11-17 COLUMBIA LANE, HOMEBUSH

Qualitative Wind Assessment

Prepared for:

JQZ
PO Box 686
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SLR Ref: 610.17674-R01
Version No: -v1.2
August 2019

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with JQZ (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.17674-R01-v1.2	21 August 2019	Peter Hayman	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
610.17674-R01-v1.1	7 August 2019	Peter Hayman	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
610.17674-R01-v1.0	2 August 2019	Peter Hayman	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy

EXECUTIVE SUMMARY

SLR Consulting Pty Ltd (SLR) has been engaged by JQZ to assess the environmental impact of the proposed 11-17 Columbia Lane, Homebush mixed used development, with regard to the wind environment in and around the site. This report will form part of the development application to the Strathfield Council.

The area surrounding the proposed development site has a range of building types and sizes. This includes four neighbouring high-rises which will provide the proposed site with good ground level protection from northerly and westerly winds.

Local Wind Climate

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) provide the strongest winds for the whole year.

Existing Winds

Existing street level wind conditions in the vicinity of the site are likely to be close to the 16 m/s “walking comfort” criterion for some prevailing wind directions given the degree of shielding afforded to the site by surrounding buildings and vegetation.

Future Wind Environment

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

- There is some low level shielding in most directions and significant shielding to the west and north east from the large neighbouring buildings.
- There is significant vegetation throughout the site which is part of the proposed landscape design. This will help to shield adverse winds.
- Glazed screens have been added to corner balconies to provide shielding to one aspect.

Accordingly, it is the opinion of SLR that ground levels wind speeds within all public access areas surrounding the development would remain at their present levels or be reduced with the addition of the proposed development and its wind mitigation treatments, thereby meeting the Council requirements.

The above analysis has been made on the basis of our best engineering judgment and on the experience gained from scale model wind tunnel testing or computational fluid dynamics analysis of a range of developments. The conclusions of this SLR report will be checked during the upcoming wind tunnel testing, with specific design mitigations to be confirmed during the detailed design phase of the proposed development.

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1 Introduction

SLR has been engaged by JQZ to assess the environmental impact of the proposed 11-17 Columbia Lane, Homebush mixed used development, with regard to the wind environment in and around the site. This report will form part of the development application to the Strathfield Council.

1.2 Proposed Site Location

The development site is bounded by Columbia Lane to the east, Gramophone Lane to the north and the Powells Creek stormwater canal to the south and west. The Nipper Street Extension also runs through the site. There are train lines to the south and east and Parramatta Road and the M4 to the north. The site is approximately 200 m east of Homebush Train Station – refer **Figure 1**.

Figure 1 Site Location

Image: Nearmap (July 2019)

1.3 Proposed Development Description

The proposed mixed-use development will comprise:

- Maximum GFA of 32,840sqm;
- A 25 storey (Building A) and 26 storey (Building B) mixed-use building (two tower elements) with an 8 storey podium which includes a total of 398 apartments (inclusive of 5 ground floor live/work suites)
- 4 levels of basement car parking accommodating 494 car parking spaces.
- Landscaping works including the embellishment of a new communal open space area located in the north-eastern portion, a communal open space (courtyard) at ground level (western portion) and roof terraces above podium levels 7, 8 and 13.
- Provision of a public domain and new road corridor which includes an extension of Nipper Street to the south, providing a connection between Gramophone Lane and Columbia Lane.

Figure 2 Site Layout

Figure 3 View from Northeast

1.4 Surrounds

The area surrounding the proposed development site has a range of building types and sizes. To the north are two large residential developments that were completed in 2017. Beyond this is Parramatta Road and the M4 Motorway and further afield are 2-3 storey warehouses along the train line. To the northeast is the three storey Kennards Self Storage building. This is followed by the M4 and low level residential dwellings. To the east beyond the train line is mix of high-rise residential buildings which becomes low level residential around to the south east. On the south of the train line are a number of medium density blocks generally in the range of 2-4 storeys. There are also some high-rise residential buildings. This trend continues clockwise around to the south west. To the west and north west there is a mix of high-rises, low level residential and open space in the form of car parks, empty block and parks.

2 Sydney's Wind Climate

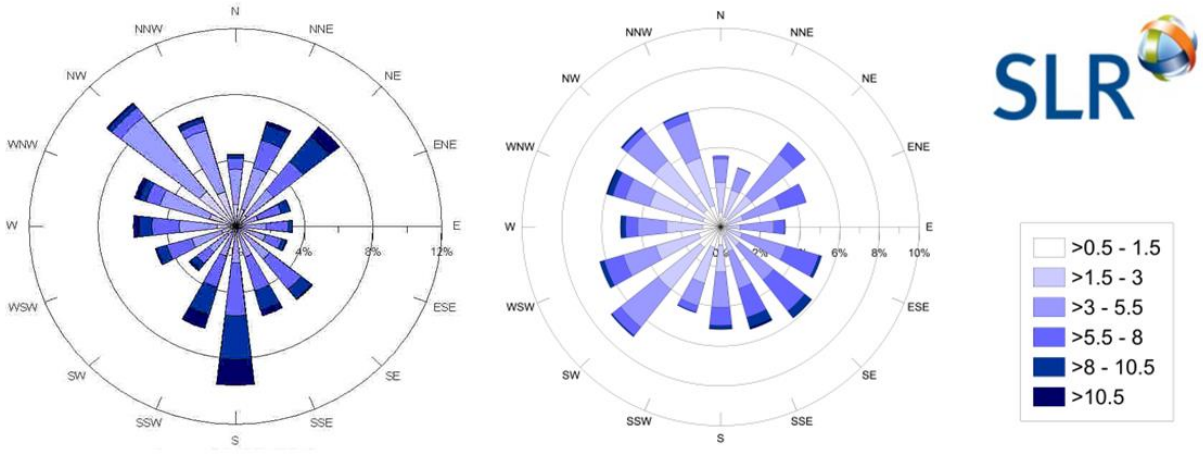
The data of interest in this study are the annual, extreme mean hourly wind speeds and largest gusts experienced throughout the year, how these winds vary with azimuth, and the seasonal break-up of winds into the primary Sydney wind seasons.

2.1 Seasonal Variations of Sydney's Regional Wind Climate

The key characteristics of Sydney's Regional Wind Climate are shown in the **Figure 4** wind rose, taken from Bureau of Meteorology met data recorded at Sydney Airport. The corresponding seasonal wind roses (refer **Appendix A**) show 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 southerly winds generally provide the strongest gusts during summer.
- Winter/Early Spring winds occur mainly from the west and the south. West quadrant winds provide the strongest winds during winter and in fact for the whole year.

Figure 4 Sydney Airport (Bureau of Meteorology Station) Annual Wind Rose



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, topography and built environment, which all influence the 'local' wind environment, including:

- Two large 14 storey developments to the north, completed in 2017
- The 17 storey brick apartment buildings to the west
- The site is more open directly to the south and south east although there are a number of medium density buildings on the south side of the train line which include some taller buildings around 11-13 storeys.

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 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 than for "walking comfort".

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 conditions satisfy the relevant criteria.

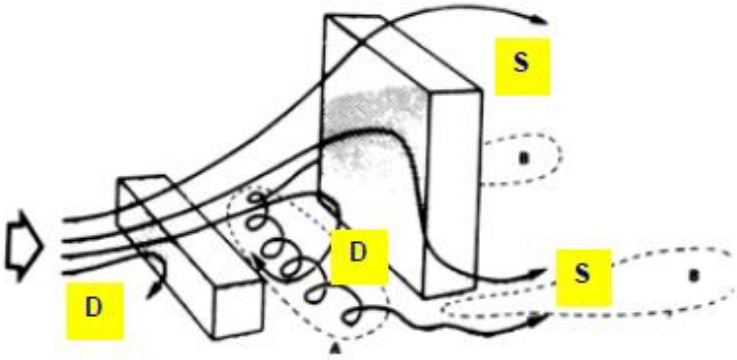
Finally, it is noted that the limiting wind speed criteria in **Table 1** are based on the maximum wind gust occurring (on average) once per year. Winds at all other times, i.e. monthly winds, weekly winds, etc., would be of lesser magnitude. So for example, a location with a maximum annual gust of 10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

4 Building-Wind Interactions – Some General Observations

The impact of wind flowing past buildings has well known general impacts at ground level – refer **Figure 4**. In general, the taller the building, the more pronounced the impact on ground level winds.

- **Downwash winds "D"** are the winds which impact on the windward face of a building and are then deflected downwards to Ground Level in a vertical direction; and
- Accelerating **Shearflow winds "S"** are the winds which experience acceleration as they pass by the building edges and roof as the wind flow moves around and past the building.

Figure 5 Windflow Patterns Past Regular-Shaped Buildings

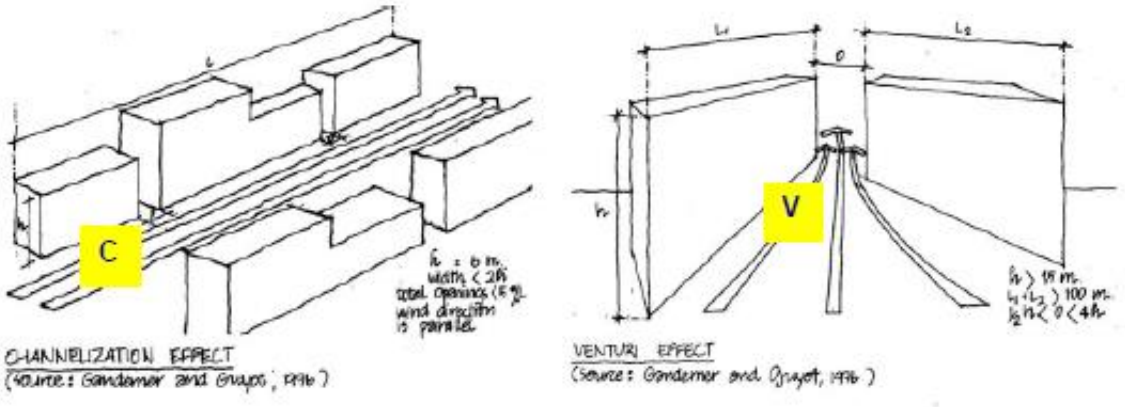


The grouping of buildings can also have an impact on resulting pedestrian winds – refer to **Figure 5**.

- **Channelling Effect winds "C"** result when there are rows of parallel buildings (especially taller ones) where the gaps in between line up with prevailing wind directions.

- **Venturi Effect winds "V"** result when wind flow is forced to pass between two converging buildings or groups of buildings with a resulting increase in flow.

Figure 6 Windflow Patterns Past Groups of Buildings



CHANNELIZATION EFFECT
(Source: Gandemer and Guyot, 1976)

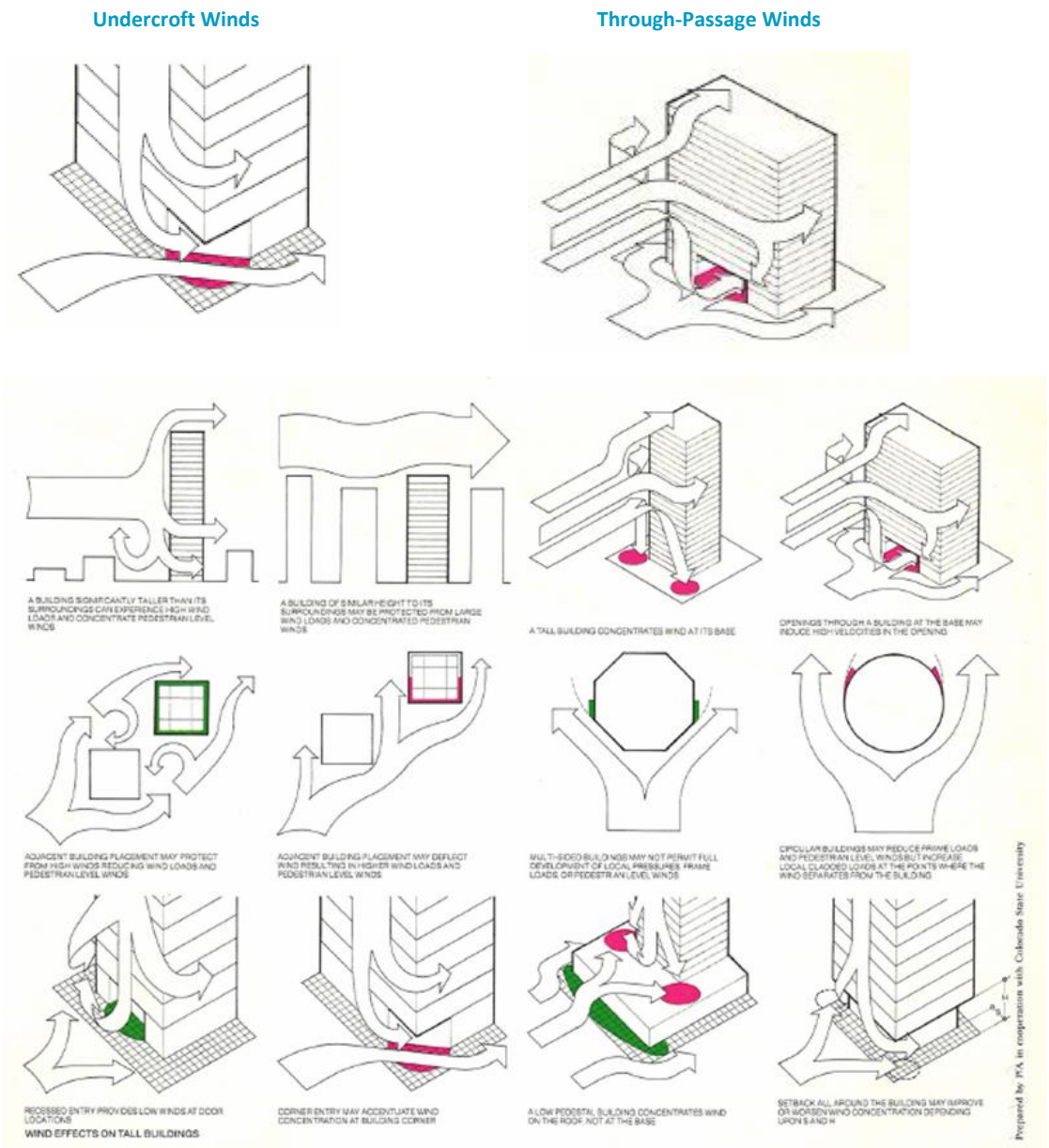
VENTURI EFFECT
(Source: Gandemer and Guyot, 1976)

Local building details can also influence winds in the immediate vicinity – refer **Figure 6**.

The **"Undercroft"** effect is a well-known adverse building-wind characteristic as depicted in the generic building wind effect diagrams shown below. The winds are induced towards the negative pressure area within the undercroft, creating concentrated adverse wind flow through undercroft. This same pressure difference between the windward and leeward facades of a building can induce a strong wind tunnel effect through any open passage located at the base of a building – the **"Through Passage"** effect.

These and other common building-related wind impacts are depicted in **Figure 6**.

Figure 7 Undercroft Winds and Through-Passage Winds



5 Wind Impact of the Proposed Development

5.1 Existing Winds – Wind Impacts and Effects

Existing street level wind conditions in the vicinity of the site could be close to 16 m/s *"walking comfort"* criterion for some prevailing wind directions, given the shielding afforded by the surrounding built environment which consists of buildings with a wide variety of heights. Potential adverse wind flows may arise is winds from the south as the site is more open in this direction.

Northeast Winds

Currently the site has good low level shielding with some medium and large buildings like the residential tower to the north and the storage building to the northeast. Northeast winds are generally mild and the potential therefore for exceedance of the 16 m/s criterion along the pedestrian pathways at the site is small, i.e. occurrences, if any, are likely to be very infrequent.

Southerly Winds

The site is more open to winds from the south and southeast although as noted previously there are a number of medium density buildings to the south that will provide some shielding. There is also a line of trees that provide some shielding to the site. That being said there may still be some potential for exceeding of the 16 m/s walking criterion from the southerly winds along Columbia Lane.

Westerly Winds

The upstream buildings and line of trees along the edge of the canal should provide good shielding to the site for winds from this direction. It is SLR's opinion that the 16m/s walking comfort criterion is unlikely to be exceeded even though winds from the west are generally the strongest across the year.

Upper Level Winds

Existing upper level wind conditions at the site are likely to exceed the 10 m/sec "outdoor seating" comfort criterion for some of the exposed wind directions, in particular southerly winds but also the north east and west directions at elevations above the height limits of surrounding buildings.

5.2 Future Winds – Predicted Wind Flow 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 (i.e. surrounding footpaths, primary entry points, internal public access areas, seating and dining areas, etc) are identified in **Figure 8, Figure 9, Figure 10, Figure 11** and **Figure 12**.

Figure 8 Areas of Interest (Ground Level)

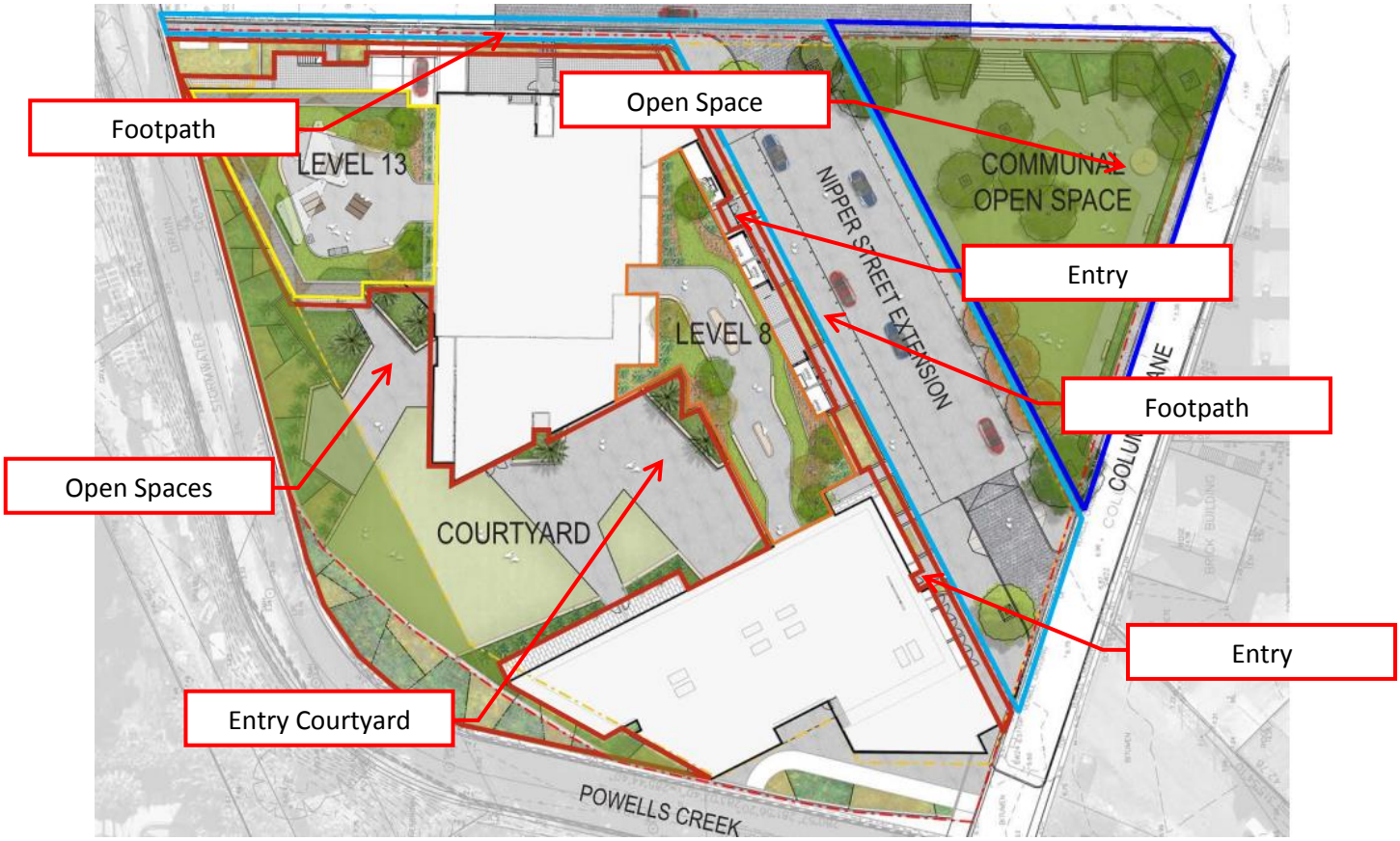


Figure 9 Areas of Interest (Levels 2-6)

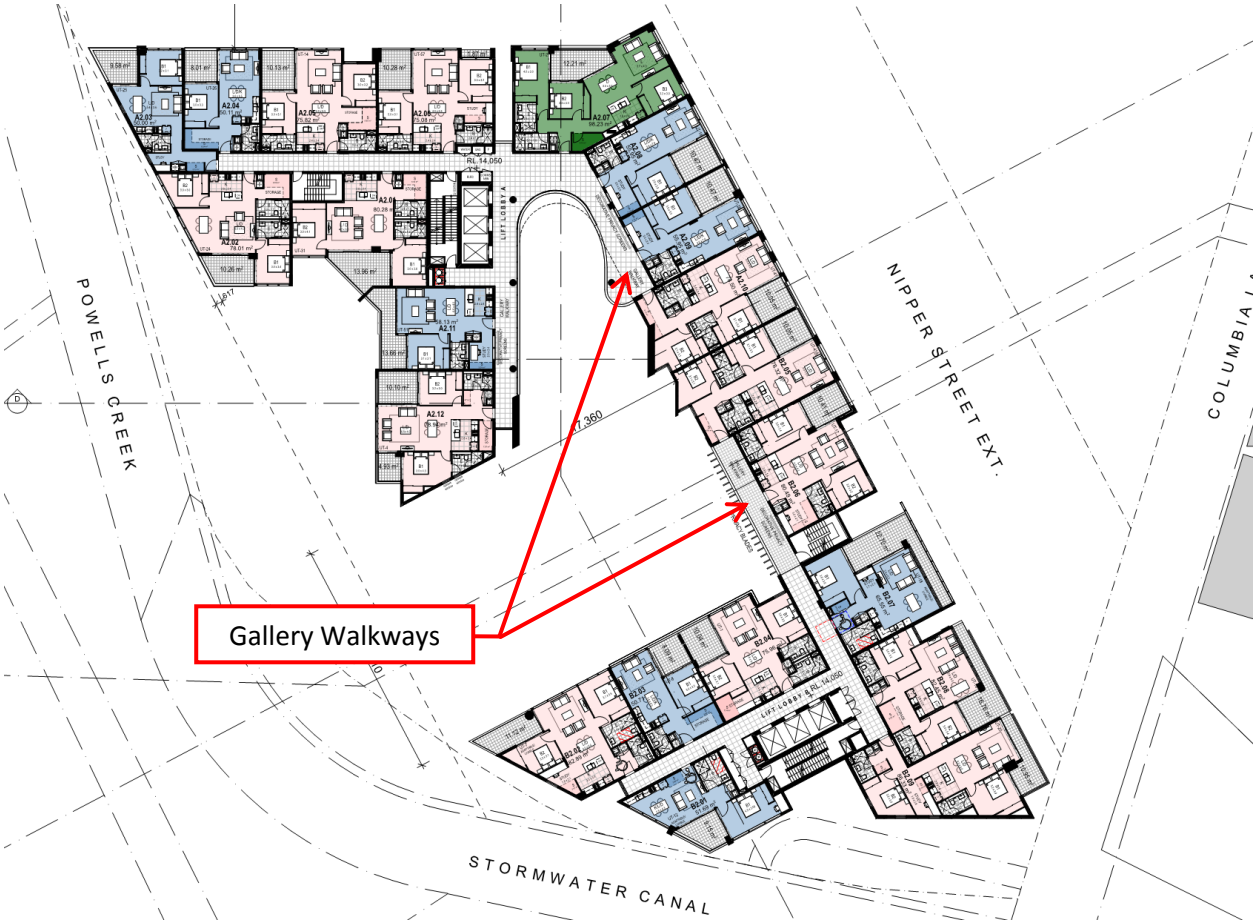


Figure 10 Areas of Interest (Level 7)

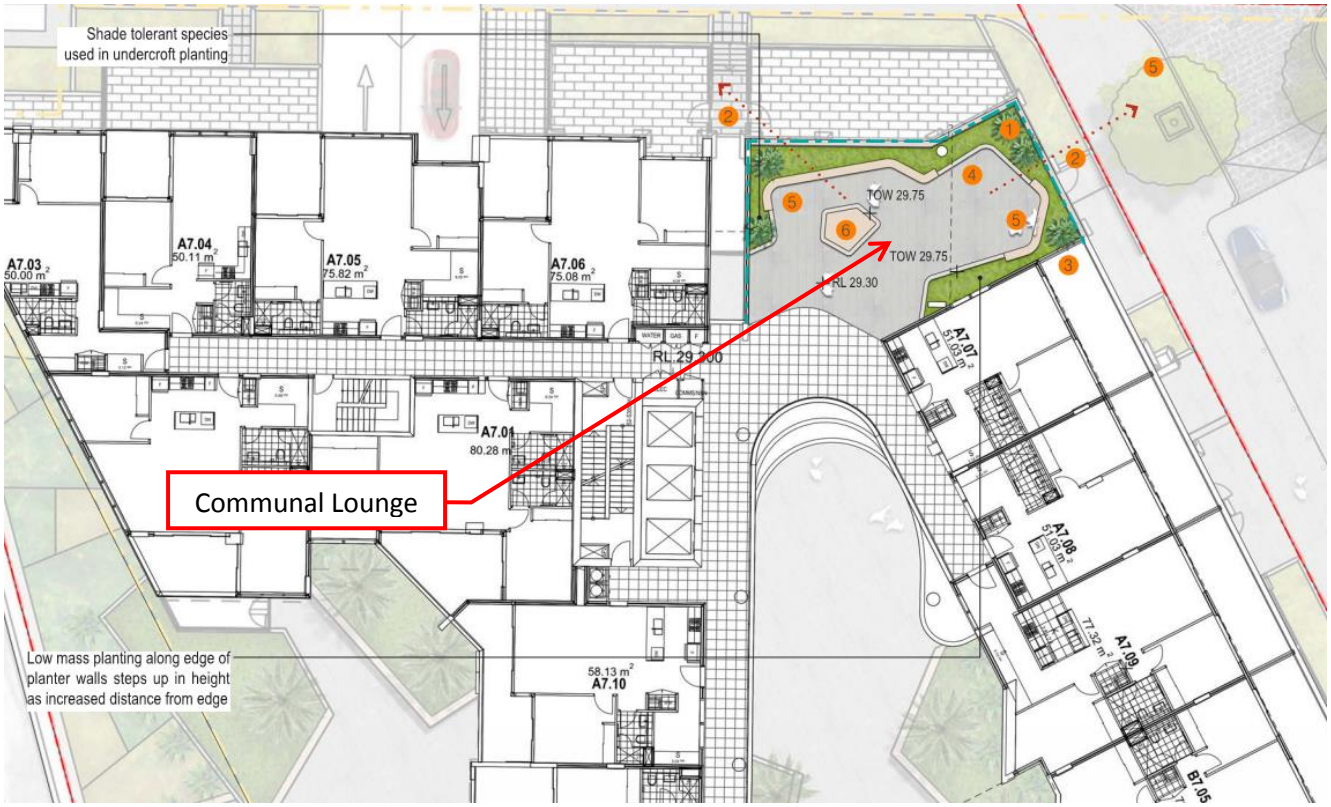


Figure 11 Areas of Interest (Levels 8)

Figure 12 Areas of Interest (Levels 13)

5.3 Future Wind Environment – Areas of Interest

The wind impact of the proposed development is described by examining the impact of prevailing wind conditions on areas of interest within and external to the development. The key directions analysed are north east, south/south east and westerly winds.

Location: **Gramophone Lane Pedestrian Footpath**
Wind Speed Target: **16 m/s – Comfortable Walking**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The Gramophone Lane footpath is located on the north side of the proposed site and will be well shielded by the upstream buildings.
South/Southeast	Likely comply	Along with some upstream buildings the footpath will receive shielding from the development itself
West	Likely comply	The upstream buildings in this direction will provide good shielding to the footpath area

Location: **Nipper Lane Extension Pedestrian Footpath**
Wind Speed Target: **16 m/s – Comfortable Walking**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The Nipper Lane Extension footpath faces the northeast divides the residential tower and the separate open space. This area will be well shielded by the upstream buildings.
South/Southeast	Likely comply	The upstream buildings will provide some shielding to this area. The footpath will receive shielding from the development itself in southerly winds. Planned landscaping and vegetation will also provide shielding.
West	Likely comply	The upstream buildings in this direction will provide good shielding to the footpath area along with the development itself.

Location: **Nipper Lane Extension Entries**
Wind Speed Target: **13 m/s – Standing, Waiting, Window Shopping**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The entries are well recessed and will receive shielding from the upstream buildings.
South/Southeast	Likely comply	The entries are well recessed and will receive shielding from the development itself.
West	Likely comply	The entries are well recessed and will receive shielding from the upstream buildings and the development itself.

Location: **Entry Courtyard**
Wind Speed Target: **10 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The courtyard area will be well shielded by the upstream buildings and the development itself.
South/Southeast	Likely comply	The courtyard area will receive some shielding from the upstream buildings and be well shielded by development itself.
West	Likely comply	The courtyard area will be well shielded by the upstream buildings and some shielded from the development itself.

Location: **Western Open Space**
Wind Speed Target: **10 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The common open space will be well shielded by the upstream buildings and the development itself.
South/Southeast	Likely comply	The common open space will receive some shielding from the upstream buildings and be well shielded by development itself.
West	Likely comply	The common open space will be well shielded by the upstream buildings.

Location: **Communal Open Space**
Wind Speed Target: **10 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The separate open space to the northeast of the residential building will be well shielded by the upstream buildings.
South/Southeast	Likely comply	The upstream buildings will provide some shielding. Landscaping and vegetation through the area will provide additional shielding
West	Likely comply	The separate open space will be well shielded by the upstream buildings and the development itself.

Location: **Gallery Walkways**
Wind Speed Target: **16 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The walkways will be well shielded by the development itself.
South/Southeast	Likely comply	The walkways will be well shielded by the development itself.
West	Likely comply	The walkways will be well shielded by the development itself and upstream buildings.

Location: **Level 7 Communal Lounge**
Wind Speed Target: **10 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	Shielding will be provided by the upstream buildings and the planned landscaping and screens that will be 1.8 metres high.
South/Southeast	Likely comply	Shielded will be provided by the development itself and the planned landscaping and vegetation.
West	Likely comply	Shielded will be provided by the development itself and the planned landscaping and vegetation. The upstream buildings will also provide shielding.

Location: **Level 8 Connection Garden**
Wind Speed Target: **10 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The space could be impacted by winds accelerating between the towers. Some shielding will be provided by the upstream buildings. Additional shielding will be provided by the planned 1.2 metre balustrade and vegetation throughout the space
South/Southeast	Likely comply	The central space will receive shielding from the development itself along with the planned landscaping and vegetation through the connection.
West	Likely comply	The open spaces will be well shielded by the towers to the west of the development site. The planned landscaping and vegetation will also provide shielding.

Location: **Level 13 Northern Garden**
Wind Speed Target: **10 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	The Northern Garden will receive shielding from the large towers to the north. Shielding will also be provided by the planned landscaping and vegetation.
South/Southeast	Likely comply	The space will receive good shielding in south easterly winds from the development itself. The planned 1.2 metre balustrade and vegetation throughout the space will also provide shielding.
West	Likely comply	The open spaces will be well shielded by the towers to the west of the development site. The planned landscaping and vegetation will also provide shielding.

Location: **Private Balconies and Terraces**
Wind Speed Target: **10 m/s – Dining in Outdoor Restaurant**

Direction	Future Compliance	Key Factors
Northeast	Likely comply	A number of balconies are recessed into the facade. Corner balconies have been given one open aspect
South/Southeast	Likely comply	A number of balconies are recessed into the facade. Corner balconies have been given one open aspect. The no-trafficable area of apartment B17.06 should be used as a planter to provide shielding
West	Likely comply	A number of balconies are recessed into the facade. Corner balconies have been given one open aspect

6 Wind Amelioration Recommendations

On the basis of the expected wind impacts outlined in previous four sections, recommendations for wind break features are made in areas where winds are expected to

- Approach or exceed 10 m/s, 13 m/s or 16 m/s depending on the designated use for that area.

These wind mitigation recommendations are summarised in **Table 2**. If these wind mitigation measures are implemented then SLR would expect compliance with the criteria stated in **Section 3**.

Table 2 Recommended Wind Mitigation

Location of Interest	Wind Impact Potential	Mitigation Recommendation
Footpath Along Gramophone Lane	**Low** Winds should be below 16m/s for all prevailing wind directions.	**No Mitigation Required** All planned landscaping and vegetation should be retained
Footpath Along Nipper Lane Extension	**Low** Winds should be below 16m/s for all prevailing wind directions.	**No Mitigation Required** All planned landscaping and vegetation should be retained
Nipper Lane Extension Entries	**Low** Winds should be below 13m/s for all prevailing wind directions.	**No Mitigation Required** Recesses of building entries from façade above should be retained. Additional landscaping could further reduce wind speeds around the building entries.
Entry Courtyard	**Low** Winds should be below 10m/s for all prevailing wind directions.	**No Mitigation Required** All planned landscaping and vegetation should be retained
Western Open Space	**Low** Winds should be below 10m/s for all prevailing wind directions.	**No Mitigation Required** All planned landscaping and vegetation should be retained
Communal Open Space	**Low** Winds should be below 10m/s for all prevailing wind directions.	**No Mitigation Required** All planned landscaping and vegetation should be retained
Gallery Walkways	**Low** Winds should be below 16m/s for all prevailing wind directions.	**No Mitigation Required**
Level 7 Communal Lounge	**Low** Winds should be below 10m/s for all prevailing wind directions.	**No Mitigation Required** Planned landscaping and screens to be retained
Level 8 Connection Garden	**Low** Winds should be below 10m/s for all prevailing wind directions.	**No Mitigation Required** Planned landscaping and screens to be retained
Level 13 Northern Garden	**Low** Winds should be below 10m/s for all prevailing wind directions.	**No Mitigation Required** Planned landscaping and screens to be retained

Location of Interest	Wind Impact Potential	Mitigation Recommendation
Private Balconies	**Low** Winds should be below 10 m/s for all prevailing wind directions.	**Mitigation Required** B17.06 to have dense vegetation on the non-trafficable part of the roof. Corner balconies have had glazed screens added to one aspect SLR recommends utilising Computational fluid Dynamics to quantify wind speeds at balconies and determine appropriate wind shielding, during detailed design.

7 Conclusion

Local Wind Climate

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) provide the strongest winds for the whole year.

Existing Winds

Existing street level wind conditions in the vicinity of the site are likely to be close to the 16 m/s "walking comfort" criterion for some prevailing wind directions given the degree of shielding afforded to the site by surrounding buildings and vegetation.

Future Wind Environment

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

- There is some low level shielding in most directions and significant shielding to the west and north east from the large neighbouring buildings.
- There is significant vegetation throughout the site which is part of the proposed landscape design. This will help to shield adverse winds.
- Glazed screens have been added to corner balconies to provide shielding to one aspect.

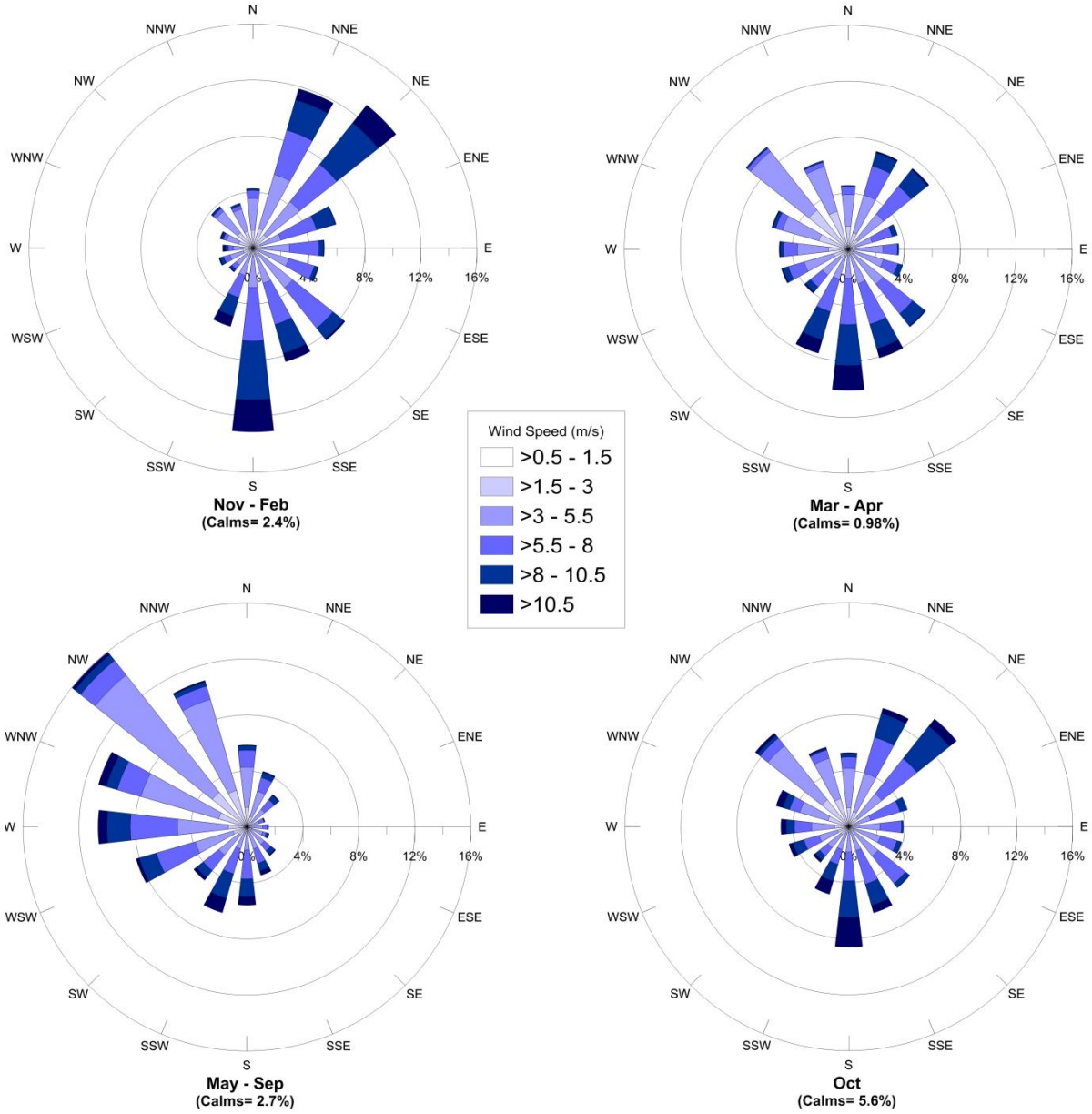
Accordingly, it is the opinion of SLR that ground levels wind speeds within all public access areas surrounding the development would remain at their present levels or be reduced with the addition of the proposed development and its wind mitigation treatments, thereby meeting the Council requirements.

The above analysis has been made on the basis of our best engineering judgment and on the experience gained from scale model wind tunnel testing or computational fluid dynamics analysis of a range of developments. The conclusions of this SLR report will be checked during the upcoming wind tunnel testing, with specific design mitigations to be confirmed during the detailed design phase of the proposed development.

APPENDIX A

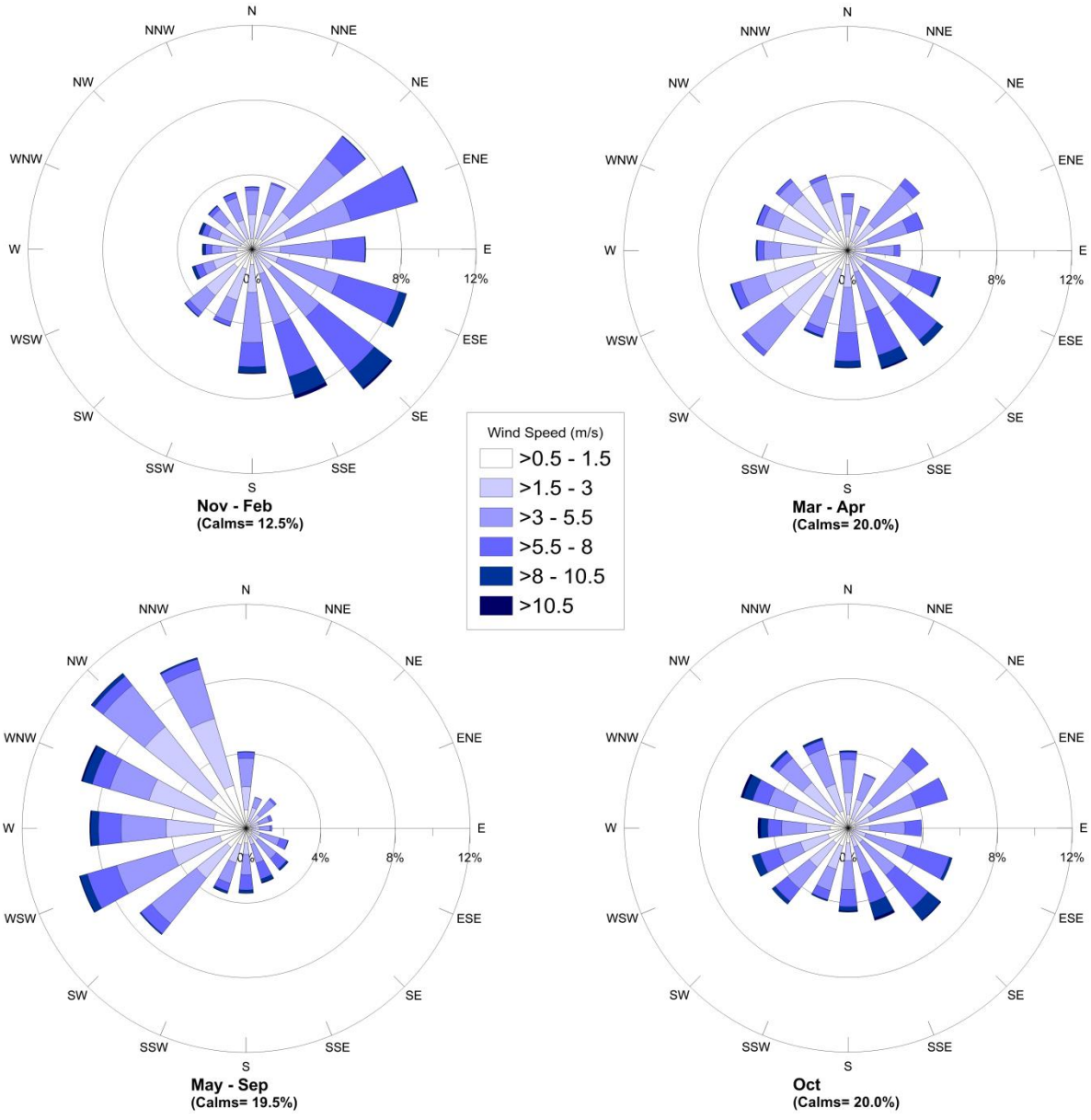
Seasonal Wind Roses for Bureau of Meteorology Met Stations at Sydney (Kingsford Smith) Airport and Bankstown Airport

Sydney Airport AWS
(Observations)
1999-2017
600.09300



Appendix A (contd)

Bankstown Airport AWS
(Observations)
1999-2017
600.09300



Morning Winds

Afternoon Winds

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