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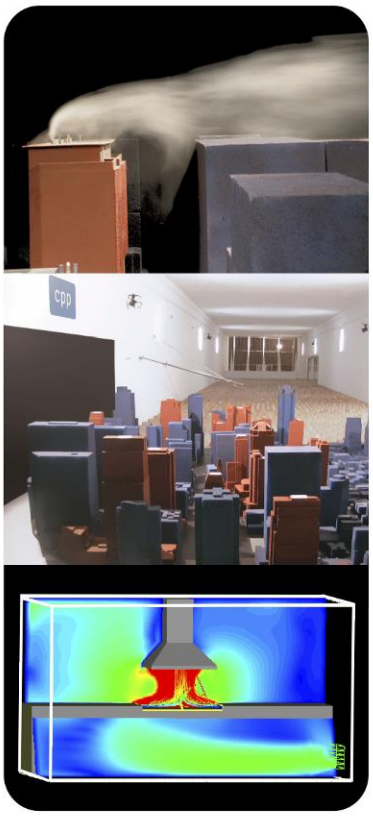
WIND ENGINEERING AND AIR QUALITY CONSULTANTS

FINAL REPORT



Qualitative Wind Assessment for:

12 FREDERICK STREET

TOWER B

St. Leonards, Australia

Prepared for:

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Sydney

NSW 2000

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CPP Project: 11523

DOCUMENT VERIFICATION

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09/06/17	Draft report	AN	AN	AN
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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

INTRODUCTION

Cermak Peterka Petersen Pty. Ltd. has been engaged by Donald Cant Watts Corke to provide a qualitative assessment of the pedestrian level wind conditions in and around Tower B of the 12 Frederick Street development, St Leonards.

The project involves construction of a new tower, known as 'Tower B', situated on the northern and eastern sides of the 2-storey podium of the proposed Tower A (SSD 7543) on the site, Figure 2. The new tower will:

- be 6 storeys in height with a maximum RL (inclusive of the lift overrun) of RL 138.50
- have a GFA of approximately 7,000 m^2 (equivalent FSR of 1.1:1)
- comprise uses associated with the proposed health hub and ancillary to the Royal North Short Hospital and North Short Private Hospital, including medical specialist suites and associated allied health uses such as osteopathy, physiotherapy and speech pathology. Gross floor area (GFA) of 7,655 m^2

It is noted that the proposal refines the concept proposal for Tower B (SSD 8499) by:

- a reduction in maximum building height from RL 144.150 to RL 138.350
- a reduction in GFA of 7,665 m^2 to 7,000 m^2
- refinement of the range of uses for the building to include specialist medical suites and allied health uses

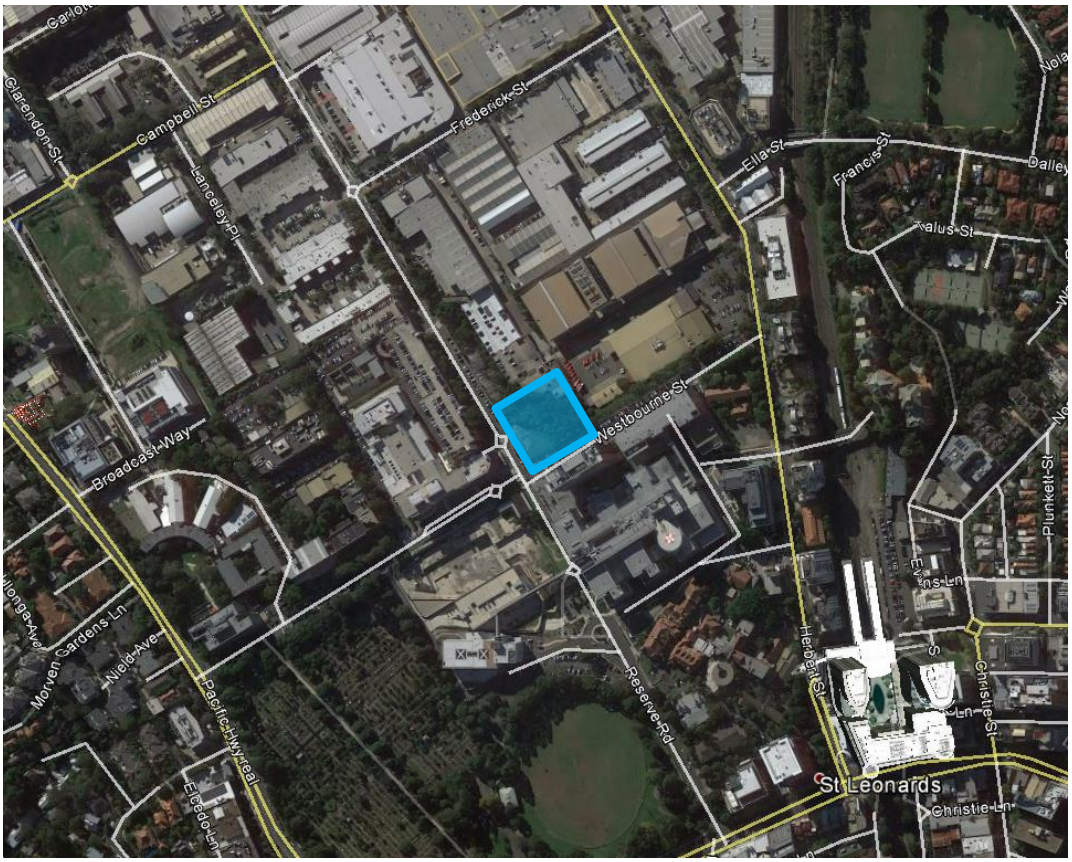

Figure 1: Location of proposed development site (Google Earth, 2016)

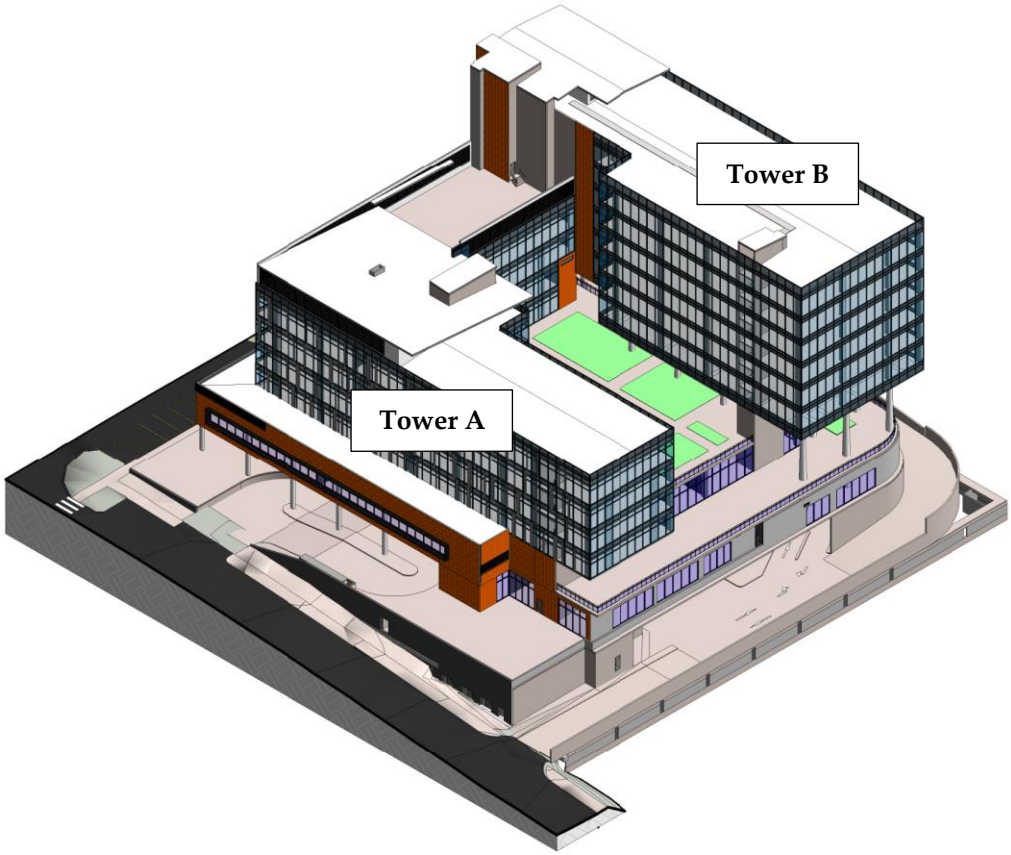

Figure 2: 3D perspective viewed from the west

SYDNEY WIND CLIMATE

The proposed development lies approximately 14 km to the north of Sydney Airport Bureau of Meteorology anemometer. The wind rose for the airport, shown in Figure 3, is considered to be representative of prevailing winds at the site.

It is evident that the prevailing winds from coastal Sydney come from the north-east, south, and west. Winds from the north-east tend to be summer sea breezes and bring welcome relief on summer days. Winds from the south tend to be cold and are generally associated with frontal systems that can last several days and occur throughout the year. Winds from the west are the strongest of the year and are associated with large weather patterns and thunderstorm activity. These winds occur throughout the year and can be cold or warm depending on the inland conditions.

This wind assessment is focused on these prevailing wind directions.

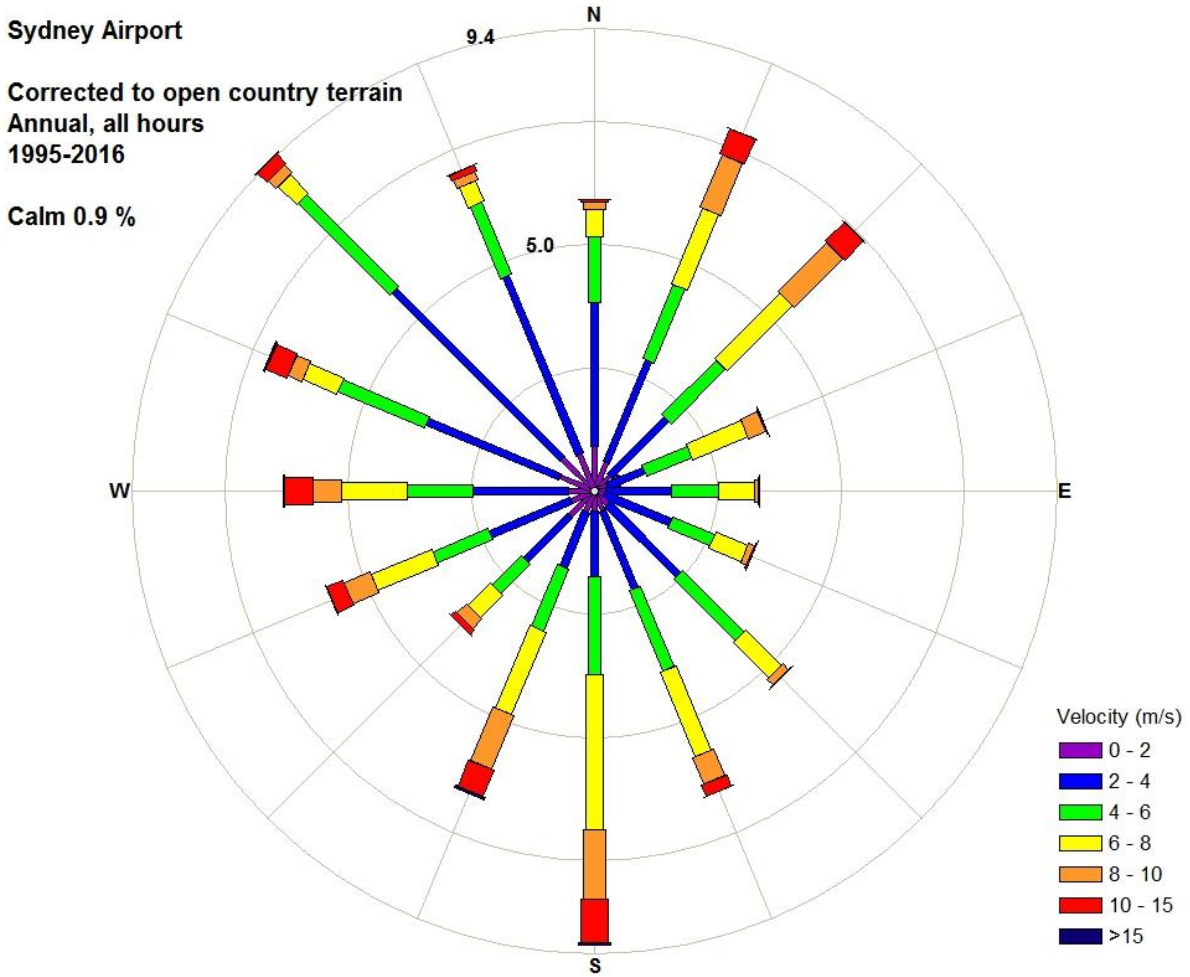

Figure 3: Wind rose of direction and speed for Sydney Airport

ENVIRONMENTAL WIND SPEED CRITERIA

It is generally accepted that wind speed and the rate of change of wind velocity are the primary parameters that should be used in the assessment of how wind affects pedestrians. Over the years, a number of researchers have added to the knowledge of wind effects on pedestrians by suggesting criteria for comfort and safety. Because pedestrians will tolerate higher wind speeds for a smaller period of time than for lower wind speeds, these criteria provide a means of evaluating the overall acceptability of a pedestrian location. A location can further be evaluated for its intended use, such as for an outdoor café or footpath.

City of Willoughby Council do not specify a wind assessment criterion for the region enveloping the proposed development site. The wind assessment criteria used in this study are based upon research of Lawson (1990), which are described in Table 1 for both pedestrian and distress. The benefits of these criteria over many in the field are that they use both a mean and gust equivalent mean (GEM) wind speeds to assess the suitability of specific locations. The criteria based on the mean wind speeds define when the steady component of the wind causes discomfort, whereas the GEM wind speeds define when the wind gusts cause discomfort. The level and severity of these comfort categories can vary based on individual preference, so calibration to the local wind environment for all wind directions is recommend when evaluating with Lawson ratings.

Once expected wind conditions are qualitatively determined throughout the site, it is necessary to assess the conditions against the criteria for comfort and safety (distress) in Table 1.

Comfort (maximum of mean or gust equivalent mean ($GEM^{+\cdot}$) wind speed exceeded 5% of the time)	
< 4 m/s	Pedestrian Sitting (considered to be of long duration)
4 - 6 m/s	Pedestrian Standing (or sitting for a short time or exposure)
6 - 8 m/s	Pedestrian Walking
8 - 10 m/s	Business Walking (objective walking from A to B or for cycling)
> 10 m/s	Uncomfortable
Distress (maximum of mean or GEM wind speed exceeded 0.022% of the time)	
<15 m/s	not to be exceeded more than two times per year (or one time per season) for general access
<20 m/s	not to be exceeded more than two times per year (or one time per season) where only able bodied people would be expected; frail or cyclists would not be expected

The wind speed is either a mean wind speed or a gust equivalent mean (GEM) wind speed. The GEM wind speed is equal to the 3 s gust wind speed divided by 1.85.

Table 1: Pedestrian comfort criteria for various activities

WIND FLOW MECHANISMS

When the wind hits a large isolated building, the wind is accelerated down and around the windward corners, Figure 4; this flow mechanism is called downwash and causes the windiest conditions at ground level on the windward and sides of the building. In Figure 4 smoke is being released into the wind flow to allow the wind speed, turbulence, and direction to be visualised. The image on the left shows smoke being released across the windward face, and the image on the right shows smoke being released into the flow at about third height in the centre of the face.

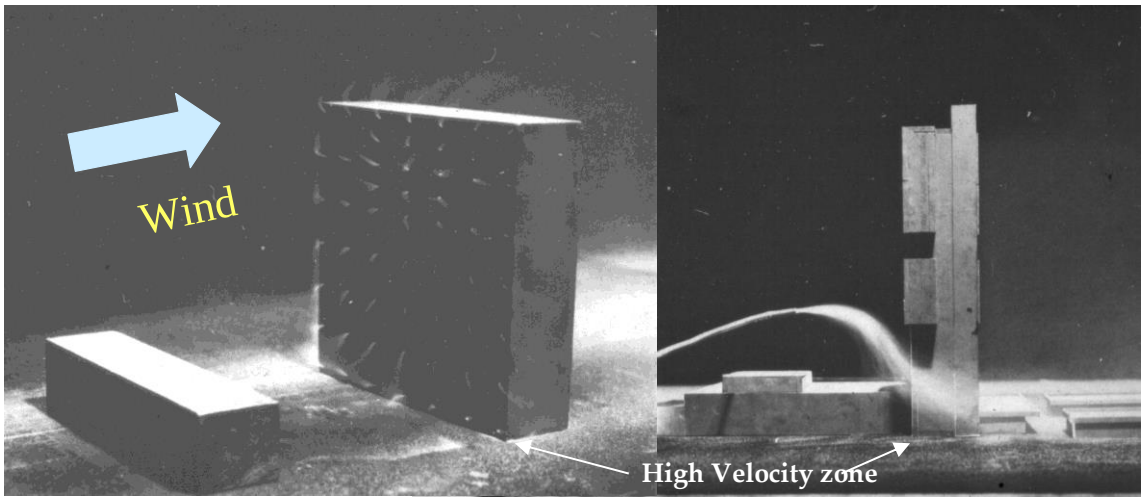

Figure 4: Flow visualisation around a tall building

Techniques to mitigate the effects of downwash winds on pedestrians include the provision of horizontal elements, the most effective being a podium to divert the flow away from pavements and building entrances. Awnings along street frontages perform a similar function and the deeper the horizontal element generally the more effective it will be in diverting the flow.

Channelling occurs when the wind is accelerated between two buildings or along straight streets with buildings on either side.

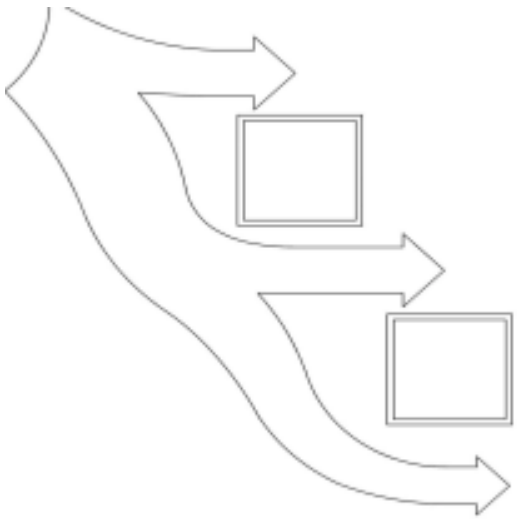

Figure 5: Wind channelling between buildings

ENVIRONMENTAL WIND ASSESSMENT

The proposed development will be positioned near the south end of the block bounded by Reserve Road, Frederick, Herbert, and Westbourne Streets. Winds in this type of urban-scape tend to be channelled along the streets with local effects being dictated by local topography and exposed large buildings nearby. The development site is located at the base of a 21 m high cliff to the south and west of the development site, with a maximum height on the corner of Reserve Road and Westbourne Street, Figure 6. The topography gradually descends from the maximum height down Reserve Road to the north-west, and Westbourne Street to the north-east.

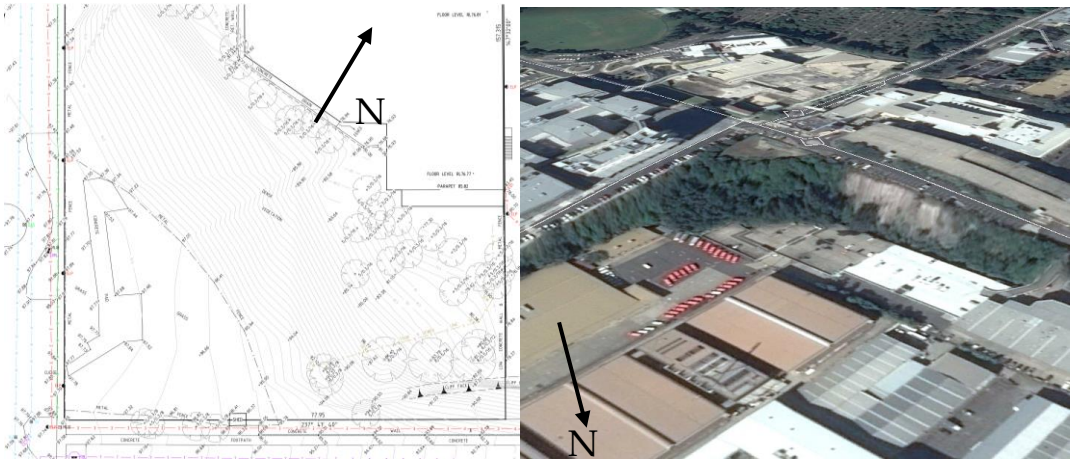

Figure 6: Topography contours of cliff face (left), and view from north (right)

At ground level, the main building entrance on Westbourne Street will be setback from the site boundary. The maximum height of the proposed development is about RL 134 m, and the corner of Reserve Road and Westbourne Street is approximately RL 98 m, Figure 8.

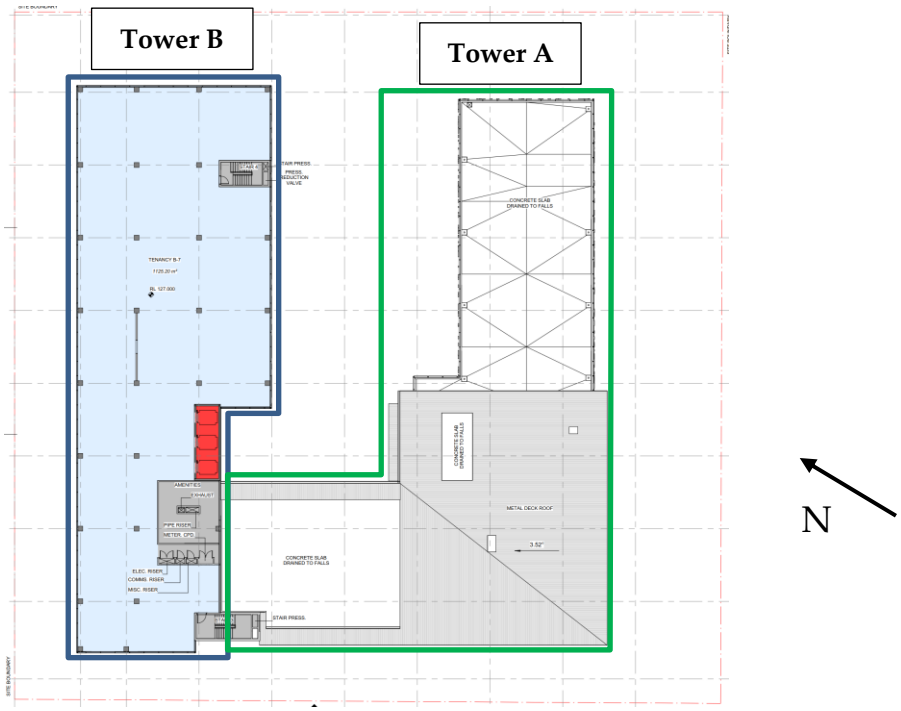

Figure 7: Level 7B floor plan showing tower envelopes

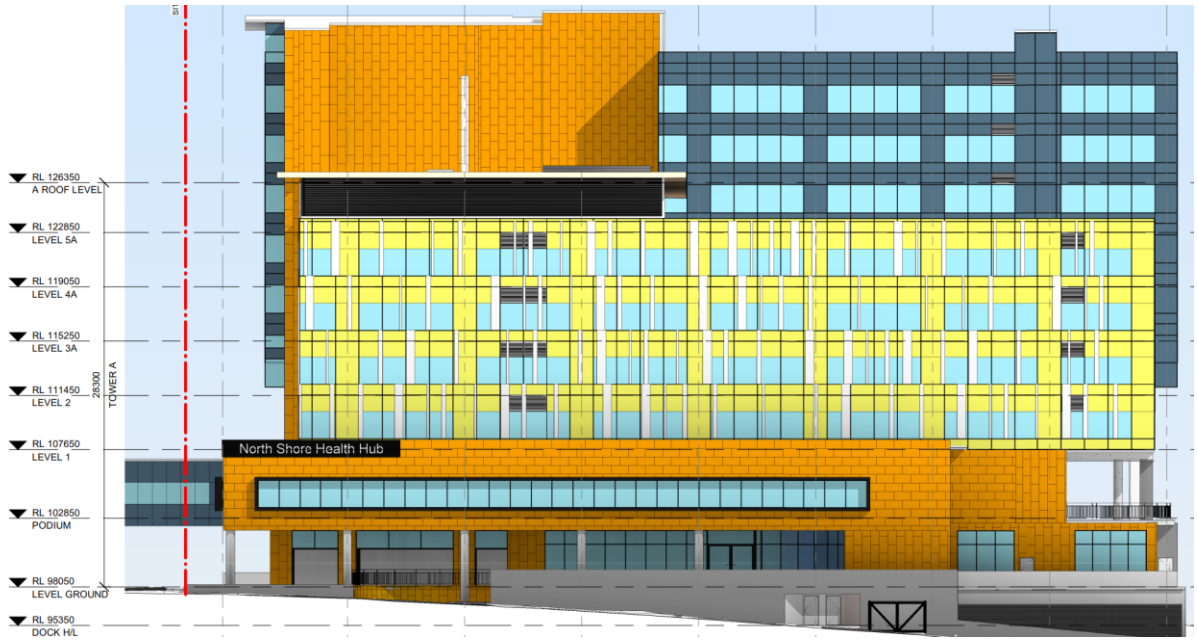

Figure 8: South elevation of proposed development

Winds from the North-east

At an elevation of about RL 134 m, the proposed Tower B will be exposed to winds from the north-east as it will stand taller than most buildings to the north-east quadrant. Approach winds will impact the narrow side of the tower allowing majority of the wind to flow horizontally around it. A small amount of downwash from the north-east façade of the tower will generate wind flow onto the podium level, and reducing the quantity of downwash reaching ground level. This will generate relatively windy conditions on the podium rooftop, particularly under Tower B. Local mitigation such as plantar boxes and vertical screening would be recommended for publicly accessible areas to help create pockets of calm conditions.

Tower B is not expected to significantly increase the existing wind conditions at ground level along Reserve and Westbourne Roads during wind events from the north-east; the street frontages are expected to remain suitable as public accessways.

Winds from the South

Currently, demolition of the old hospital building at 1 Westbourne Street behind the Chapel to the south of the development site has created a space to allow a larger volume of wind from the south south-west to reach the development site. The proposed Tower A and podium massing would largely shield Tower B from winds from the south, and encourage a large amount of wind to flow over and around Tower B. Some winds will downwash from the exposed upper levels of Tower B onto the podium, before channelling underneath Tower B and dispersing over the neighbouring site. Local mitigation such as plantar boxes and vertical screening would be recommended for publicly accessible areas to help create pockets of calm conditions.

It is expected Tower B will not have a significant impact on the existing wind conditions at ground level along Reserve Road and Westbourne Street at pedestrian level.

There will be construction of a large building dedicated to research and education at 1 Westbourne Street, and will help provide future shielding for the development site's street frontages from winds from the south. With the future 1 Westbourne Street building in place, winds channelling along Westbourne Street and Reserve Road may become more noticeable. The addition of the proposed Tower B will have minimal effects on the wind conditions at pedestrian level as it will be nested in the existing flow field during winds from the south.

Winds from the West

The development site is largely shielded by the North Shore Private Hospital and carpark from winds coming from the west quadrant creating a calm area where Tower B will reside. Thus, the addition of the proposed building is expected to have minimal effect on the wind conditions at ground level.

Summary

For all wind directions, it is predicted pedestrian level wind conditions along Reserve Road and Westbourne Street after the addition of the proposed development will remain similar to existing conditions, rated in the pedestrian standing to walking range with reference to the Lawson criterion while passing the distress criterion.

The podium rooftop is expected to be windy, and local mitigation such as plantar boxes with dense plants and vertical screening would be recommended.

CONCLUSIONS

Cermak Peterka Petersen Pty. Ltd. has provided an opinion based assessment of the pedestrian level wind environment in and around the 12 Frederick Street site, St Leonards.

Existing wind conditions at pedestrian level along the street frontages of the development site are relatively windy due to channelling wind flow generated by existing surrounding buildings. The addition of the proposed Tower B is expected to have marginal effects on the existing conditions.

The wind conditions for the street frontages of the site are expected to range between pedestrian standing and walking Lawson criteria, similar to existing conditions, while passing the distress criterion.

Verification of the predicted wind environment surrounding the site will require wind tunnel testing.

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