global environmental solutions

Dee Why Town Centre

Quantitative Wind Assessment

Report Number 610.14419-R04

1 March 2024

Meriton Group

Level 11, Meriton Tower

528 Kent Street

SYDNEY NSW 2000

Version: v1.0

Dee Why Town Centre

Quantitative Wind Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
2 Lincoln Street
Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
+61 2 9427 8100 +61 2 9427 8200
sydney@slrconsulting.com www.slrconsulting.com

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.14419-R04-V1.0	1 March 2024	Dr Neihad Al-Khalidy	Dr Peter Georgiou	Dr Neihad Al-Khalidy

Executive Summary

SLR Consulting Australia (SLR) has been engaged by Meriton Group to prepare a quantitative wind impact assessment for the podium level of the proposed mixed-use development at 884-896 Pittwater Road, 14-28 Oaks Avenue & 9-17 Howard Avenue, Dee Why.

SLR has previously conducted a qualitative and a quantitative assessment of the site, proposing wind mitigation devices for upper balconies and additional landscaping for certain ground level areas around the site. The effectiveness of the existing and proposed landscaping elements has not been assessed in the previous studies.

Particular interest will be placed on the podium level, specifically in the retail area on the west and east sides.

Wind speeds for the podium level have been quantified using Computational Fluid Dynamics (CFD). The current study also incorporated the existing landscaping elements.

Sydney Winds

The Sydney wind climate is characterised by dominant (prevailing) north-easterly, westerly and southerly winds. While northeast winds are the more common prevailing wind direction (occurring typically as offshore land-sea breezes), southeast and south winds generally provide the strongest gusts during summer.

West quadrant winds (southwest to northwest and common throughout winter) provide the strongest winds for the whole year.

Existing Wind Environment

Existing street level wind conditions in the vicinity of the site are likely to be close to the16 m/s *"walking comfort"* criterion for some prevailing wind directions given the orientation of the site and the upstream shielding afforded to the site by surrounding buildings and vegetation.

Wind Impact of the Project Site – Current Condition

In relation to the wind impact of the proposed development with the currently proposed design features and existing landscaping elements (the "Base Case" condition), some locations surrounding the site have the potential to experience elevated wind speeds, in excess of the standard once per year walking comfort criteria and, in one isolated case, potentially exceeding the safety criteria for walking (Refer **Figure 10**).

Westley wind

- Strong westerly winds cause local acceleration effects at the corners of the building. Refer **Figure 9**

- The existing landscaping elements provide an acceptable wind environment for sitting/dining at all areas except Region A in **Figure 8B**. The wind speeds in the scoured area are above the comfort criteria for dining.

Northeasterly wind

- Northerly winds create a "venturi" effect within the outdoor area/pathway between podiums.
- The current landscaping elements provide localised wind speeds reduction at various locations.

Executive Summary

- The dining criterion is exceeded at a number of locations (Refer Region A and Region B, **Figure 9B**).

Southerly Winds

- Prevailing winds align with building geometry conditions conducive to accelerated windflow, eg south winds can approach the site accelerating in between the upstream hills and winds then funnel between the residential towers and downwash through the constricted (narrow) section and impact the outdoor area/pathway and the central part of the podium. Refer **Figure 10 and Figure 11**
- Most retail areas experience increased wind speeds above the comfort criteria for dining (Refer scoured area in **Figure 10B**.

Southwesterly wind

- Adverse winds are mitigated by the existing landscape elements. Refer **Figure 12B**.

Recommended Wind Mitigations

On the basis of the CFD simulation predictions and potential non-compliance locations, the following wind mitigation treatments are recommended:

- Additional landscaping elements. Refer **Figure 14**
- Wind breaks for west side retail. Refer **Figure 15**
- Work with the local tenancies to deploy local windbreak solutions (eg Pull up / Pull down screens). Examples are shown in **Figure 16**

Table of Contents

TABLES

Table of Contents

FIGURES

APPENDICES

1 INTRODUCTION

SLR Consulting Australia (SLR) has been engaged by Meriton Group to prepare a quantitative wind impact assessment for the podium level of the proposed mixed-use development at 884-896 Pittwater Road, 14-28 Oaks Avenue & 9-17 Howard Avenue, Dee Why.

SLR has previously conducted a qualitative and a quantitative assessment of the site, proposing wind mitigation devices for upper balconies and additional landscaping for certain ground level areas around the site. The effectiveness of the existing and proposed landscaping elements has not been assessed in the previous studies.

Particular interest will be placed on the podium level, specifically in the retail areas on the west and east sides.

1.1 Development Site

The proposed development site was previously occupied by retail shops and an open space car park. It is bounded by Pittwater Road, Oaks Avenue and Howard Avenue.

The surrounding built environment includes:

- street front shops and a residential building to the west
- low level retail buildings to the north and south and
- residential apartment buildings to the east.

The development site location is shown in **Figure 1**.

Figure 1 Site Location

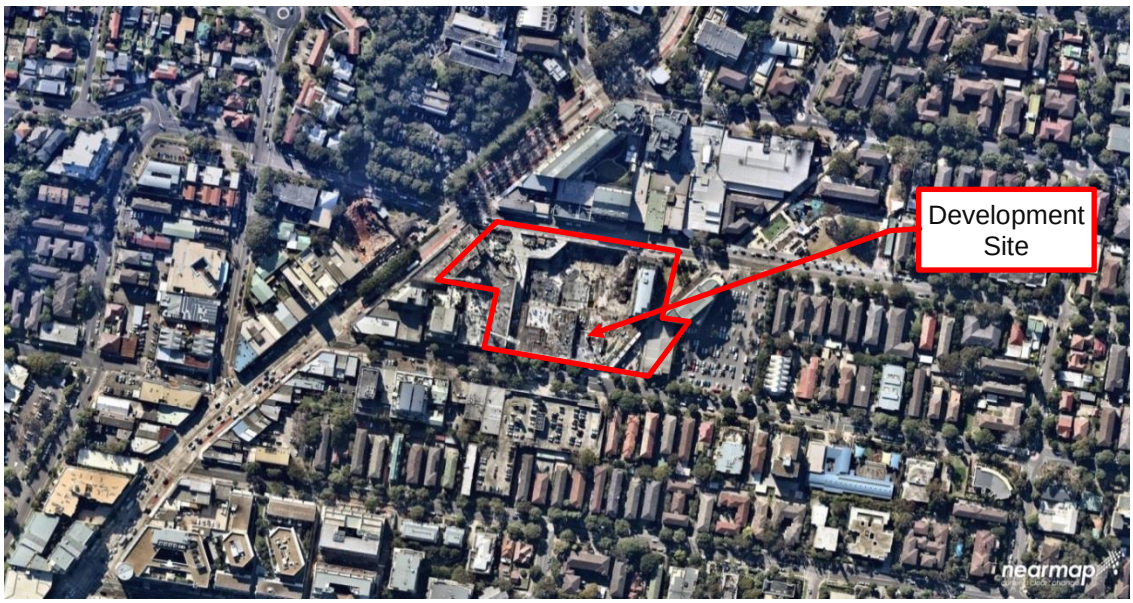


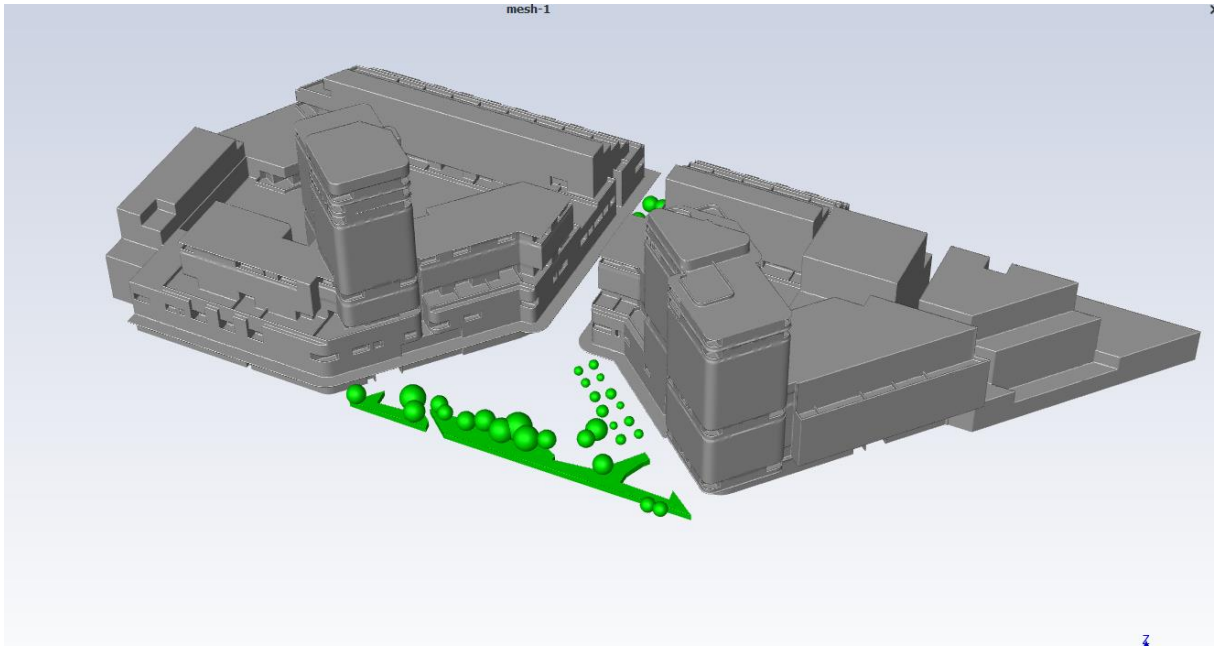
Image: Nearmap July 2017

1.2 Development Description

The proposed development comprises:

- Three levels of basement carpark;
- Retail tenancies with a major supermarket on ground floor;
- Commercial offices, retail shops, gym and childcare centre on level 1;
- Four residential towers; A, B, C and D;
- Two residential indoor swimming pools with gym on level 2 next to court yard; and
- Residential apartments from level 2 to17.

Figure 2 3D Model of the Proposed Development (View from Northwest)



2 AREAS OF INTEREST

Based on the recommendations put forward in SLR's previous wind studies

- SLR Report 610-14419-R03, *"Dee Why Town Centre – Quantitative Wind Assessment"*, August 2017.
    - The report provided wind mitigation treatments for the upper-level balconies including the incorporation of winter gardens or sliding screens around all corner balconies of residential apartments located above Level 10.
    - The report identified high ground level wind speeds and recommended additional landscaping for certain ground level area to meet comfort level for walking. The landscaping has not been modelled in the above study.
- SLR Letter 610.14419-L01-v0.1 dated 30th September 2019
    - The observations made during the 23 August 2019 site visit aligned with the SLR's August 2017 CFD study.
    - The letter recommended wind mitigation treatment for one of the retails.

Particular interest will be placed on the podium level, specifically in the retail area on the west and east sides.

Previous mitigation recommendations put forward from qualitative and quantitative analysis included the following:

- Retention of planned and existing landscaping around the site, with additional landscaping proposed for the Pittwater Road perimeter of the building and around the retail entrances and pathway through the centre of the development (Refer **Figure 3**); and
- Deploy local windbreak solutions for a selected west side retail. Refer **Figure 4**

Figure 3 SLR August 2017 Wind Recommendations – Podium Level

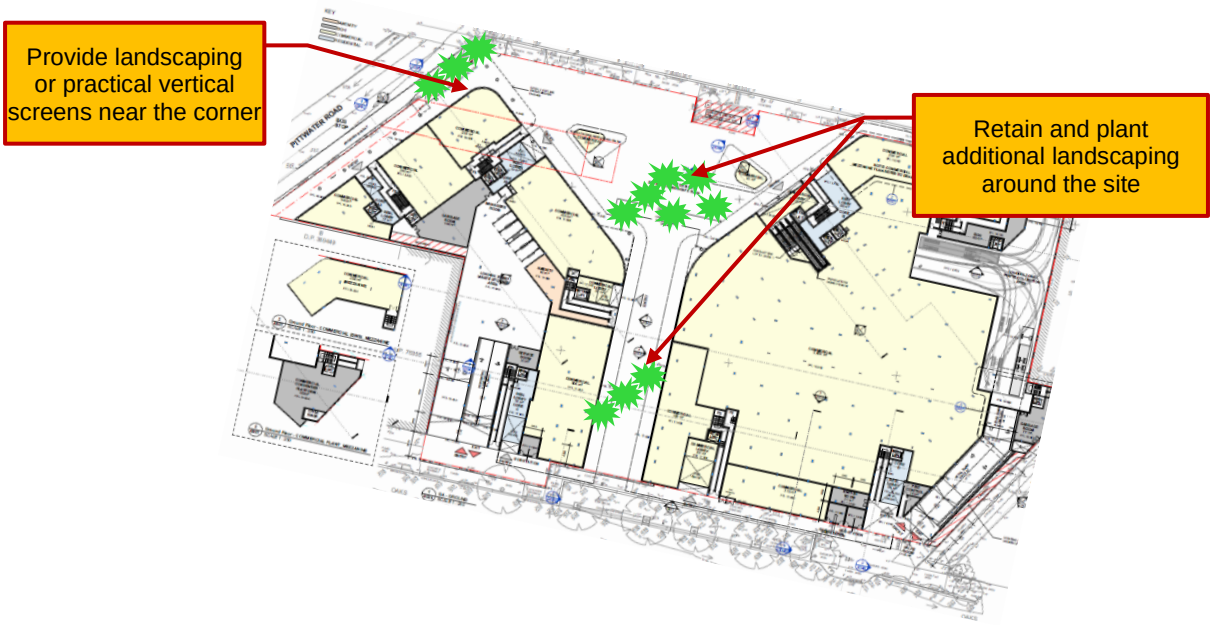


Figure 4 Mitigation Recommendations for a Selected Retail - Podium Level, West Central Area

2.1 Site Phots Regarding Current Wind Mitigations

The podium contain extensive landscaping can be seen in **Figure 5.**

- The design incorporates significant landscaping in podium park area Howard Avenue Perimeter.
- The landscaping elements in the southern podium area near Oaks Avenue create a localised wind break and wind can accelerate between the buildings.

Figure 5 Site Photos Taken on 09 February 2024

3 SYDNEY'S WIND CLIMATE

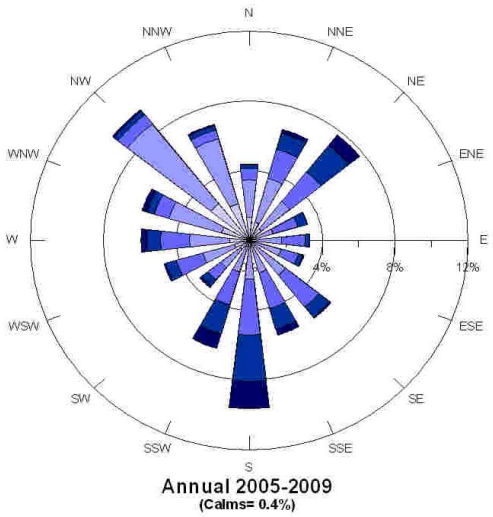
The data of interest in this study are the annual extreme, mean hourly wind speeds and largest gusts experienced throughout the year, how these winds vary with azimuth, and the seasonal break-up of winds into the primary Sydney wind seasons.

3.1 Seasonal Winds

In relation to key characteristics of the Sydney Region Wind Climate (refer wind roses provided in **Appendix A**) relevant to the wind impact assessment of the proposed development, we note that Sydney is affected by two primary wind seasons:

- Summer winds occur mainly from the northeast, southeast and south.
  - While northeast winds are the more common prevailing wind direction (occurring typically as offshore land-sea breezes), southeast and south winds generally provide the strongest gusts during summer.
- Winter/Early Spring winds occur mainly from the west and the south.
  - West quadrant winds (southwest to northwest) provide the strongest winds during winter and in fact for the whole year.

Figure 6 Annual Sydney Wind Rose for Years (2005-2009)



The wind rose above shows the stronger winds in dark blue from the northeast, south and west.

3.2 Wind Exposure at the Site – the "Local" Wind Environment

Close to the ground, the "regional" wind patterns described above are affected by the local terrain and topography.

- The site currently receives reasonable shielding from commercial and residential buildings to the north, east and west.
- Dense vegetation provides good low level shielding to the northwest.
- The site is somewhat more exposed to the south and southeast quadrant due to the lower level of surrounding buildings in this direction.
- Northerly winds may create a "venturi" effect along the outdoor area/pathway between podiums.

4 WIND ACCEPTABILITY CRITERIA

4.1 Standard Local Government Criteria

The choice of suitable criteria for evaluating the acceptability of particular ground level conditions has been the subject of relatively recent research. The acceptability criteria that have been developed from this research and currently referenced by most Australian Local Government Development Control Plans have been summarised below in **Table 1**.

Table 1 Standard Local Government Wind Acceptability Criteria

Type of Criteria	Limiting Gust Wind Speed Occurring Once Per Year	Activity Concerned
Safety	24 m/s	Knockdown in Isolated Areas
	23 m/s	Knockdown in Public Access Areas
Comfort	16 m/s	Comfortable Walking
	13 m/s	Standing, Waiting, Window Shopping
	10 m/s	Dining in Outdoor Restaurant

The primary objectives relating to the above wind impact criteria are as follows:

- The general objective is for annual 3-second gust wind speeds to remain at or below the so-called 16 m/sec “Walking Comfort” criterion. Whilst this magnitude may appear somewhat arbitrary, its value represents a level of wind intensity which the majority of the population would find unacceptable for comfortable walking on a regular basis at any particular location.
- In many urban locations, either because of exposure to open water conditions or because of street “canyon” effects, etc, the 16 m/s “Walking Comfort” level may already be currently exceeded. In such instances a new development should ideally not exacerbate existing adverse wind conditions and, wherever feasible and reasonable, ameliorate such conditions.

It can be seen in **Table 1** that the recommended limiting wind speeds for spaces designed for activities such as seating, outdoor dining, etc., are lower (ie more stringent) than for “walking comfort”.

4.2 Application of Standard Council Wind Criteria for the Current CFD Study

The criteria provided in **Table 1** should not be viewed as *“hard”* numbers as the limiting values were generally derived from subjective assessments of wind acceptability. Such assessments have been found to vary with the height, strength, age, etc, of the pedestrian concerned.

A further factor for consideration is the *extent* of windy conditions: some relaxation of the above criteria may be acceptable for small areas under investigation provided the general site conditions satisfy the relevant criteria.

Finally, it is noted that the ground level wind acceptability criteria provided in **Table 1** have been stated in terms of the maximum **gust wind speed per annum** as it is the wind pressures associated with these gusts that people perceive as being acceptable or unacceptable whilst performing various activities.

Maximum wind gusts will differ from the corresponding mean wind speed modelled in the current CFD investigation (see Results Section of this report). For a normally distributed process it is reasonable to assume that the 2-3 second maximum gust may be up to 3.5 standard deviations above the mean. It is therefore conservative to assume that mean wind could be approximately half the magnitude of gust wind speeds given the level of wind turbulence expected at the proposed site.

The equivalent mean wind speed acceptability criteria for the CFD study are summarised in

Table 2 Equivalent Pedestrian Level Mean Wind Acceptability Criteria

Type of Criteria	Limiting MEAN Wind Speed Occurring Once Per Year	Activity Concerned	Impacts
Safety	12 m/s	Knockdown in Isolated Areas	People blown over by gusts
	11.5 m/s	Knockdown in Public Access Areas	Generally impedes progress, great difficulty with balance
Comfort	8 m/s	Comfortable Walking	Inconvenience felt when walking, umbrellas used with difficulty, wind noise on ears unpleasant
	6.5 m/s	Standing, Waiting, Window Shopping	Force of wind felt on body, hair disarranged.
	5 m/s	Dining in Outdoor Restaurant	Raises dust, and loose paper, clothing flaps

5 CFD MODELLING ASSUMPTIONS AND ANALYSIS

SLR Consulting has modelled the proposed development and the surrounds using the SpaceClaim software packages. This was then imported into ANSYS to prepare the model for solving.

The surrounding buildings and terrain have been simplified to reduce computational time.

Sydney's highest wind speeds come from the northeast, southeast, south and west (southwest to northwest). Of these the west has been identified as most critical to this project.

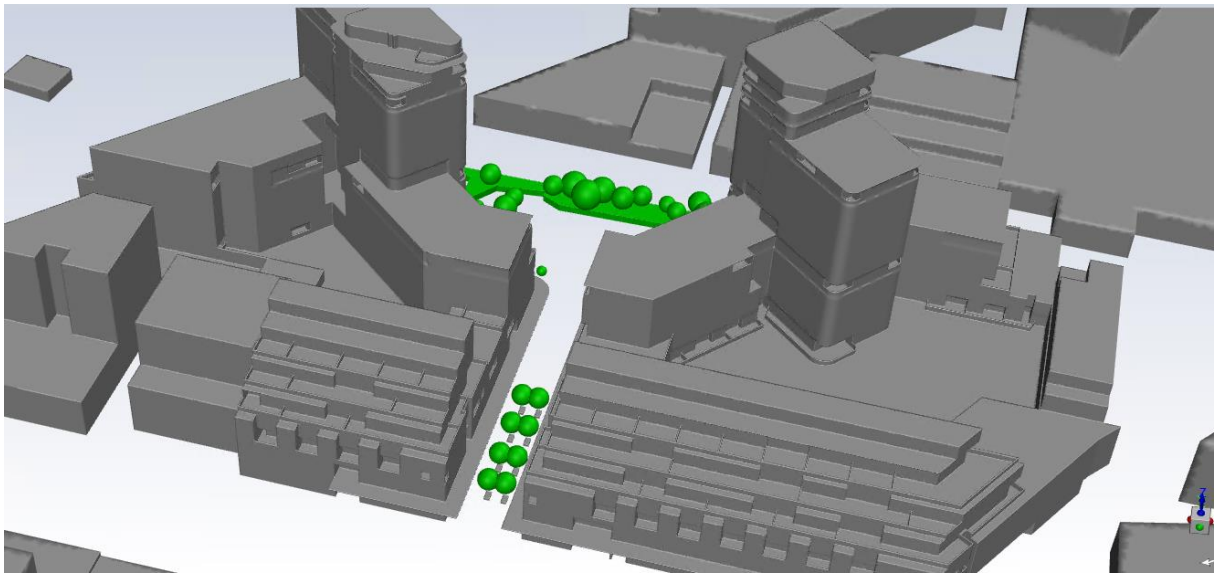
Ambient wind profiles have been created to simulate the annual maximum mean wind speeds from these directions utilising the Australian Wind Code (AS1170.2). This will be used to check the podium level conditions for potential adverse wind areas.

5.1 Modelling

A 3D model of the development area and surrounding buildings was created from 3D and 2D AutoCAD files and photos supplied by Meriton and received on 16 February 2024. Additional blocks were then added around the development site to an approximate radius of up to 400 m to give a more accurate result. The 3D model accounts for the site topography.

The 3D geometry for CFD Modelling is shown in **Figure 7**. A calculation domain of 2000 m length, 2000 m width and 400 m height was used for the CFD analysis.

Figure 7 3D Model of the Site and Surrounds



The four key prevailing Sydney wind directions were modelled and the podium and retail areas were checked for any exacerbation of the current wind conditions caused by the proposed development.

5.2 Boundary Conditions

5.2.1 Wind Condition

The CFD study was undertaken to estimate the velocity and pressure profile during elevated wind conditions representing an annual exceedance probability. At the upwind free boundary inlet mean wind velocity profiles were derived from Bureau of Meteorology data and the Australian Wind Code AS1170.2 for Sydney's four prevailing wind directions. At the downwind and upper free boundaries constant pressure boundary conditions were applied.

The following prevailing wind conditions for Sydney were modelled:

- West Winds
- Northeast Winds
- South Winds
- Southwest Winds

The following velocity boundary conditions for the most critical westerly winds were used representing the mean wind speed with height with a 1 year return period.

- Height 10 m Mean wind velocity 11.5 m/s for west winds
- Height 10-400 m Mean wind velocity profile based on AS1170.2 (for the relevant direction)

5.2.2 Other Boundary Conditions

The following additional boundary conditions were used

- Turbulence quantities (kinetic energy and dissipation rate) were calculated from empirical relationships
- A wall function data group was used to avoid using a very fine mesh near the wall and improve turbulent flow simulation

5.3 Discretization

The software package utilised in the current CFD analysis is the commercially available code Fluent. The CFD model solves continuity and momentum equations in the computational domain to predict the steady state airflow inside and around the redevelopment.

- For the current analysis polyhedral elements with a total 29,703,784 nodes used to cover the computational domain. Polyhedral cells are especially beneficial for handling recirculating flows and used to provide more accurate results than even hexahedra mesh. For a hexahedral cell, there are three optimal flow directions which lead to the maximum accuracy while for a polyhedron with 12 faces there are six optimal directions which, together with the larger number of neighbours lead to a more accurate solution with a lower cell count.
- SST k-Omega turbulence model was used for all analysed cases.
- An iterative procedure was used to estimate the air velocity in terms of three directions, pressure profile and turbulence parameters. For the pressure velocity coupling a global solver based on the SIMPLE algorithm was employed.

The normalised residuals of continuity for all cases were reduced by between four and seven orders of magnitude while the normalised residual of x-, y-, and z-velocity, k and Omega was reduced between four and six orders of magnitude demonstrating a valid solution.

6 CFD RESULTS AND DISCUSSIONS – CURRENT CONDITIONS

Four prevailing wind directions were modelled as part of the study, namely:

- Westerly Winds
- Northeast Winds
- Southerly Winds
- Southwest Winds

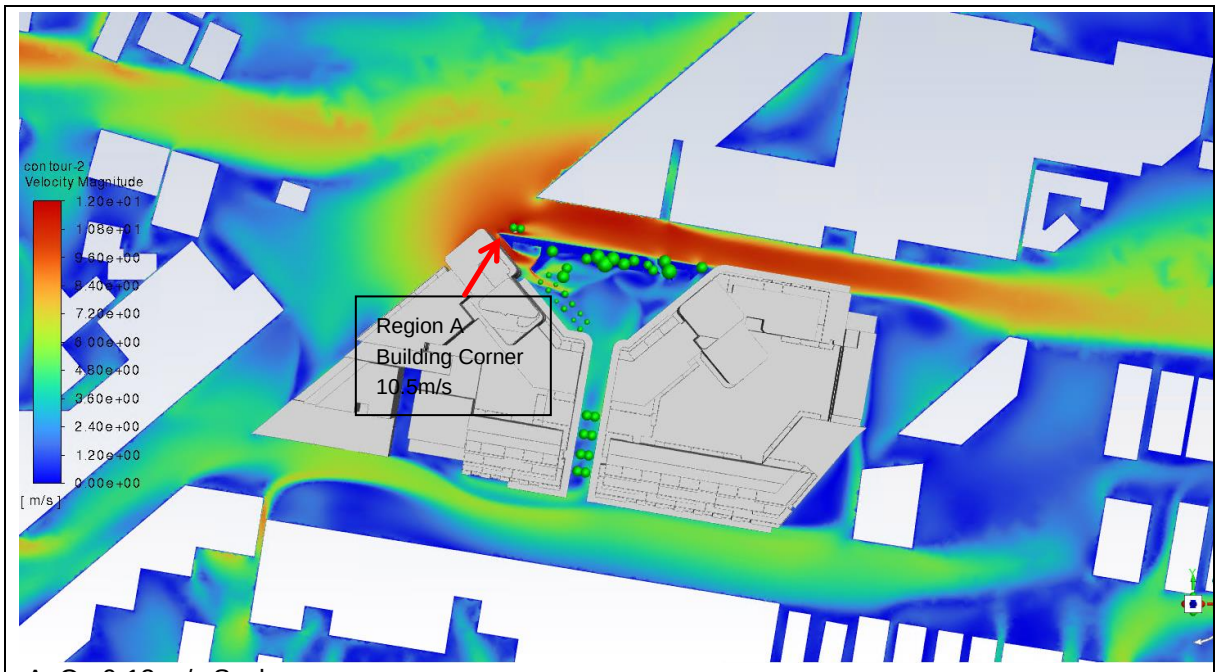
6.1 Westerly (Winter) Winds

Figure 8 shows airflow velocities at a 2D horizontal section at 1.5 m above ground (typical chest level). Velocity magnitudes are plotted on a colour coded scale between 0 and 12 m/s and 0 to 5 m/s respectively.

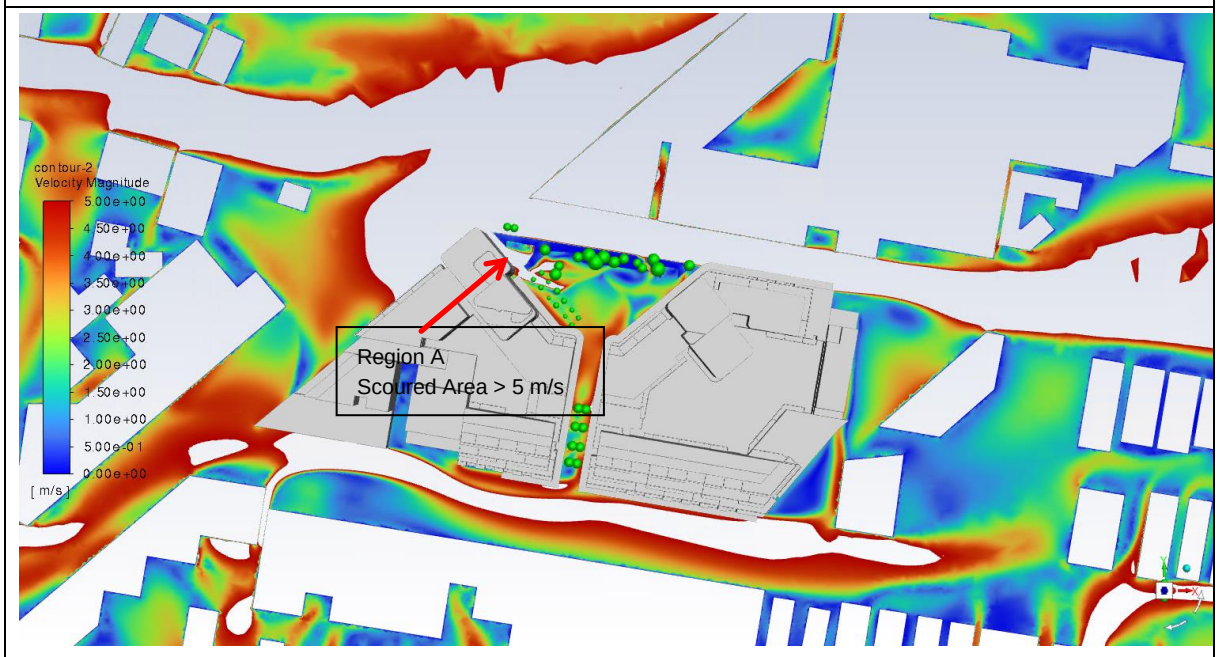
The following conclusions can be reached from **Figure 8**:

- The CFD model captures the fluid flow characteristics in significant detail. Wind is approaching the site from the west (270^{o} relative to north) as per the given boundary condition. Wind is then accelerated near the edges and stagnated and recirculated behind the buildings.
- Wind is accelerated near the edge of some buildings (Refer **Figure 8A**). The mean wind speed at Region A is approximately 10.5 m/s. Corresponding gust strengths at this location will have magnitudes as high as 21 m/s thereby exceeding the comfort criteria for walking.
- The proposed landscaping provides an acceptable environment for sitting at all areas except the scoured areas in **Figure 8B**. The wind speeds in the scoured area are above the comfort criteria for dining.

Figure 8 Contours of Velocity Magnitudes (m/s) at a Typical Chest Level – Westerly Wind 1.5 m above Ground



A: On 0-12 m/s Scale



B: On 0-5 m/s Scale

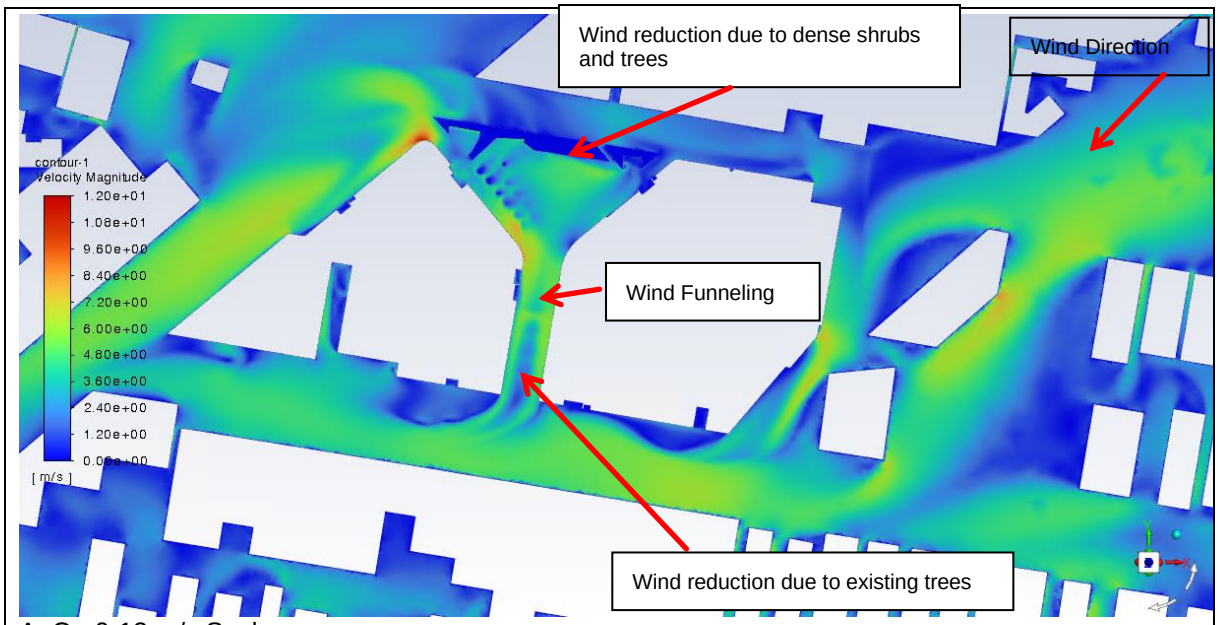
6.2 Northeast (Summer) Winds

Figure 9 shows airflow velocities at a 2D horizontal section at 1.5 m above ground. Velocity magnitudes are plotted on a colour coded scale between 0 and 12 m/s and 0 to 5 m/s respectively.

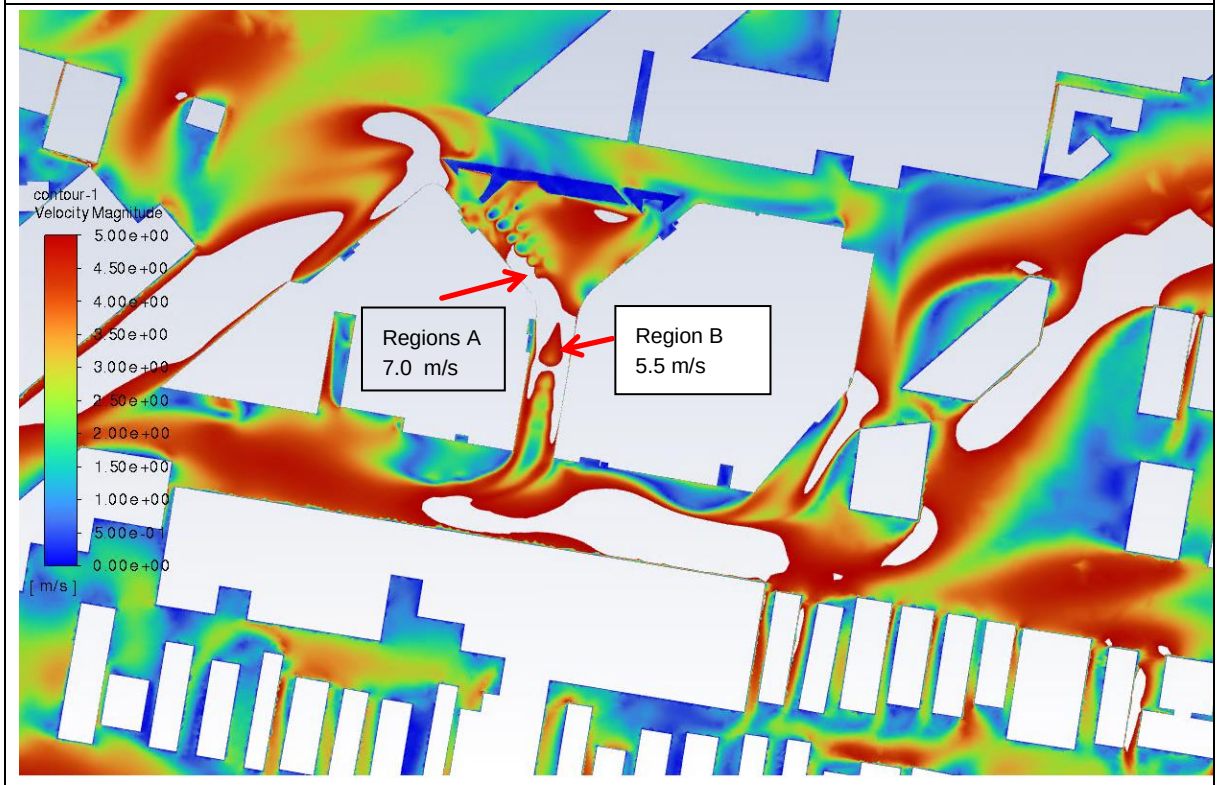
The following conclusions can be reached from **Figure 9**:

- Wind is funnelling between the residential towers and the wind speeds up as it flows through the constricted (narrow) section between the two towers (venturi effect).
- The current landscaping provides localised wind speed reductions at various locations.
- The maximum mean wind speed at the west side retail areas (Region A) is approximately 7 m/s (Refer **Figure 9B**). Corresponding gust strengths at this region will exceed the comfort criterion for standing and sitting.
- The maximum mean wind speed at the east side retail areas (Region B) is approximately 5.5 m/s (Refer **Figure 9B**). Corresponding gust strengths at this region will exceed the comfort criterion for sitting.

Figure 9 Contours of Velocity Magnitudes (m/s) at a Typical Chest Level – North-easterly Wind 1.5 m Above Ground



A: On 0-12 m/s Scale



B: On 0-5 m/s Scale

6.3 Southerly (All-Year Round) Winds

Figure 10 shows airflow velocities at a 2D horizontal at 1.5 m above ground. Velocity magnitudes are plotted on a colour coded scale between 0 and 12 m/s and 0 to 8 m/s respectively.

The following conclusions can be reached from **Figure 10**:

- The CFD model captures the fluid flow characteristics in significant detail (Refer **Figure 16A**). Wind is approaching the site from the south (180^{o} relative to north) as per the given boundary condition. Wind is then accelerated near the edges and stagnated and recirculated behind the buildings.
- The building to the immediate south provides lower ground level shielding to the Dee Why Town Centre.
- The existing tree at region A (**Figure 10A**) provide additional localised podium level shielding.
- Winds funnel between the towers and downwash through the constricted section and other public area. Downwash effect is shown in **Figure 10**
- The maximum mean wind speed at the east side retail (Region A, **Figure 10B**) is approximately 13 m/s (Refer **Figure 9B**). Corresponding gust strengths at this region will exceed the safety criteria for walking.
- Most retail areas experience increased wind speeds above the comfort criteria for dining (Refer scoured area in **Figure 10B**.

Figure 10 Contours of Velocity Magnitudes (m/s) at a Typical Chest Level – Southerly Wind 1.5 m above Ground

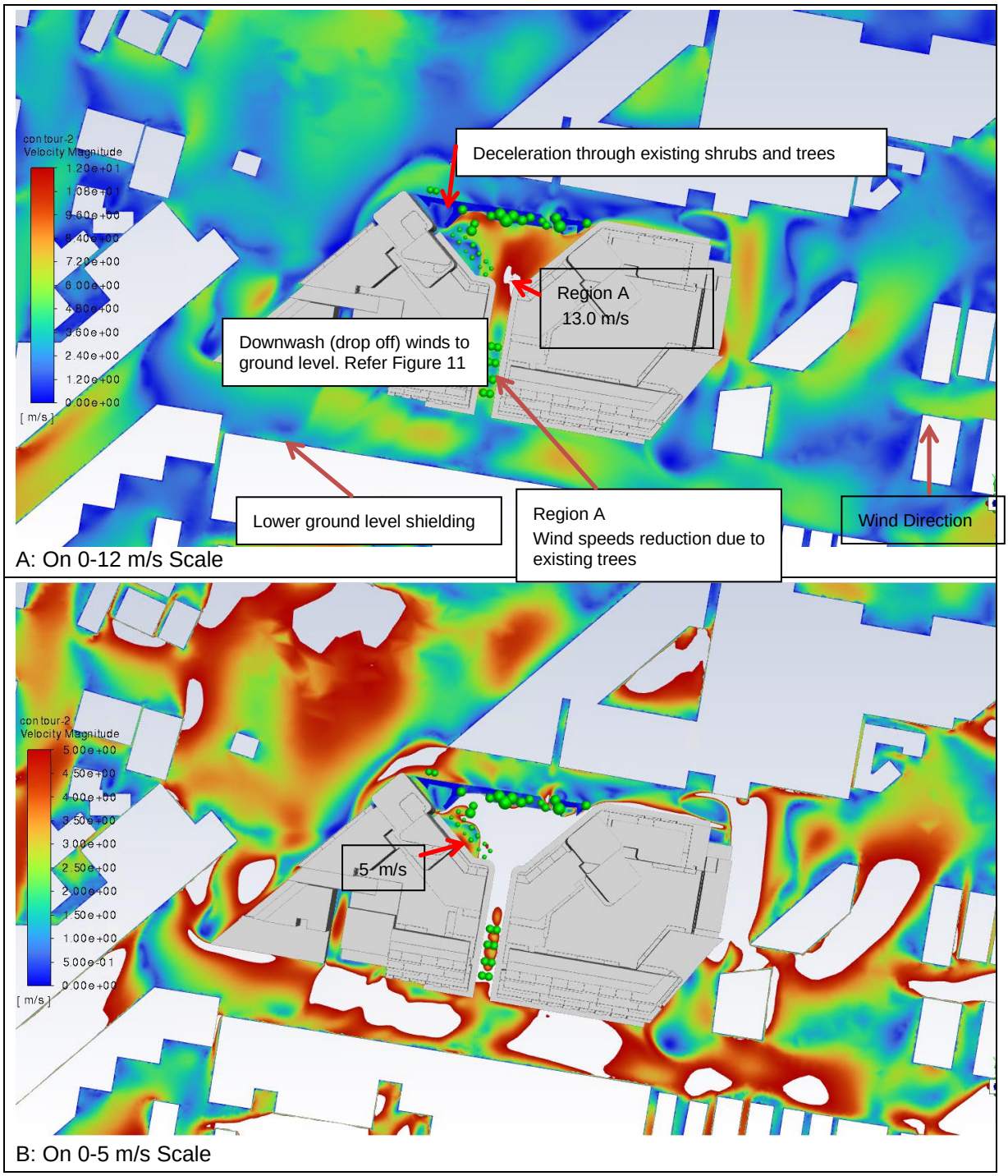
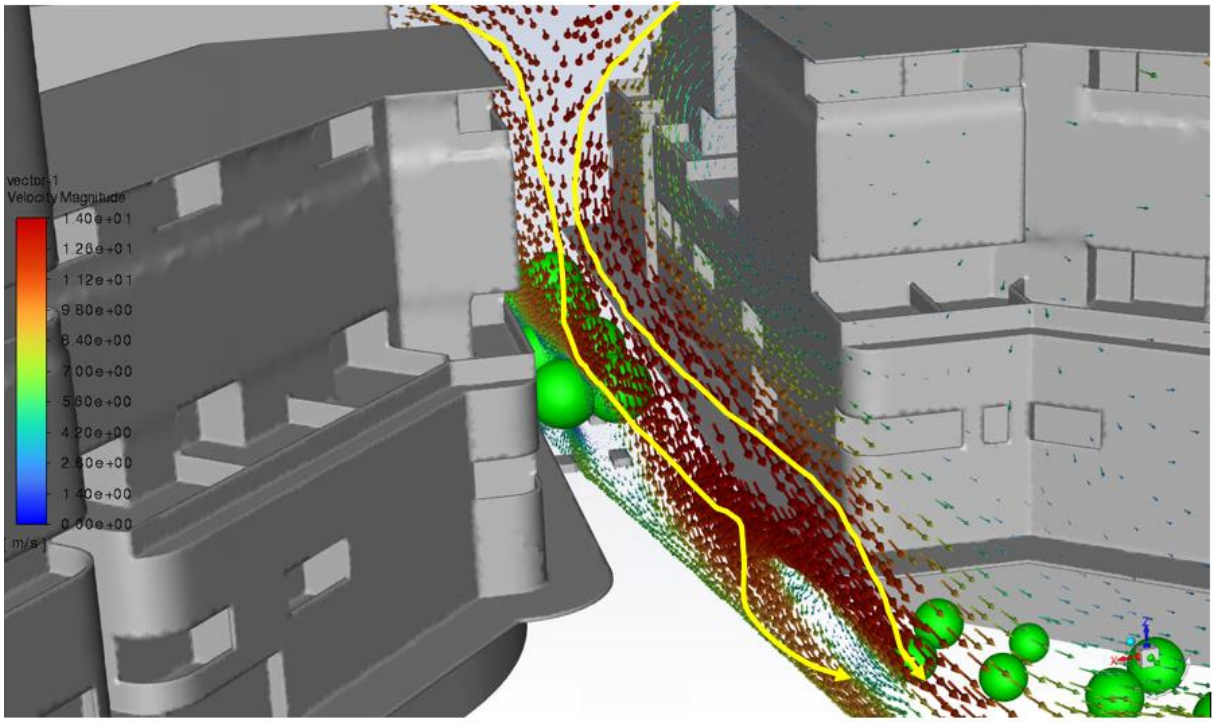


Figure 11 Velocity Vector (m/s) at a Selected 2D Section between the Two Towers



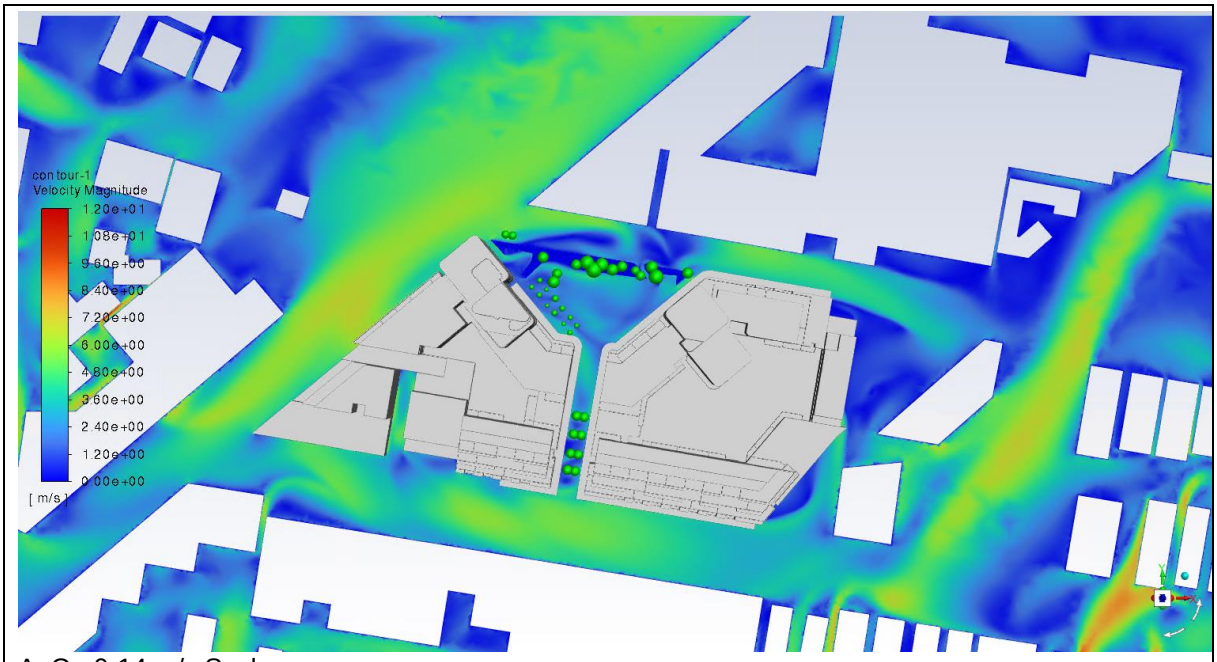
6.4 Southwest Winds

Figure 12 shows airflow velocities at a 2D horizontal section at 1.5m above ground. Velocity magnitudes are plotted on a colour coded scale between 0 and 12 m/s and 0 to 5 m/s respectively.

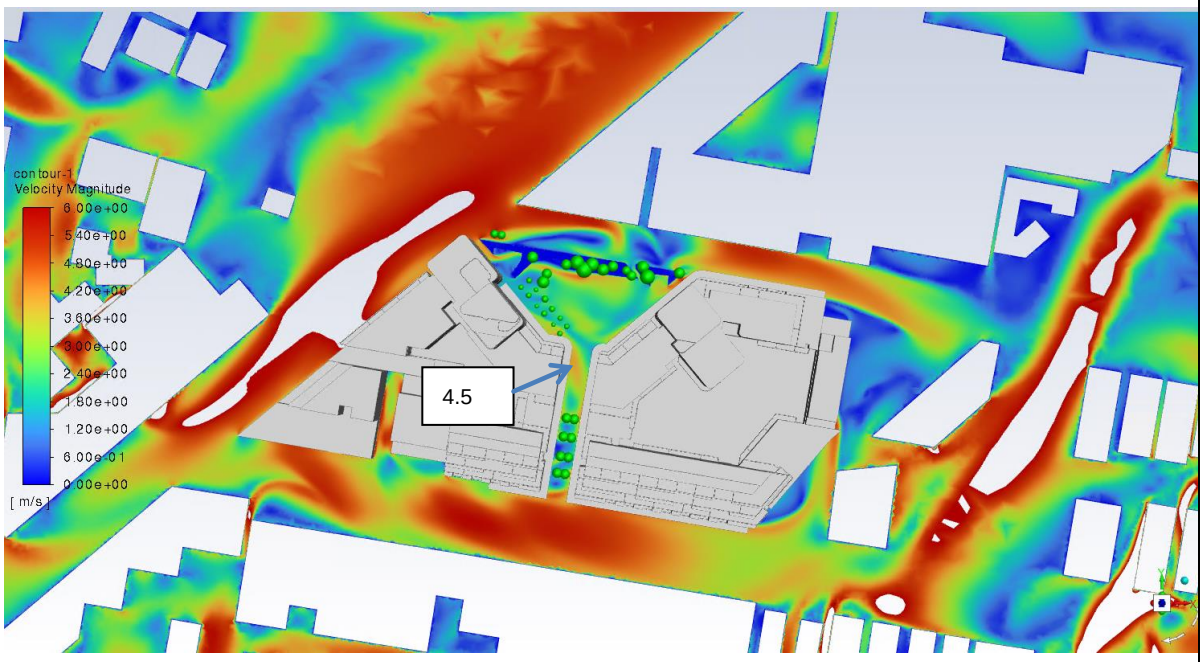
The following conclusions can be reached from **Figure 12**:

- Adverse winds are mitigated by the existing landscape elements and the maxim maximum mean wind speed at the podium seating areas is 4.7 m/s (Refer **Figure 12B**). Corresponding gust strengths at those locations will have a magnitude of 9.4 m/s thereby satisfying the comfort criterion for dining.

Figure 12 Contours of Velocity Magnitudes (m/s) at a Typical Chest Level – South-westerly Wind 1.5 m Above Podium



A: On 0-14 m/s Scale



B: On 0-6 m/s Scale

7 CFD RESULTS AND DISCUSSIONS – PROOSED WIND MITIGATION CONDITIONS

The following previous mitigation recommendations are modelled:

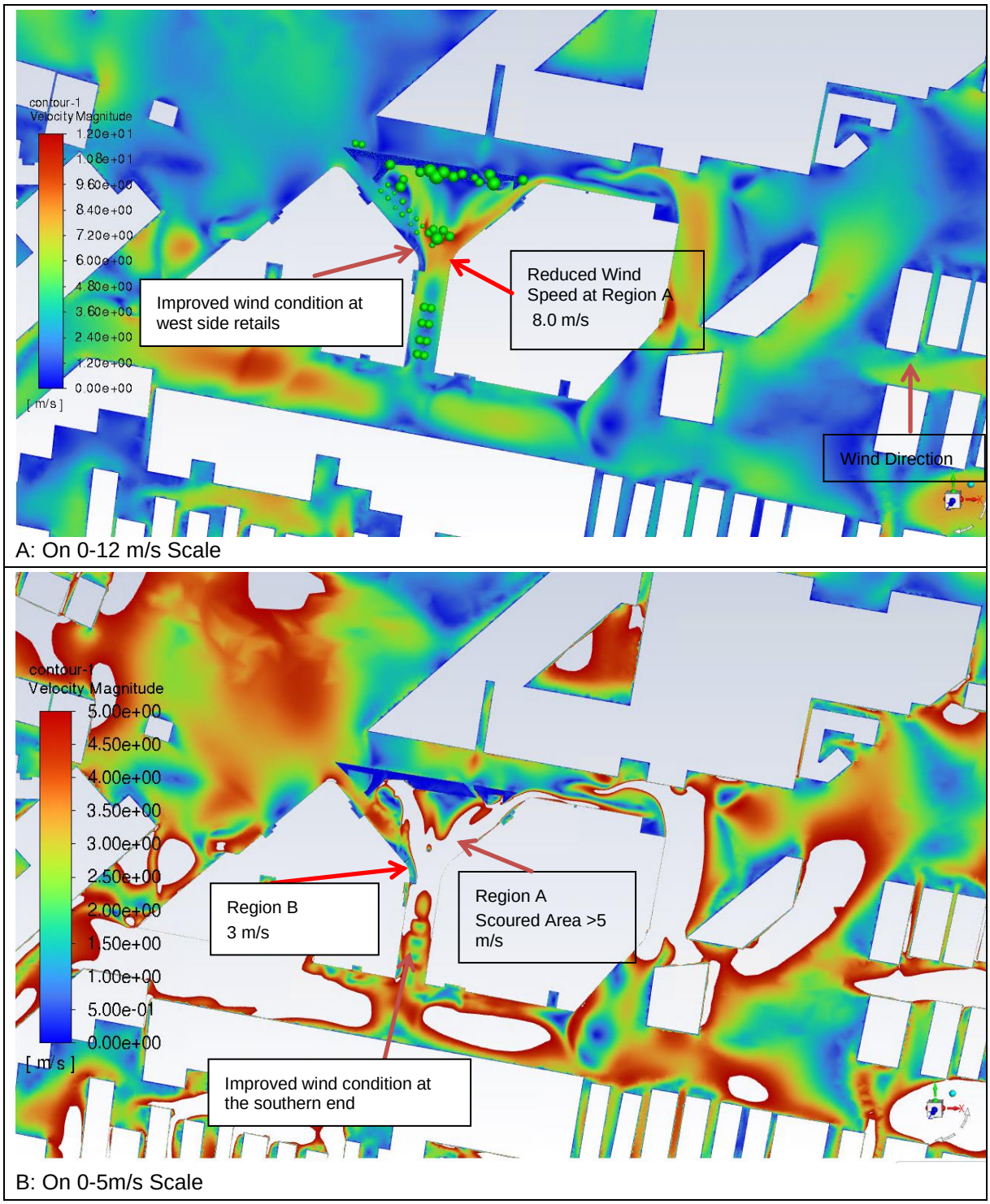
- Additional landscaping proposed for the central part of the podium (Refer **Figure 3**)
- Deploy local windbreak solutions for a selected west side retail (Refer **Figure 4**)

Note: No landscaping elements have been added for the Pittwater Road perimeter of the building due to space limitations.

Results of simulations are presented for Southerly wind condition in **Figure 13**. The following can be concluded from **Figure 13**:

- The additional landscaping elements assisted to reduce the wind speed at the east side retail element to ~ 8.0 m/s (Refer region A, **Figure 13A**). The safety criteria is now satisfied and the walking criteria is approached.
- The maximum mean wind speed at the west side retail (Region A, **Figure 10B**) is reduced to below 5 m/s (Refer **Figure 13B**), thereby satisfying the comfort criteria for sitting and dining.
- Most retail areas experience increased wind speeds above the comfort criteria for dining (Refer scoured area in **Figure 13B**.

Figure 13 Contours of Velocity Magnitudes (m/s) at a Typical Chest Level – Proposed Wind Mitigation, Southerly Wind 1.5 m Above Podium



8 WIND MITIGATION TREATMENT RECOMMENDATIONS

Section 6 provided guidance as to the areas where the adopted wind acceptability criterion had the potential to be exceeded and an indication as to the likely local optimum wind treatment strategy, ie whether the wind condition of interest is likely to arise from accelerating winds which require vertical windbreaks (such as landscaping) or downwash winds which require horizontal windbreaks (such as awnings, canopies).

Primary Wind Conditions of Concern

The wind conditions of primary concern:

- Prevailing winds align with building geometry conditions conducive to accelerated windflow, eg south winds can approach the site accelerating in between the upstream hills and winds then funnel between the towers and downwash through the constricted (narrow) section and impact the outdoor area/pathway and the central part of the podium. Refer **Figure 10**
- Strong westerly winds cause local acceleration effects at the corners of the development (Refer **Figure 8**)
- Northerly winds can create a “venturi” effect along the outdoor area/pathway between podiums. Refer **Figure 9**

These wind conditions generally represent a horizontal acceleration of winds. The current landscape and proposed landscape will help mitigate most of the adverse winds and satisfy the walking criteria at most locations except at isolated areas (Refer Region A, **Figure 8A and** Region A, **Figure 10A**).

In order to satisfy the sitting criteria at the retail areas, the following wind mitigation treatments are proposed (Refer **Figure 14** and **Figure16**).

- Additional landscaping elements, Refer **Figure 14**
- Wind breaks for west side retail. Refer **Figure 15**
- Work with the local tenancies to deploy local windbreak solutions (eg Pull up / Pull down screens). **Figure 16** shows a photograph of windbreak features employed at the nearest commercial building to the east of the site along Howard Avenue. The Howard Avenue Café is completely shielded by perimeter plastic curtains during windy conditions.

Figure 14 Mitigation Recommendations (Ground Level)

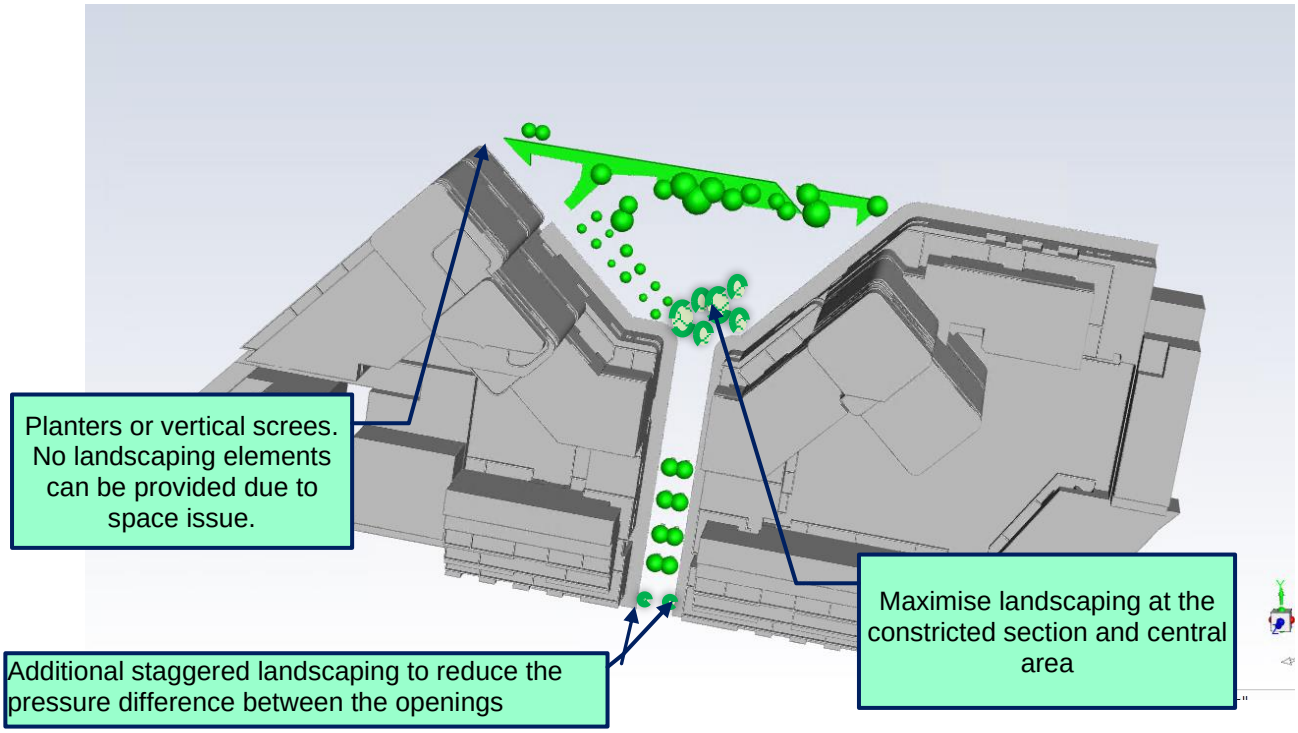


Figure 15 Mitigation Recommendations for a Selected Retail - Podium Level, West Central Area

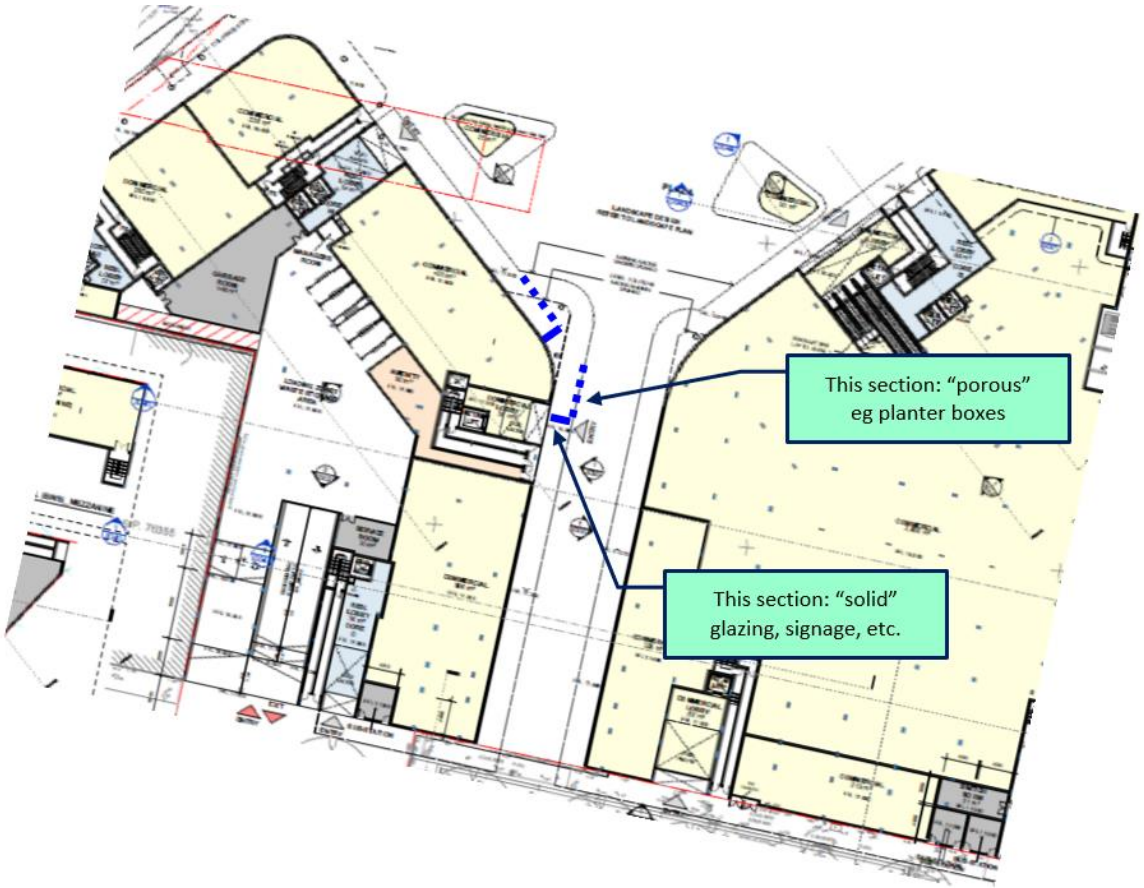
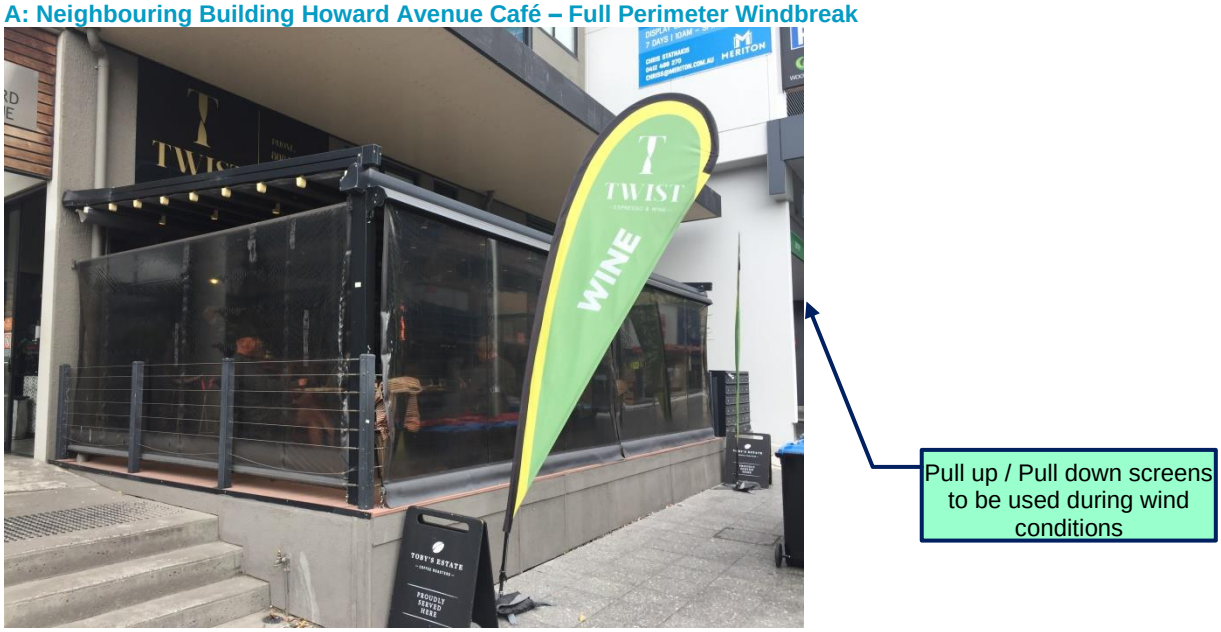


Figure 16 Example of Localised Wind Mitigation Recommendations

A: Neighbouring Building Howard Avenue Café – Full Perimeter Windbreak



B: Neighbouring Building East Façade – Restaurant Terrace Windbreak

9 CONCLUSION

SLR Consulting Australia (SLR) has been engaged by Meriton Group to prepare a quantitative wind impact assessment for the podium level of the proposed mixed-use development at 884-896 Pittwater Road, 14-28 Oaks Avenue & 9-17 Howard Avenue, Dee Why.

SLR has previously conducted a qualitative and a quantitative assessment of the site, proposing wind mitigation devices for upper balconies and additional landscaping for certain ground level areas around the site. The effectiveness of the existing and proposed landscaping elements has not been assessed in the previous studies.

Particular interest will be placed on the podium level, specifically in the retail area on the west and east sides.

Wind speeds for the podium level have been quantified using Computational Fluid Dynamics (CFD). The current study also incorporated the existing landscaping elements.

Sydney Winds

The Sydney wind climate is characterised by dominant (prevailing) north-easterly, westerly and southerly winds. While northeast winds are the more common prevailing wind direction (occurring typically as offshore land-sea breezes), southeast and south winds generally provide the strongest gusts during summer.

West quadrant winds (southwest to northwest and common throughout winter) provide the strongest winds for the whole year.

Existing Wind Environment

Existing street level wind conditions in the vicinity of the site are likely to be close to the16 m/s *"walking comfort"* criterion for some prevailing wind directions given the orientation of the site and the upstream shielding afforded to the site by surrounding buildings and vegetation.

Wind Impact of the Project Site – Current Condition

In relation to the wind impact of the proposed development with the currently proposed design features and existing landscaping elements (the "Base Case" condition), some locations surrounding the site have the potential to experience elevated wind speeds, in excess of the standard once per year walking comfort criteria and, in one isolated case, potentially exceeding the safety criteria for walking (Refer **Figure 10**).

Westley wind

- Strong westerly winds cause local acceleration effects at the corners of the building. Refer **Figure 9**

- The existing landscaping elements provide an acceptable wind environment for sitting/dining at all areas except Region A in **Figure 8B**. The wind speeds in the scoured area are above the comfort criteria for dining.

Northeasterly wind

- Northerly winds create a "venturi" effect within the outdoor area/pathway between podiums.
- The current landscaping elements provide localised wind speeds reduction at various locations.
- The dining criterion is exceeded at a number of locations (Refer Region A and Region B, **Figure 9B**).

Southerly Winds

- Prevailing winds align with building geometry conditions conducive to accelerated windflow, eg south winds can approach the site accelerating in between the upstream hills and winds then funnel between the residential towers and downwash through the constricted (narrow) section and impact the outdoor area/pathway and the central part of the podium. Refer **Figure 10 and Figure 11**
- Most retail areas experience increased wind speeds above the comfort criteria for dining (Refer scoured area in **Figure 10B**.

Southwesterly wind

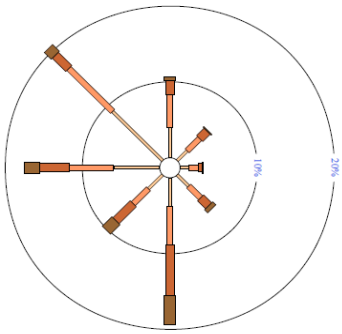
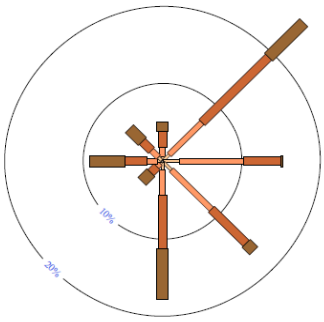
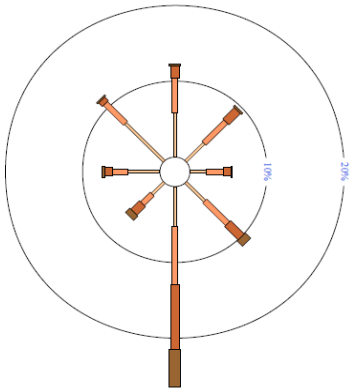
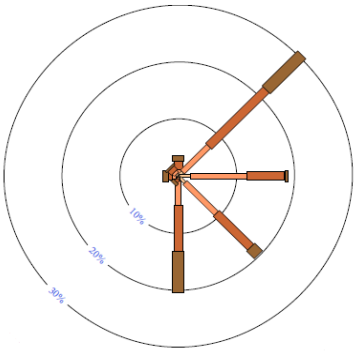
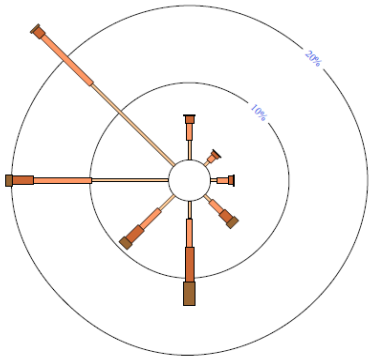
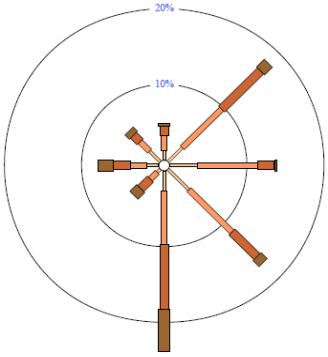
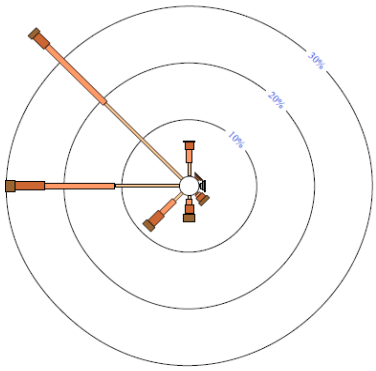
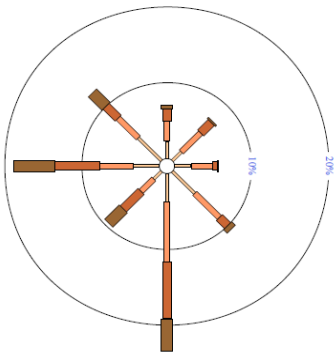
- Adverse winds are mitigated by the existing landscape elements. Refer **Figure 12B**.

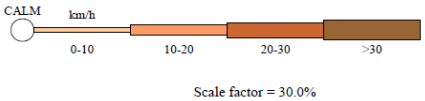
Recommended Wind Mitigations

On the basis of the CFD simulation predictions and potential non-compliance locations, the following wind mitigation treatments are recommended:

- Additional landscaping elements. Refer **Figure 14**
- Wind breaks for west side retail. Refer **Figure 15**
- Work with the local tenancies to deploy local windbreak solutions (eg Pull up / Pull down screens). Examples are shown in **Figure 16**

SYDNEY WIND ROSES

	Morning Winds	Afternoon Winds
Spring		
Summer		
Autumn		
Winter		



Scale factor = 30.0%