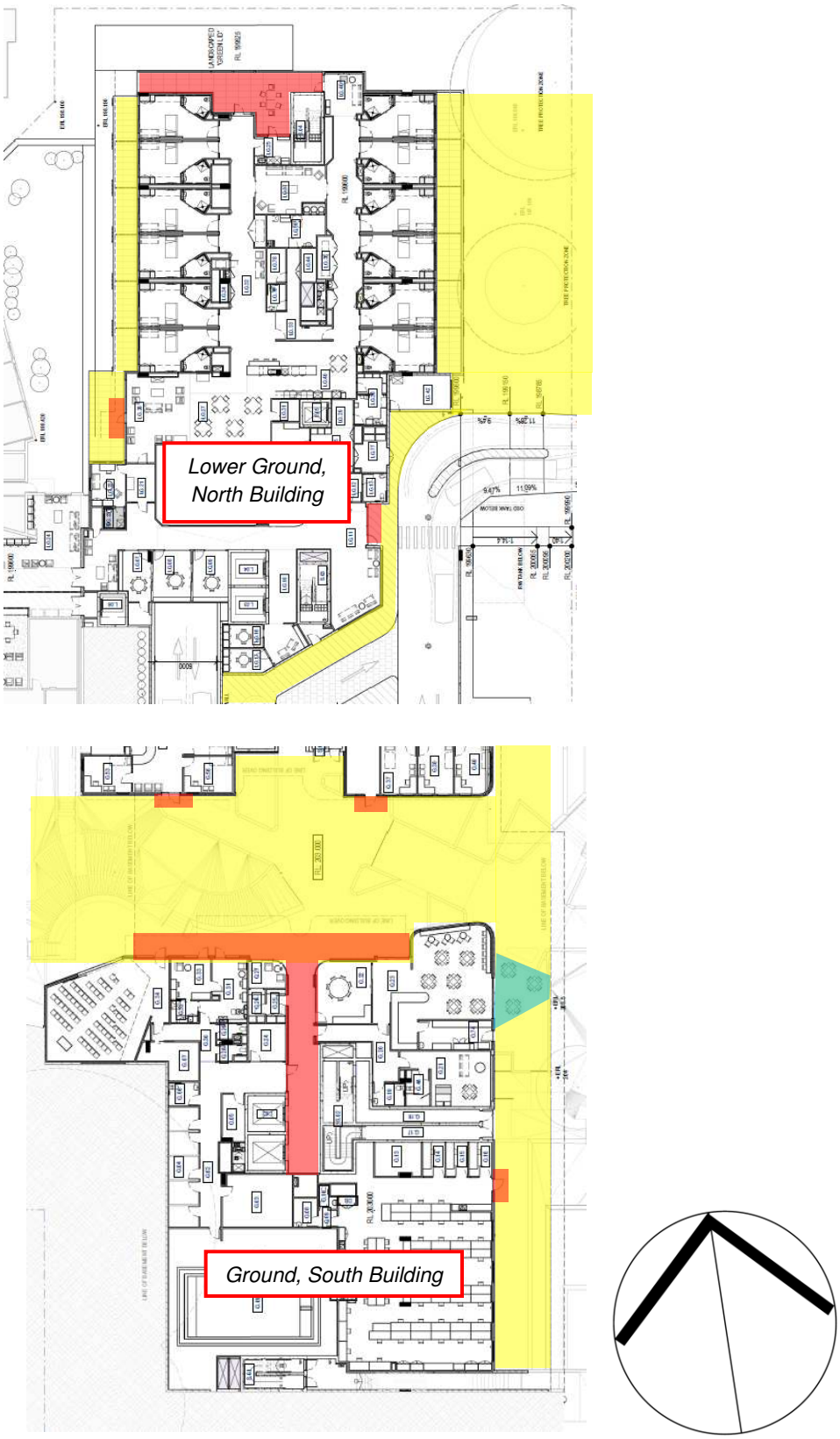
Table 2: Recommended application of criteria

Area	Specific location	Recommended Criteria
Public Footpaths, Access ways and courtyard	Surround the two buildings and the open area between S and N buildings (Figure 7)	Walking
Building Entrances	Throughout site (Figure 7)	Standing
Outdoor open areas	North of the North Building (Figure 7)	Standing
Outdoor seated areas	At north east frontage of the south building (Figure 7)	Sitting
Balcony/Terraces	Up the height of the buildings	Walking (See discussion below)

2.5.2 Terrace / Balcony Recommended Criterion Discussion

There are proposed Balconies and Terraces located up the height of the development. Vipac recommends as a minimum that balcony/terrace areas meet the criterion for walking since:

- these areas are not public spaces;
- the use of these areas is optional, and only intended to be used on fair weather days with calm winds;
- many similar developments in Wahroonga and other Australian capital cities experience wind conditions on balconies and elevated deck areas in the vicinity of the criterion for walking.



Recommended to fulfil Walking Recommended to fulfil Standing Recommended to fulfil Sitting

Figure 7: Lower Ground (top) and Ground floor (Bottom) with recommended wind criteria overlaid.

3 Pedestrian Level Wind Effects

3.1 Discussion & Recommendations

Due to the height of the proposed redevelopment, wind conditions are expected to increase. However, change in wind conditions is not expected to be significant, in consideration of the surrounding existing developments, especially the 4-storey and 5-storey buildings to the west and north respectively. As such, the walking areas of the proposed development would be expected to have wind conditions satisfying the recommended walking comfort criterion.

As the heights are above the surrounding areas in some directions, the proposed redevelopment is particularly exposed to easterly and south western winds. Such that high wind levels are expected through the open spaces between S and N buildings. However the shielding provided by the existing west stage 1 building is expected to be beneficial to the wind environment. Many of the entrances are also set back from the articulated façade, such that all entrances are expected to be within the recommended standing comfort criterion.

The communal area north of the North building is shielded by the 5-storey existing development to the north and the building overhead, such that wind conditions are expected to be within the recommended standing comfort criterion, or better.

The outdoor seated areas in northeast frontage of South building might be expected to have wind level over Sitting criterion. We recommend 1.5 m high windscreens / landscaping to create a calmer wind environment for these areas (Figure 8).

The Green Roof on the roof top of the North building is expected to receive shielding from the 1m high solid balustrades such that wind conditions are expected to be within the recommended walking comfort criterion.

In general, the balconies and terraces are expected to have wind speeds within the walking comfort criterion.

The wind conditions of the proposed redevelopment would be expected to fulfil safety criterion.

It should be noted that this study is based on experience only and has not utilised any experimental data for the analysis.

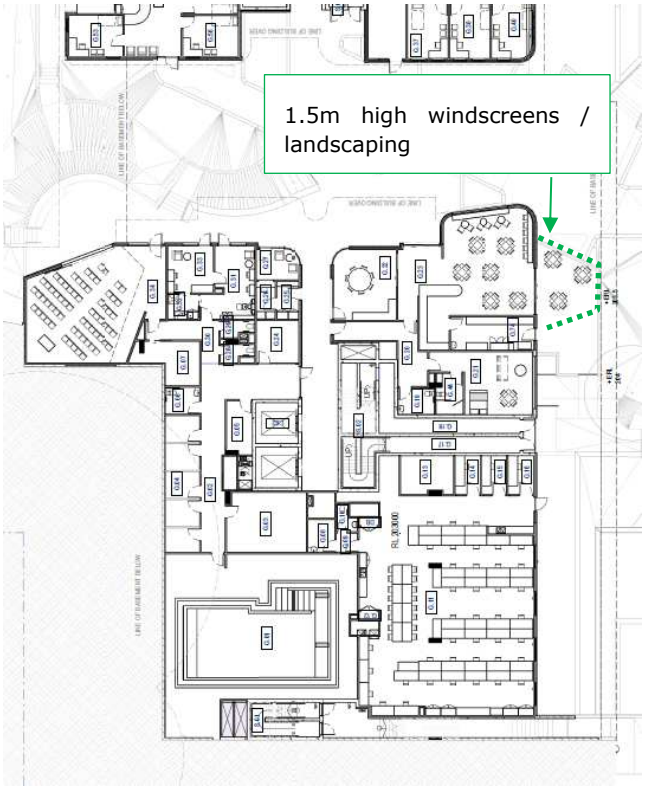


Figure 8: Ground floor plan with the recommended wind control measures overlaid.

4 Conclusions

An appraisal of the likely wind conditions at the pedestrian ground level and balconies of the proposed redevelopment of part of the site at 4-12 Neringah Avenue South, Wahroonga has been made.

Vipac has carefully considered the form and exposure of the proposed development, nominated criteria for various public areas according to their function and referred to past experience to produce our opinion of likely wind conditions.

The findings of this study can be summarised as follows:

With proposed design:

- Wind conditions in the ground level footpaths and access ways would be expected to be within the **walking** comfort criterion.
- The building entrances would be expected to be within the **standing** comfort criterion
- **With recommendations** the seated areas would be expected to fulfil **sitting** criterion.
- The terraces and balconies would be expected to be within the recommended **walking** comfort criterion.
- Wind conditions of the proposed redevelopment would be expected to fulfil safety criterion.

As a general statement, educating occupants about wind conditions at open terrace/balcony areas during high-wind events and fixing loose, lightweight furniture on the terrace are highly recommended.

The assessments provided in this report have been made based on experience of similar situations in Wahroonga and around the world. As with any opinion, it is possible that an assessment of wind effects based on experience and without experimental validation may not account for all complex flow scenarios in the vicinity.

This Report has been Prepared

For

HammondCare

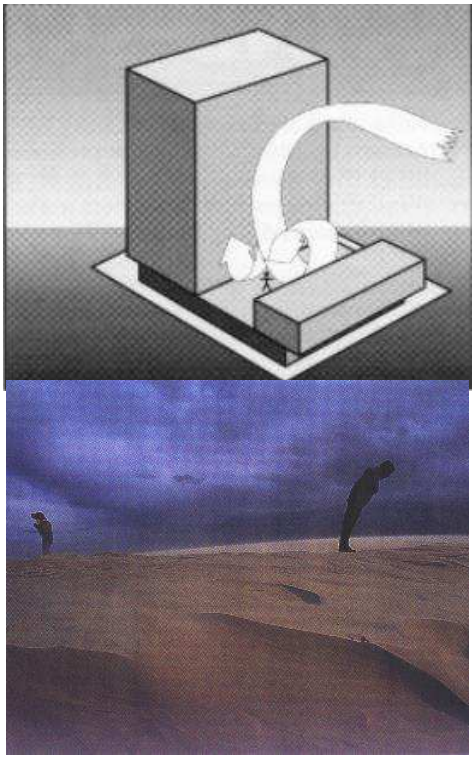
By

VIPAC ENGINEERS & SCIENTISTS PTY LTD.

Appendix A Environmental Wind Effects

Atmospheric Boundary Layer

As wind flows over the earth it encounters various roughness elements and terrain such as water, forests, houses and buildings. To varying degrees, these elements reduce the mean wind speed at low elevations and increase air turbulence. The wind above these obstructions travels with unattenuated velocity, driven by atmospheric pressure gradients. The resultant increase in wind speed with height above ground is known as a wind velocity profile. When this wind profile encounters a tall building, some of the fast-moving wind at upper elevations is diverted down to ground level resulting in local adverse wind effects.



The terminology used to describe the wind flow patterns around the proposed development is based on the aerodynamic mechanism, direction and nature of the wind flow.

Downwash – refers to a flow of air down the exposed face of a tower. A tall tower can deflect a fast-moving wind at higher elevations downwards.

Corner Accelerations – when wind flows around the corner of a building it tends to accelerate in a similar manner to airflow over the top of an aeroplane wing.

Flow separation – when wind flowing along a surface suddenly detaches from that surface and the resultant energy dissipation produces increased turbulence in the flow. Flow separation at a building corner or at a solid screen can result in gusty conditions.

Flow channelling – the well-known "street canyon" effect occurs when a large volume of air is funnelled through a constricted pathway. To maintain flow continuity the wind must speed up as it passes through the constriction. Examples of this might occur between two towers, in a narrowing street or under a bridge.

Direct Exposure – a location with little upstream shielding for a wind direction of interest. The location will be exposed to the unabated mean wind and gust velocity. Piers and open water frontage may have such exposure.

Appendix B References

[1] *Structural Design Actions, Part 2: Wind Actions*, Australian/New Zealand Standard 1170.2:2011

[2] *Wind Effects on Structures* E. Simiu, R Scanlan, Publisher: Wiley-Interscience

[3] *Architectural Aerodynamics* R. Aynsley, W. Melbourne, B. Vickery, Publisher: Applied Science Publishers

Appendix C Drawings List

Drawings Received: November 2022

DG-00-00 - COVER PAGE_revP11.pdf

DG-00-01 - CONTEXT PLAN_revP11.pdf

DG-01-00 - EXISTING SITE PLAN_revP10.pdf

DG-01-01 - EXISTING SITE PLAN & SITE ANALYSIS_revP10.pdf

DG-02-01 - PROPOSED SITE PLAN_revP15.pdf

DG-03-01 - FLOOR PLAN - BASEMENT 2_revP8.pdf

DG-03-02 - FLOOR PLAN - BASEMENT 1_revP11.pdf

DG-03-03 - FLOOR PLAN - LOWER GROUND_revP10.pdf

DG-03-04 - FLOOR PLAN - GROUND_revP10.pdf

DG-03-05 - FLOOR PLAN - LEVEL 1_revP10.pdf

DG-03-05 - FLOOR PLAN - LEVEL 2_revP10.pdf

DG-03-07 - FLOOR PLAN - LEVEL 3_revP10.pdf

DG-03-08 - FLOOR PLAN - LEVEL 4_revP10.pdf

DG-03-09 - FLOOR PLAN - LEVEL 5_revP10.pdf

DG-03-10 - ROOF PLAN_revP4.pdf

DG-04-01 - EXISTING & DEMOLITION SITE PLAN_revP12.pdf

DG-20-00 - SITE ELEVATIONS_revP12.pdf

DG-20-01 - MATERIALS & FINISHES PALETTE_revP2.pdf

DG-30-00 - SITE SECTIONS_revP13.pdf

DG-82-01 - SEPP COMPLIANCE - CROSS VENTILATION STUDY_revP1.pdf

DG-83-01 - SEPP COMPLIANCE - SOLAR ACCESS_revP1.pdf