



HEGGIES

REPORT 10-7707-R2

Revision 1

**Garvan St Vincent's Campus
Cancer Centre
Qualitative Wind Impact Assessment**

PREPARED FOR

**Capital Insight Pty Ltd
77 Berry Street
NORTH SYDNEY NSW 2060**

9 JUNE 2009

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Garvan St Vincent's Campus Cancer Centre Qualitative Wind Impact Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-7707-R2	Revision 1	9 June 2009	Sophie Wong Kai In	Dr Peter Georgiou	Dr Neihad Al-Khalidy
10-7707-R2	Revision 0	28 April 2009	Sophie Wong Kai In	Dr Peter Georgiou	Dr Neihad Al-Khalidy



EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been engaged by Capital Insight Pty Ltd on behalf of Garvan and St Vincent & Mater Health Sydney to assess the environmental impact of the proposed Garvan St Vincents Campus Cancer Centre (GSVCCC) at 362 Victoria Street, Darlinghurst, with respect to Environmental Wind Effects.

The proposed development site is bounded by Victoria Street on the west. Liverpool Street and Burton Street are located on the north and south of the development site respectively. The area surrounding the development comprises of low to mid-rise commercial buildings:

The proposed development will be an eleven storey building comprising:

- Five levels of underground carpark;
- Retail area on the ground floor (Level 4) with access to Victoria Street
- Reception and medical/commercial area on the ground floor with entrance on Victoria Street;
- Common courtyard on the ground floor on the west of the proposed building with outdoor dining tables.
- A terrace garden on the northern side of level 6;
- The north façade of Levels 7 to 14 is set back by 13 m.

Existing Winds

Existing street level wind conditions in the vicinity of the site are likely to be either close to or under 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 site is shielded by numerous mid-rise buildings from the north clockwise through to the south.
- Awnings are already planned above all the entrances on Victoria Street and above the pedestrian footpath which will minimise the potential for “downwash” winds to occur, ie winds which impact on the west-facing façade of the development and are then deflected back towards the ground.
- Pedestrian areas located on the west and east side of the development are protected from adverse winds by existing and planned landscaping.
- The outdoor meeting area on the east side of the development is shield by adjacent buildings and the proposed development.

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



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Appendix A SYDNEY WIND ROSES



1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been engaged by Capital Insight Pty Ltd on behalf of Garvan and St Vincent & Mater Health Sydney to assess the environmental impact of the proposed Garvan St Vincents Campus Cancer Centre (GSVCCC) at 362 Victoria Street, Darlinghurst, with respect to Environmental Wind Effects.

1.1 Development Site

An aerial view of the site is shown in **Figure 1**. The proposed development site is bounded by Victoria Street on the west. Liverpool Street and Burton Street are located on the north and south of the development site respectively. The area surrounding the development comprises:

- 5 to 8 storey Garvan Institute Building immediate southeast through to south of the development site
- 2-storey Green Park Hotel located immediate north to the development site
- 9-storey Lowy Packer Building located immediate east to the development site
- mid to high rise buildings to the south of Burton Street (St Vincents Hospital precinct)
- 2-storey buildings on the opposite side of Victoria Street, west to the development site
- 8-storey building at the northeast of Liverpool and Victoria Street junction

Figure 1 Site Location





1.2 Development Description

The development site currently consists of a mix of low-rise commercial buildings that are to be demolished and replaced by the proposed Garvan St Vincents Campus Cancer Centre (GSVCCC). The proposed development will be an eleven storey building comprising:

- Five levels of underground carpark;
- Retail area on the ground floor (Level 4) with access to Victoria Street
- Reception and medical/commercial area on the ground floor with entrance on Victoria Street;
- Common courtyard on the ground floor on the west of the proposed building with outdoor dining tables.
- A roof garden on the northern side of level 6;
- The north façade of Levels 7 to 14 is set back by 13 m.

Prevailing wind directions of interest in Sydney are from northeast, southerly, southeast and westerly winds.



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, especially close to the ground, to the north clockwise to the south from the existing low-to-mid rise buildings surrounding the site.
- Further afield, mid-to-high rise buildings within the eastern fringes of the Sydney CBD precinct will ameliorate west-northwest quadrant winds, while the drop in topography to the east will enable speed-up of winds at upper levels approaching from this direction.



3 WIND ACCEPTABILITY CRITERIA

3.1 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, including those of Sydney 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.

3.2 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 under 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.

Northeast Winds

Good shielding is available to the northeast from the high-rise buildings on the north of Liverpool Street and from the 9-Storey Packer Lowy Building, as well as other developments further upstream. In addition, northeast winds are generally mild and the potential therefore 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.

Southeast Quadrant (Southeast to South) Winds

The presence of 5-8 storey Garvan Institute Building immediately upstream should result in wind conditions close to the ground being below the 16 m/sec criterion from these directions. Winds at elevated heights however will tend to be considerably stronger.

West Quadrant (Northwest to Southwest) Winds

Westerly winds, which provide the highest winds affecting the Sydney region. The ground level is reasonably shielded by the low rise building on the west of Victoria Street, as well as other developments further upstream. Therefore the wind conditions should 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 as there is not upstream shielding at elevated heights.

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 **Figures 2 and 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 (Level 4) - Points of Interest Regarding Public Access

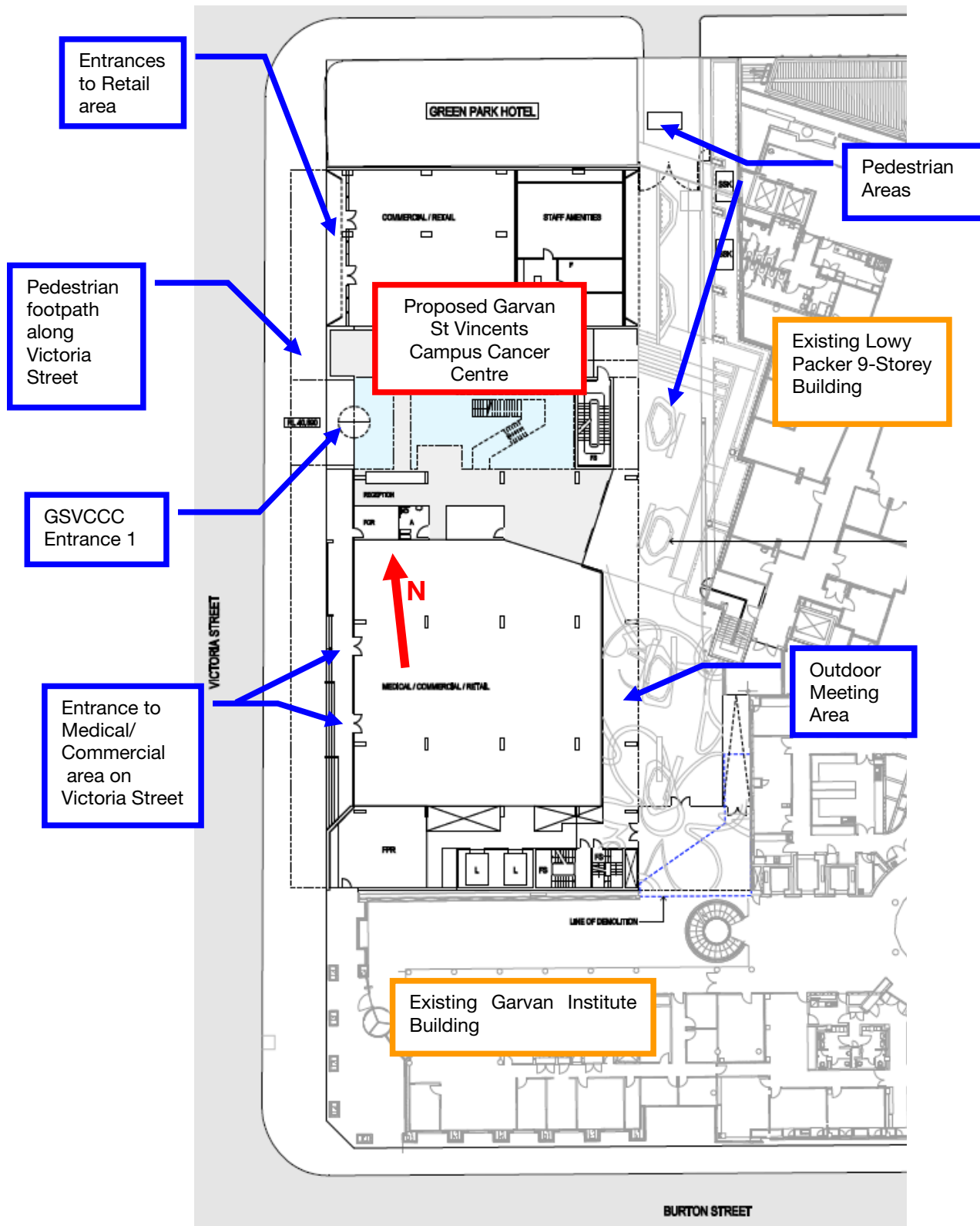
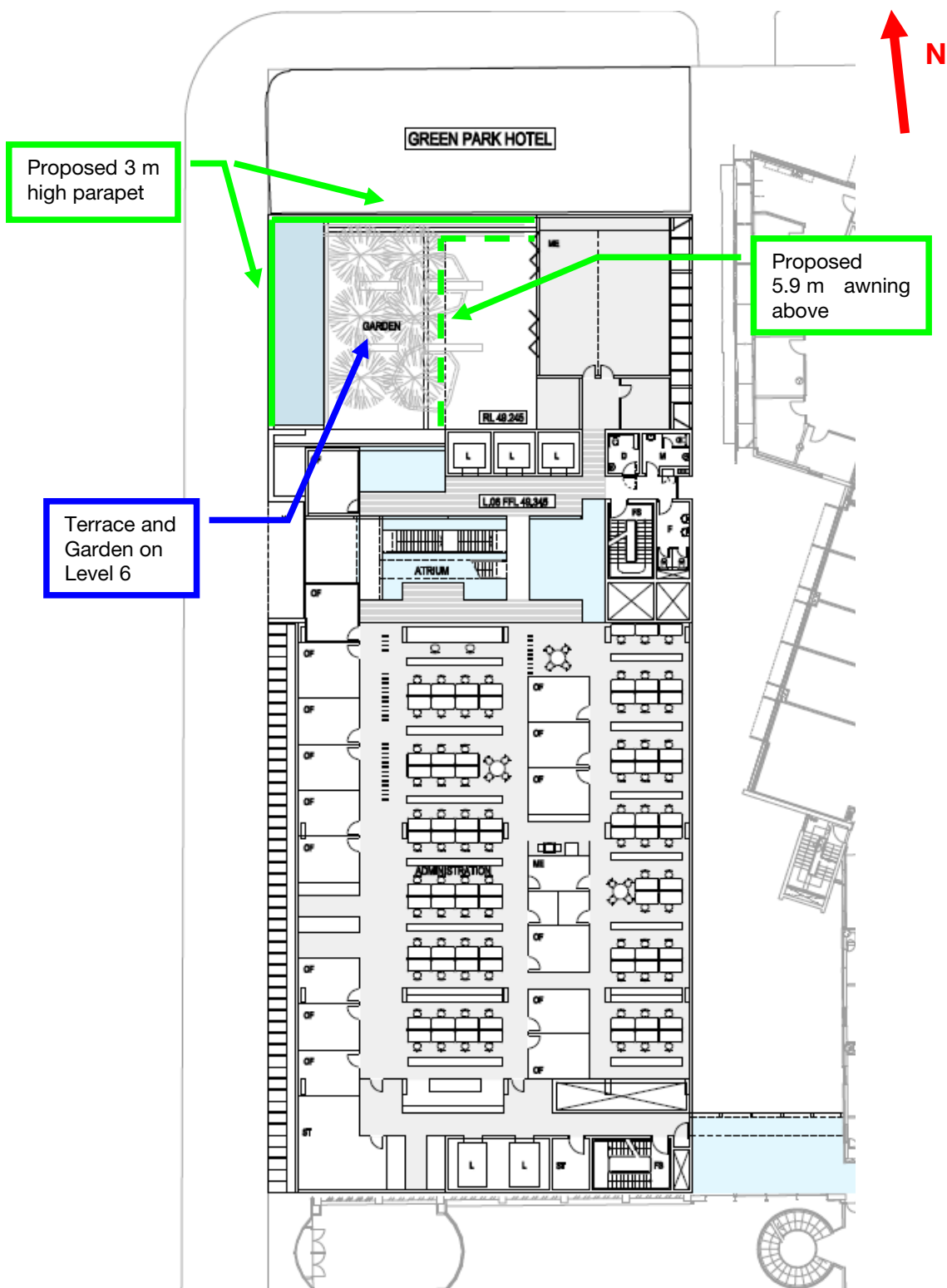




Figure 3 Level 6 - Points of Interest Regarding Public Access





4.2.1 Northeast Winds

Location	Wind Impact
Pedestrian footpath along Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings and the development itself.• Winds channelling along Victoria Street• Existing Landscaping along pedestrian footpath.
Entrance to Retail Area on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings and the development itself.• Winds channelling along Victoria Street• Existing Landscaping along pedestrian footpath.
Entrance to Garvan St Vincent Campus Cancer Centre on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings and the development itself.• Winds channelling along Victoria Street• Existing Landscaping along pedestrian footpath.
Entrance to Medical/Commercial Area on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings and the development itself.• Winds channelling along Victoria Street• Existing Landscaping along pedestrian footpath.
Pedestrian walkway along the eastern façades of the development	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Landscaping already planned along east side footpath
Outdoor Meeting area along the south of the eastern façade of the development	Potential impact here should be below or close to 10 m/sec dining criterion , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings• Landscaping already planned along east side footpath.
Level 6 Terrace and Garden	Potential impact here should be below or close to 10 m/sec , affected by: <ul style="list-style-type: none">• Shielding from upstream buildings.• Shielding from the meeting room on the east of the terrace garden area.• Winds accelerating over the roof of the Glenmore hotel and flowing towards the terrace• Proposed 3 m high parapet surrounding the garden area will reduce the wind impact.



4.2.2 South and Southeast Winds

Location	Wind Impact
Pedestrian footpath along Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.
Entrance to Retail Area on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.
Entrance to Garvan St Vincent Campus Cancer Centre on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.
Entrance to Medical/Commercial Area on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.
Pedestrian walkway along the eastern façades of the development	Potential impact here should be well below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Landscaping already planned along east side footpath
Outdoor Meeting area along the south of the eastern façade of the development	Potential impact here should be below to 10 m/sec dining criterion , affected by: <ul style="list-style-type: none">• Shielding from the immediate south building.
Level 6 Terrace and Garden	Potential impact here should be below 10 m/sec , affected by: <ul style="list-style-type: none">• Shielding from upstream buildings.• Shielding from the development itself.



4.2.3 Westerly Winds

Location	Wind Impact
Pedestrian walkway along Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.• Downwash generating by winds impacting the west-facing façade of the development then diverted towards the ground.• Awnings above the pedestrian areas will minimise the downwash from the westerly winds impacting the west-facing façade.
Entrance to Retail Area on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.• Downwash generating by winds impacting the west-facing façade of the development then diverted towards the ground.• Awnings above the entrance will minimise the downwash from the westerly winds impacting the west-facing façade.
Entrance to Garvan St Vincent Campus Cancer Centre on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.• Downwash generating by winds impacting the west-facing façade of the development then diverted towards the ground.• Awnings above the entrance will minimise the downwash from the westerly winds impacting the west-facing façade.
Entrance to Medical/Commercial Area on Victoria Street	Potential impact here should be below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the upstream buildings.• Existing Landscaping along pedestrian footpath.• Downwash generating by winds impacting the west-facing façade of the development then diverted towards the ground.• Awnings above the entrance will minimise the downwash from the westerly winds impacting the west-facing façade.
Pedestrian walkway along the eastern façades of the development	Potential impact here should be well below 16 m/sec , affected by: <ul style="list-style-type: none">• Shielding from the development itself.
Outdoor Meeting area along the south of the eastern façade of the development	Potential impact here should be below to 10 m/sec dining criterion , affected by: <ul style="list-style-type: none">• Shielding from the development itself.
Level 6 Terrace and Garden	Potential impact here should be below to 10 m/sec , affected by: <ul style="list-style-type: none">• Minimal shielding at the elevated height• Proposed 3 m high parapet surrounding the garden area will reduce the wind impact.• Downwash generated by winds impacting the west-facing façade of the meeting room located east to the terrace then diverted towards the terrace floor.• 5.9 m awning extending from the meeting room western façade will minimise the downwash.



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; or
- the 10 m/sec outdoor dining criterion.

Table 2 Windbreak Recommendations

Location of Interest	Wind Impact Potential	Windbreak Treatment Recommendations
Pedestrian footpath along Victoria Street	Mild Winds likely to be <16 m/s for all directions	Existing landscape along the pedestrian footpath. Awnings are already planned above the footpath. Consideration for potential mitigation Nil.
Entrance to Retail Area on Victoria Street	Mild Winds likely to be <16 m/s for all directions	Awning is already planned above the Entrance minimising any downwash. Consideration for potential mitigation Nil.
Entrance to Garvan St Vincent Campus Cancer Centre on Victoria Street	Mild Winds likely to be <16 m/s for all directions	Awning is already planned above the Entrance minimising any downwash. Consideration for potential mitigation Nil.
Entrance to Medical/ Commercial Area on Victoria Street	Mild Winds likely to be <16 m/s for all directions	Awning is already planned above the Entrance minimising any downwash. Consideration for potential mitigation Nil.
Pedestrian walkway along the eastern façades of the development	Mild Winds likely to be <16 m/s for all directions	The walkway is shielded by the Packer Lowy building on the east, the proposed development on the west and the Garvan Institute Foundation on the south Consideration for potential mitigation Nil.
Outdoor Meeting Area along the south of the eastern façade of the development	Mild Winds likely to be <10 m/s for all directions	The meeting area is shielded by the Packer Lowy building on the east, the proposed development on the west and the Garvan Institute on the south Consideration for potential mitigation Nil.
Level 6 Terrace and Garden	Mild Winds likely to be <10 m/s for all directions	Vertical windbreak, landscaping and awning are already planned for the Terrace and Garden area (see Figure 3), minimising the wind impact from the west clockwise through to the north. Consideration for potential mitigation Nil.



6 CONCLUSION

Heggies Pty Ltd (Heggies) has been engaged by Capital Insight Pty Ltd on behalf of Garvan and St Vincent & Mater Health Sydney to assess the environmental impact of the proposed Garvan St Vincents Campus Cancer Centre at 362 Victoria Street, Darlinghurst, with respect to Environmental Wind Effects.

The proposed development is bounded by Victoria Street on the west and surrounded by mid to high-rise buildings on the north clockwise through the south.

Prevailing wind directions of interest in Sydney are from northeast, southerly, southeast and westerly winds. Their seasonal variation is described in **Section 2** of this report.

Existing Winds

Existing street level wind conditions in the vicinity of the site are likely to be either close to or under 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 site is shielded by numerous mid-rise buildings from the north clockwise through to the south.
- Awnings are already planned above all the entrances on Victoria Street and above the pedestrian footpath which will minimise the potential for “downwash” winds to occur, ie winds which impact on the west-facing façade of the development and are then deflected back towards the ground.
- Pedestrian areas located on the west and east side of the development are protected from adverse winds by existing and planned landscaping.
- The outdoor meeting area on the east side of the development is shield by adjacent buildings and the proposed development.
- 3 m high parapet (vertical windbreak), landscaping and awning are already planned for the Terrace and Garden area, minimising the wind impact from the west clockwise through to the north.

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

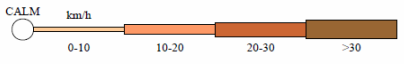
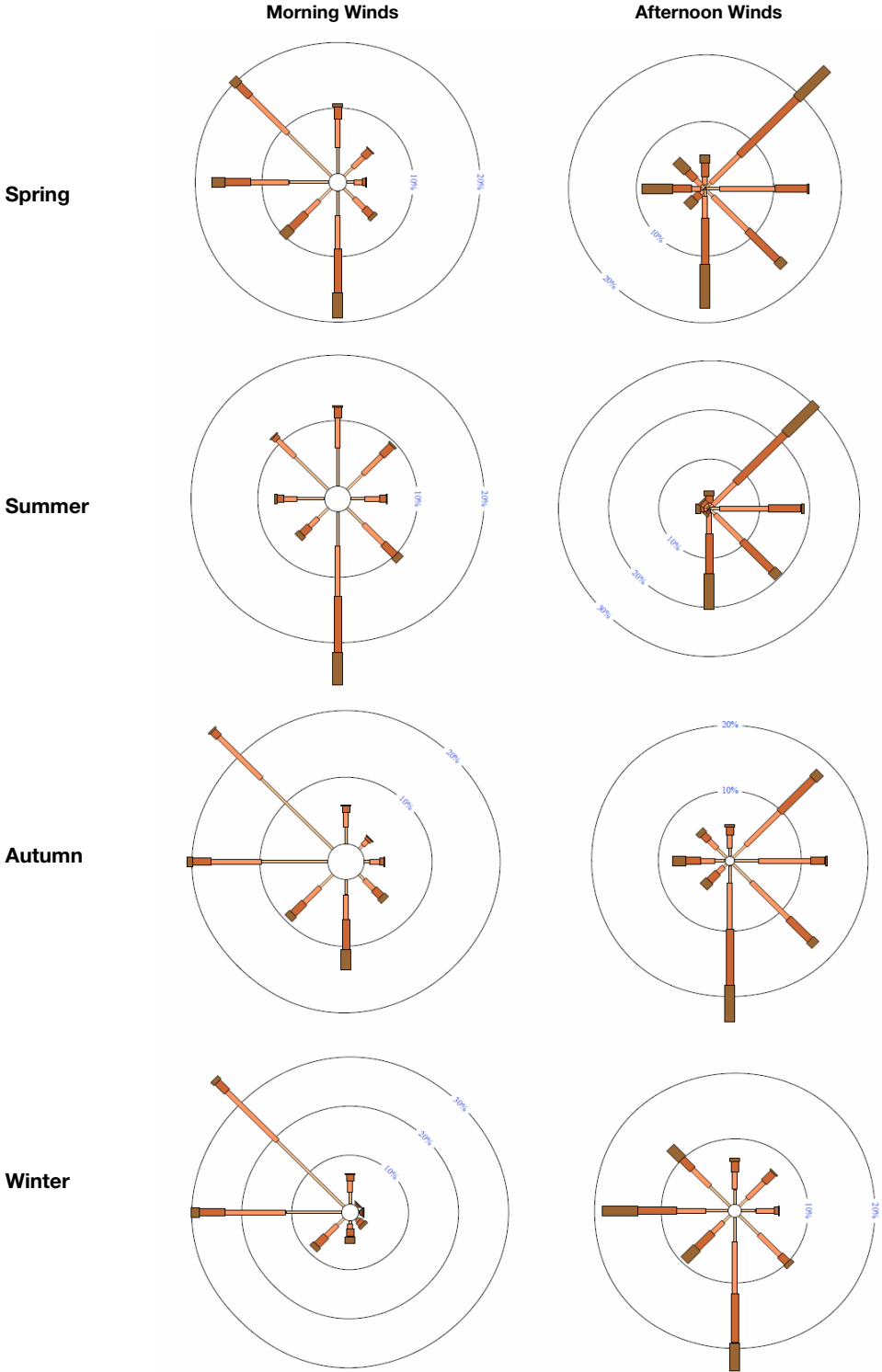
The above analysis has been made on the basis of our best engineering judgment and on the experience gained from model scale wind tunnel testing of a range of developments of similar magnitude to the currently proposed development. The analysis can be confirmed via model scale wind tunnel testing during the detailed design phase of the project.

Appendix A

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SYDNEY WIND ROSES



Scale factor = 30.0%