int

HEGGIES

REPORT 10-8070-R1

Revision 0

Wind Impact Assessment
West Ryde Housing Development
63-77 West Parade, West Ryde

PREPARED FOR

Housing NSW
PO Box K100
Haymarket NSW 1240

5 JUNE 2009

HEGGIES PTY LTD
ABN 29 001 584 612

Wind Impact Assessment

West Ryde Housing Development

63-77 West Parade, West Ryde

PREPARED BY:

Heggies Pty Ltd
2 Lincoln Street Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
Telephone 61 2 9427 8100 Facsimile 61 2 9427 8200
Email sydney@heggies.com Web www.heggies.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-8070-R1	Revision 0	5 June 2009	Disa Oqvist	Dr Peter Georgiou	Dr Neihad Al-Khalidy

EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been engaged by Housing NSW to assess the environmental impact of the proposed West Ryde Housing Development on 63-77 West Parade, West Ryde, with respect to Environmental Wind Effects.

Limited information on the building design was available at the time of the assessment. The conclusions have been based primarily on the pdf drawings "Ground Floor Plan, Concept Application", "Typical Level. Concept Application" and "Section A:A, Concept Application". The main entrances to the towers are assumed to be at the facades of the buildings facing West Parade. There will also be retail entrances on West Parade. The area on top of the podium will be public access and additional entrances will be located on the podium to facilitate movement between the towers. The exact locations of these entrances are however not known at this stage. The conclusions of this report may need to be refined when the detailed design is progressed.

The proposed development will consist of 4 residential towers of various heights:

- Tower A will comprise an 11-story residential tower.
- Tower B will comprise a 4-storey residential tower.
  - 2 levels of parking, retail and services will be located bellow Tower A and Tower B.
- Tower C will comprise a 7-storey residential tower.
  - 640 m^2 of office space at ground level will be located below Tower C.
  - 1 level of parking will be located below the office space.
- Tower D will comprise of a 4-storey residential tower.
  - 2 levels of parking, retail and services will be located below Tower D.

Existing Winds – Wind Impact and Effects

Existing street level wind conditions in the vicinity of the site are likely to be either close to or below the 16 m/sec *"walking comfort"* criterion for many prevailing wind directions given the varying degree of shielding afforded to the site by surrounding buildings.

Future Wind Environment

In terms of the *future* wind environment with the proposed development, the following features of the development are noted as being of most significance:

- The development is shielded by numerous 3-storey residential buildings to the west of the site and two 9-storey residential towers to the south
- Pedestrian areas along West Parade are somewhat protected from adverse winds by existing landscaping.
- The corners of the development towards West Parade are likely to experience winds above the 16 m/s *"walking comfort"* criterion due to wind acceleration around the corners.
- The podium area is likely to exceed the 16 m/s *"walking comfort"* criterion due to channelling of wind between the development buildings and downwash created by the wind impacting the high towers and being diverted towards the podium.
- Upper level balconies have the potential for elevated wind due to lack of shielding.

EXECUTIVE SUMMARY

Wind Amelioration

Suggested wind ameliorations to comply with the criterion are:

- Additional windbreaks, eg staggered vertical screens or landscaping such as trees, shrubs or planterboxes close to the southwest and northwest corners of the development at ground level.
- Additional windbreaks, eg staggered vertical screens or landscaping such as trees, shrubs or planterboxes between the towers at Podium level.
- Awnings above West Parade entrances and podium entrances to minimise any downwash. The awnings should span at least 1 m past the width of the entrance either side and extend a minimum of 3 m from the building facade.
- Vertical louvres should be fitted to upper level balconies to help in the dispersion of high winds.

Accordingly, it has been predicted that ground level and podium level wind speeds along all surrounding public footpaths and public access areas will either remain at their present levels or decrease slightly with the addition of the proposed development and its wind mitigation treatments.

The above analysis has been made on the basis of our best engineering judgment and on the experience gained from model scale wind tunnel testing of a range of developments of similar magnitude to the currently proposed development.

TABLE OF CONTENTS

List of Tables

List of Figures

1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been engaged by Housing NSW to assess the environmental impact of the proposed West Ryde Housing Development on 63-77 West Parade, West Ryde, with respect to Environmental Wind Effects.

Limited information on the building design was available at the time of the assessment. The conclusions have been based primarily on the pdf drawings "Ground Floor Plan, Concept Application", "Typical Level. Concept Application" and "Section A:A, Concept Application". The main entrances to the towers are assumed to be at the facades of the buildings facing West Parade. There will also be retail entrances on West Parade. The area on top of the podium will be public access and additional entrances will be located on the podium to facilitate movement between the towers. The exact locations of these entrances are however not known at this stage. The conclusions of this report may need to be modified at a later stage in the project when more design details are available.

1.1 Development Site

An aerial view of the site is shown in **Figure 1**. The proposed development site is bounded by West Parade to the west, railway lines to the east and high-rise residential buildings to the south. The area surrounding the development comprises:

- 3-storey residential buildings to the west of West Parade.
- 9-storey residential buildings immediately to the south of the development.
- 9-storey mixed-use building further to the south.
- West Ryde Railway Station south.
- 2-story Ryde-Eastwood Leagues Club to the east of the railway lines.
- Low-rise residential buildings to the north.

Figure 1 Site Location

Image courtesy of Google Earth

1.2 Development Description

The development site currently consists of low-rise detached dwellings that are to be demolished and replaced by the proposed 63-77 West Parade Development. The proposed development will consist of 4 residential towers of various heights:

- Tower A will comprise an 11-story residential tower.
- Tower B will comprise a 4-storey residential tower.
  - 2 levels of parking, retail and services will be located bellow Tower A and Tower B.
- Tower C will comprise a 7-storey residential tower.
  - 640 m2 of office space at ground level will be located below Tower C.
  - 1 level of parking will be located below the office space.
- Tower D will comprise of a 4-storey residential tower.
  - 2 levels of parking, retail and services will be located below Tower D.

2 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.

2.1 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.

2.2 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 development site receives reasonable shielding from the south from the existing high-rise building immediately south of the site.
- Shielding is also available from 3-storey residential buildings to the west of the development.
- The difference in topography around the development site is relatively small and will not have a significant influence on the local wind environment.

3 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, including those of Ryde City Council, 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/sec *"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.
- As it is proposed to have outdoor dining tables on the ground floor courtyard on the east of the new building, the area should meet the "Dining out Outdoor Restaurant" wind criterion of 10 m/sec.

3.1 Application of Standard Council Wind Criteria

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, and some relaxation of the above criteria may be acceptable for small areas under investigation provided the general site satisfies the relevant criteria.

Finally, it is noted that the limiting wind speed criteria in **Table 1** are based on the maximum wind gust occurring (on average) once per year. Winds at all other times, ie monthly winds, weekly winds, etc, would be of lesser magnitude. So for example, a location with a maximum annual gust of 10 m/sec would experience winds throughout the year of a generally very mild nature, conducive to stationary activities (seating, dining, etc).

4 WIND IMPACT OF THE PROPOSED DEVELOPMENT

4.1 Existing Winds – Wind Impact and Effects

Existing street level wind conditions in the vicinity of the site are likely to be either close to or below the 16 m/sec *"walking comfort"* criterion for many prevailing wind directions given the various degree of shielding afforded to the site by surrounding buildings.

4.1.1 Northeasterly Winds

Some shielding is available to the northeast from the low-rise residential buildings to the west of the railway lines. Northeast winds are generally mild and the potential for exceedance of the 16 m/sec criterion along the pedestrian pathways at the site is small, ie occurrences, if any, are likely to be very infrequent.

4.1.2 Southerly Winds

The presence of taller buildings immediately upstream of the development should result in wind conditions close to the ground being below the 16 m/sec criterion for southerly winds. There will be a channelling effect at the ground level for winds from SSW from already existing buildings to the south. The winds at elevated heights will tend to be considerably stronger.

4.1.3 Southeasterly Winds

Railway lines are to be found immediately east of the development and the closest buildings to the southeast are therefore located at a relatively large distance from the development. All buildings to the southeast of the development site are low-rise and will not offer any shielding from southeasterly winds. Winds approaching from the southeast will thus have the potential to exceed the 16 m/s criterion.

4.1.4 West Quadrant (Northwest to Southwest) Winds

Westerly winds provide the highest winds affecting the Sydney region. Lower levels are shielded by the 3-storey residential buildings to the west of West Parade, as well as other developments further upstream. The wind conditions should therefore be below the 16 m/sec criterion at ground level for winds which approach the site from the west. Winds at elevated heights will tend to be stronger and have the potential to exceed the 16 m/sec criterion.

4.2 Future Winds - Predicted Windflow Patterns

The following sections analyse the expected impacts of the proposed development on the pedestrian wind environment in the adjacent streetscape.

The wind impact of the proposed development is described by examining the impact of prevailing wind conditions on all public access areas of interest within and external to the development.

Areas of interest (ie public access areas) are shown in **Figure 2** and **Figure 3**.

The analysis is made on the basis of our best engineering judgement and on the experience gained from model scale wind tunnel testing of a range of developments of similar magnitude to the currently proposed development.

Figure 2 Ground Floor - Points of Interest Regarding Public Access

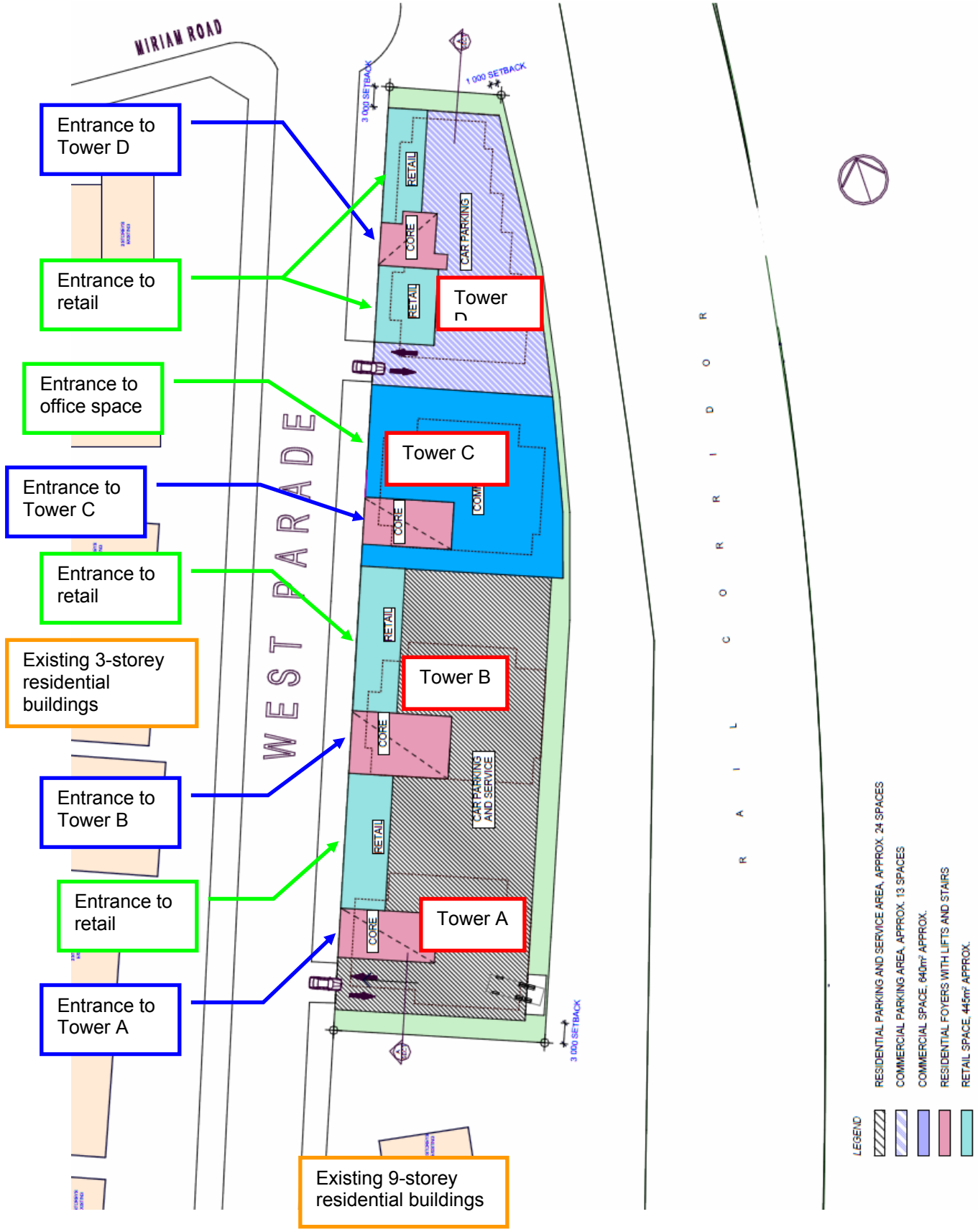
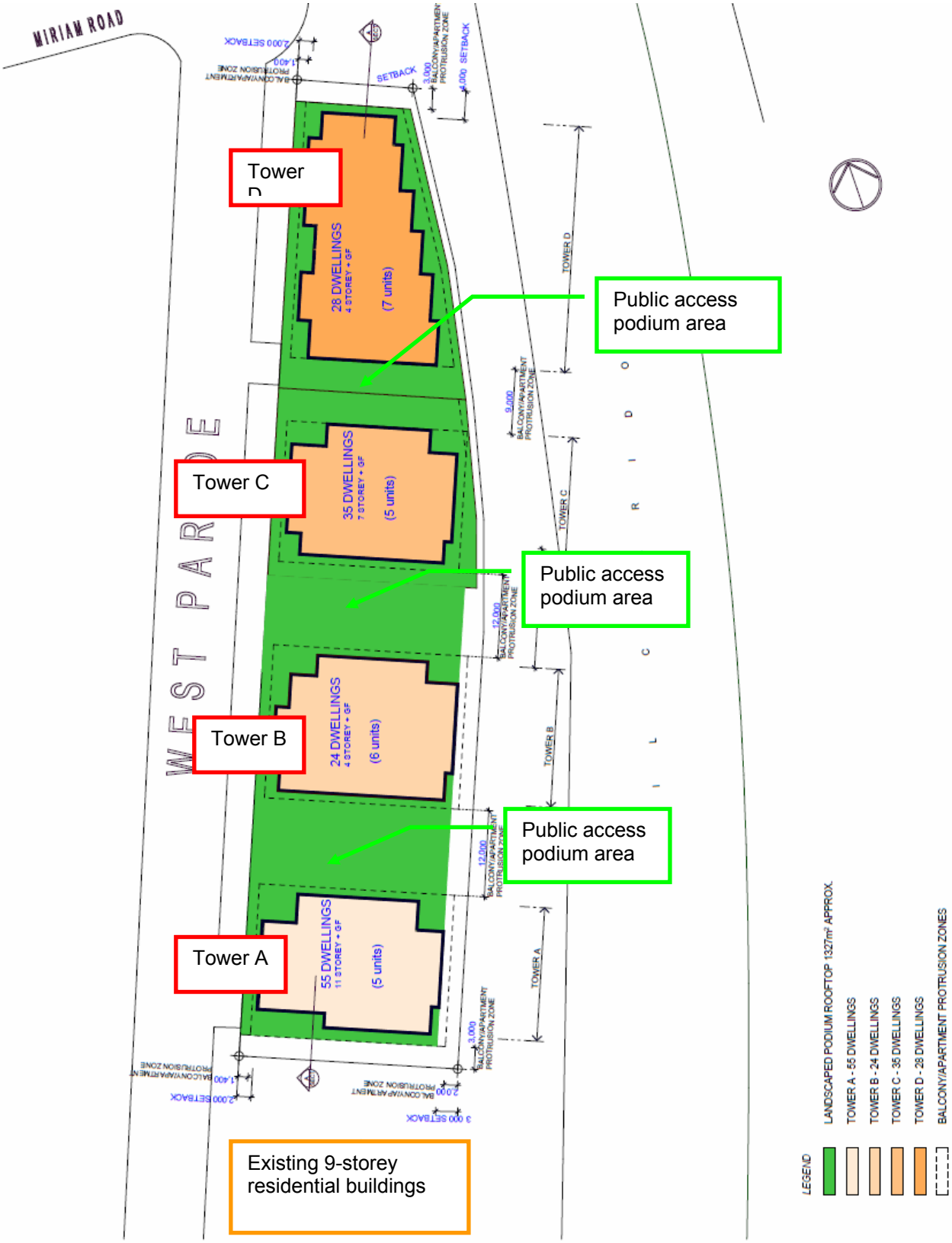


Figure 3 Level 1 - Points of Interest Regarding Public Access



4.2.1 Northeasterly Winds

Location	Wind Impact
Pedestrian footpath along West Parade	Potential impact here should be **below 16 m/sec**, except at the northern end of the development where winds will be **approaching the 16 m/sec level**, affected by: • Acceleration of winds around the northern corner of the development. • Existing landscaping to the north (corner Miriam Rd – West Parade). • Shielding from the development itself.
Tower and Retail Entrances on West Parade	Potential impact here should be **below 16 m/sec**, affected by: • Shielding from the development itself. • Existing Landscaping along pedestrian footpath on West Parade.
Public Access Areas on the Podium	Potential impact here should be **close to 16 m/sec**, affected by: • Shielding from the development itself. • Winds channelling between the towers. • Downwash generated by winds impacting the facade of primarily Tower A and Tower C and diverting towards the podium.
Tower Entrances on the Podium	Potential impact here should be **close to or at 16 m/sec**, affected by: • Shielding from the development itself. • Winds channelling between the towers. • Downwash generated by winds impacting the facade of primarily Tower A and Tower C and diverting towards the podium.
Tower A and Tower C upper level balconies	Potential impact should be **close to or above 10 m/s**, affected by: • Lack of shielding from upstream buildings. • High (although infrequent) winds impacting the balconies.

4.2.2 Southerly Winds

Location	Wind Impact
Pedestrian footpath along West Parade	Potential impact here should be **close to 16 m/sec**, affected by: • Shielding from upstream taller buildings. • Shielding from the development itself, primarily Tower A. • Acceleration of wind around southwest corner of development. • Mild channelling of winds along West Parade. • Existing landscaping along pedestrian footpath.
Tower and Retail Entrances on West Parade	Potential impact here should be **close to 16 m/sec**, affected by: • Shielding from upstream taller buildings. • Shielding from the development itself, primarily Tower A. • Mild channelling of winds along West Parade. • Existing landscaping along pedestrian footpath.
Public Access Areas on the Podium	Potential impact here should be **below 16 m/sec**, affected by: • Shielding from upstream taller buildings. • Shielding from the development itself. • Mild downwash generated by winds impacting the facade of primarily Tower C and diverting towards the podium.
Tower Entrances on the Podium	Potential impact here should be **close to 16 m/sec**, affected by: • Shielding from the development itself and upstream taller buildings • Downwash generated by winds impacting the facade of primarily Tower C and diverting towards the podium.
Tower A and Tower C upper level balconies	Potential impact should be **above 10 m/s**, affected by: • Windflow accelerating around upstream buildings. • High winds impacting the balconies.

4.2.3 Southeasterly Winds

Location	Wind Impact
Pedestrian footpath along West Parade	Potential impact here should be **close to or possibly above 16 m/sec**, affected by: • Shielding in some section by the development itself. • Acceleration of wind in other sections between the towers. • Existing and proposed landscaping along the eastern part of the development.
Tower and Retail Entrances on West Parade	Potential impact here should be **below 16 m/sec**, affected by: • Shielding from the development itself. • Existing and proposed landscaping to the east of the development.
Public Access Areas on the Podium	Potential impact here should be **close to or above 16 m/sec**, affected by: • Winds channelling between the towers. • Downwash generated by winds impacting the facade of primarily Tower C and diverting towards the podium.
Tower Entrances on the Podium	Potential impact here should be **close to or above 16 m/sec**, affected by: • Winds channelling between the towers. • Downwash generated by winds impacting the facade of primarily Tower C and diverting towards the podium.
Tower A and Tower C upper level balconies	Potential impact should be **above 10 m/s**, affected by: • Lack of shielding from upstream buildings. • Higher winds impacting the upper-level balconies.

4.2.4 Westerly Winds

Location	Wind Impact
Pedestrian footpath along West Parade	Potential impact here should be **close to or below 16 m/sec**, affected by: • Shielding from upstream low-rise buildings. • Existing landscaping along pedestrian footpath. • Mild downwash generated by winds impacting the west-facing facades of the development then diverting towards the ground.
Tower and Retail Entrances on West Parade	Potential impact here should be **close to or possibly above 16 m/sec**, affected by: • Shielding from upstream low-rise buildings. • Existing landscaping along pedestrian footpath. • Mild downwash generated by winds impacting the west-facing facades of the development then diverting towards the ground.
Public Access Areas on the Podium	Potential impact here should be **close to or above 16 m/sec**, affected by: • Some shielding from upstream low-rise buildings and the development itself. • Winds channelling between the towers.
Tower Entrances on the Podium	Potential impact here should be **close to or above 16 m/sec**, affected by: • Some shielding from upstream low-rise buildings and the development itself. • Winds channelling between the towers.
Tower A and Tower C upper level balconies	Potential impact should be **above 10 m/s**, affected by: • Lack of shielding from upstream (mainly low-rise) buildings. • High winds impacting the balconies.

5 WIND AMELIORATION RECOMMENDATIONS

On the basis of the expected wind impacts outlined in **Section 4**, recommendations for windbreak features are made in areas where winds are expected to approach or exceed:

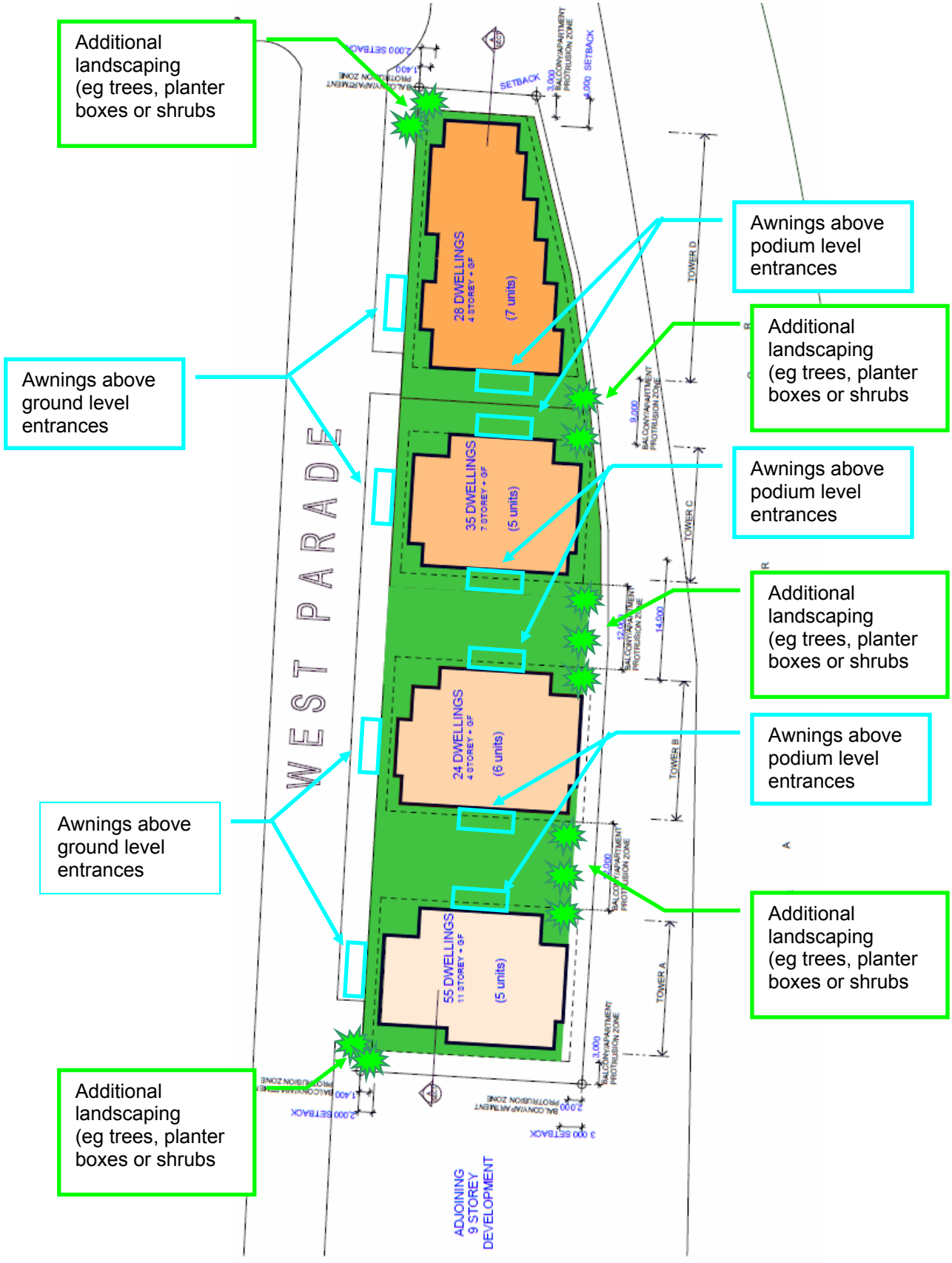
- the 16 m/sec walking comfort criterion.
- the 10 m/s dining comfort criterion.

Table 2 Windbreak Recommendations

Location of Interest	Wind Impact Potential	Windbreak Treatment Recommendations
Pedestrian footpath along West Parade	**Medium** Winds likely to be close to or above 16 m/s for winds from the northeast, southeast and southwest at the north and south ends of the development	There is existing landscape along the pedestrian footpath. **Consideration for potential mitigation** Additional landscaping elements are recommended close to the northwestern and around southwestern corners of development to reduce acceleration of wind around the extremities of the development.
Tower and Retail Entrances on West Parade	**Medium** Winds likely to be close to or above 16 m/s for west quadrant winds	There is existing landscape along West Parade. **Consideration for potential mitigation** Awnings are recommended above all main (west-facing) entrance points to minimise any downwash for westerly winds. The awnings should span at least 1 m either side of the entrance and extend a minimum of 3 m from the facade.
Public Access Areas on the Podium	**Medium** Winds likely to be close to or above 16 m/s for southeast and west quadrant winds	There will be shielding by low-rise buildings and landscaping to the east and west. **Consideration for potential mitigation** Wind mitigation such as staggered vertical screens or landscaping (eg trees, shrubs, and planter boxes) should be positioned to minimise channelling of wind between the facades.
Tower Entrances on the Podium	**Medium** Winds likely to be close to or above 16 m/s for all directions.	There will be shielding by low-rise buildings and landscaping to the east and west. **Consideration for potential mitigation** Awnings are recommended above all main (west-facing) entrance points to minimise any downwash for westerly winds. The awnings should span at least 1 m either side of the entrance and extend a minimum of 3 m from the facade.
Tower A and Tower C upper level balconies	**Medium** Winds likely to be above 10 m/s	There is minimal shielding except by the taller buildings to the south. **Consideration for potential mitigation** Vertical windbreaks are recommended, eg moveable / operable louvres to disperse the wind and help deflect it from balconies and balcony doors.

Examples of wind mitigation recommendations are shown in **Figure 4**.

Figure 4 Wind Mitigation Recommendations



6 CONCLUSION

Heggies Pty Ltd (Heggies) has been engaged by Housing NSW to assess the environmental impact of the proposed West Ryde Housing Development on 63-77 West Parade, West Ryde, with respect to Environmental Wind Effects.

Existing Winds

Existing street level wind conditions in the vicinity of the site are likely to be either close to or below the 16 m/sec *"walking comfort"* criterion for many prevailing wind directions given the varying degree of shielding (or lack thereof) afforded to the site by surrounding buildings.

Future Wind Environment

In terms of the *future* wind environment with the proposed development, the following features of the development are noted as being of most significance:

- The development is shielded by numerous 3-storey residential buildings to the west of the site and two 9-storey residential towers to the south
- Pedestrian areas along West Parade are somewhat protected from adverse winds by existing landscaping.
- The corners of the development towards West Parade are likely to experience winds above the 16 m/s *"walking comfort"* criterion due to wind acceleration around the corners.
- The podium area is likely to exceed the 16 m/s *"walking comfort"* criterion due to channelling of wind between the development buildings and downwash created by the wind impacting the high towers and being diverted towards the podium.
- Upper level balconies have the potential for elevated wind due to lack of shielding.

Wind Amelioration

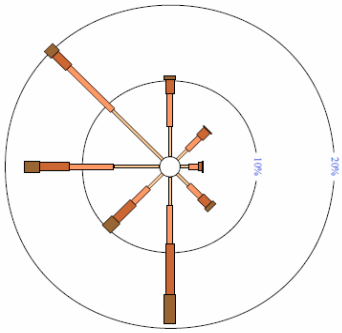
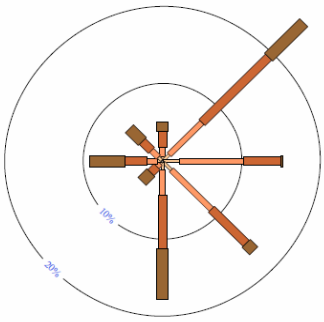
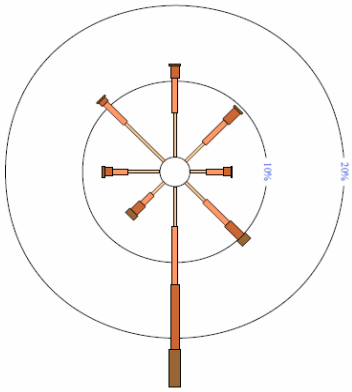
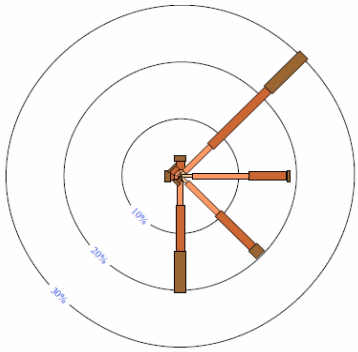
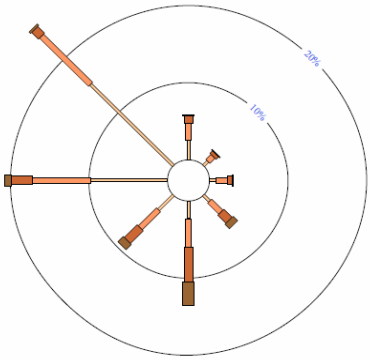
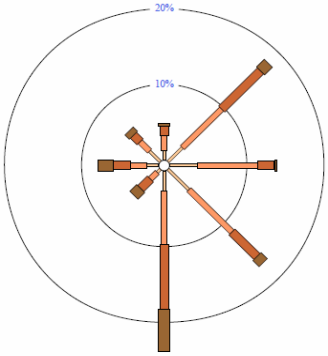
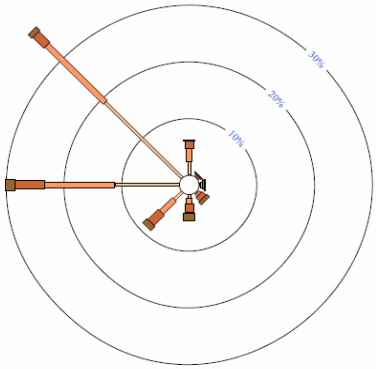
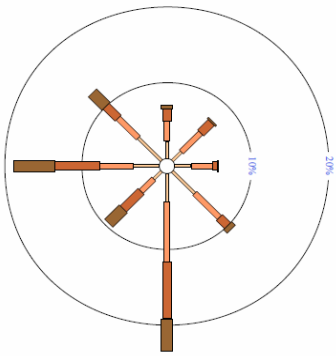
Suggested wind ameliorations to comply with the criterion are:

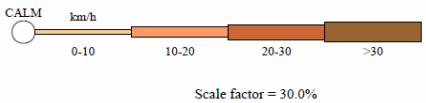
- Additional windbreaks, eg staggered vertical screens or landscaping such as trees, shrubs or planterboxes close to the southwest and northwest corners of the development at ground level.
- Additional windbreaks, eg staggered vertical screens or landscaping such as trees, shrubs or planterboxes between the towers at Podium level.
- Awnings above West Parade entrances and podium entrances to minimise any downwash. The awnings should span at least 1 m past the width of the entrance either side and extend a minimum of 3 m from the building facade.
- Vertical louvres should be fitted to upper level balconies to help in the dispersion of high winds.

Accordingly, it has been predicted that ground level and podium level wind speeds along all surrounding public footpaths and public access areas will either remain at their present levels or decrease slightly with the addition of the proposed development and its wind mitigation treatments.

The above analysis has been made on the basis of our best engineering judgment and on the experience gained from model scale wind tunnel testing of a range of developments of similar magnitude to the currently proposed development.

SYDNEY WIND ROSES

	Morning Winds	Afternoon Winds
Spring		
Summer		
Autumn		
Winter		



Scale factor = 30.0%