3 Holdsworth Avenue, St Leonards

Environmental Wind Impact - Desktop Study

New Golden Leonards Pty Ltd
Suite 11/30 Atchinson St
St Leonards NSW 1590

Prepared by:

SLR Consulting Australia

SLR Project No.: 610.30393.00000

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12 November 2024

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
R02-v5.2	12 November 2024	Dr Farzin Ghanadi	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
R02-v5.2	16 October 2024	Dr Farzin Ghanadi	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
R02-v4.0	21 June 2022	James Clearly	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with New Golden Leonards Pty Ltd (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.

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

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1.0 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by New Golden Leonards Pty Ltd to provide a qualitative (expert opinion) study assessing the environmental wind impact of a proposed development at 3 Holdsworth Avenue, St Leonards.

The assessment has been made on the basis of our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation analysis of a range of similar scale developments.

2.0 DEVELOPMENT – DESCRIPTION AND SITE CONTEXT

The proposed building at 3 Holdsworth Avenue, St Leonards, bordered by Holdsworth Avenue to the east, Marshall Avenue to the north and existing low-rise residential development to the other directions - refer **Figure 1**.

Figure 1 Project Site Location

Image: Courtesy Nearmap, September 2024

2.1 Development Description

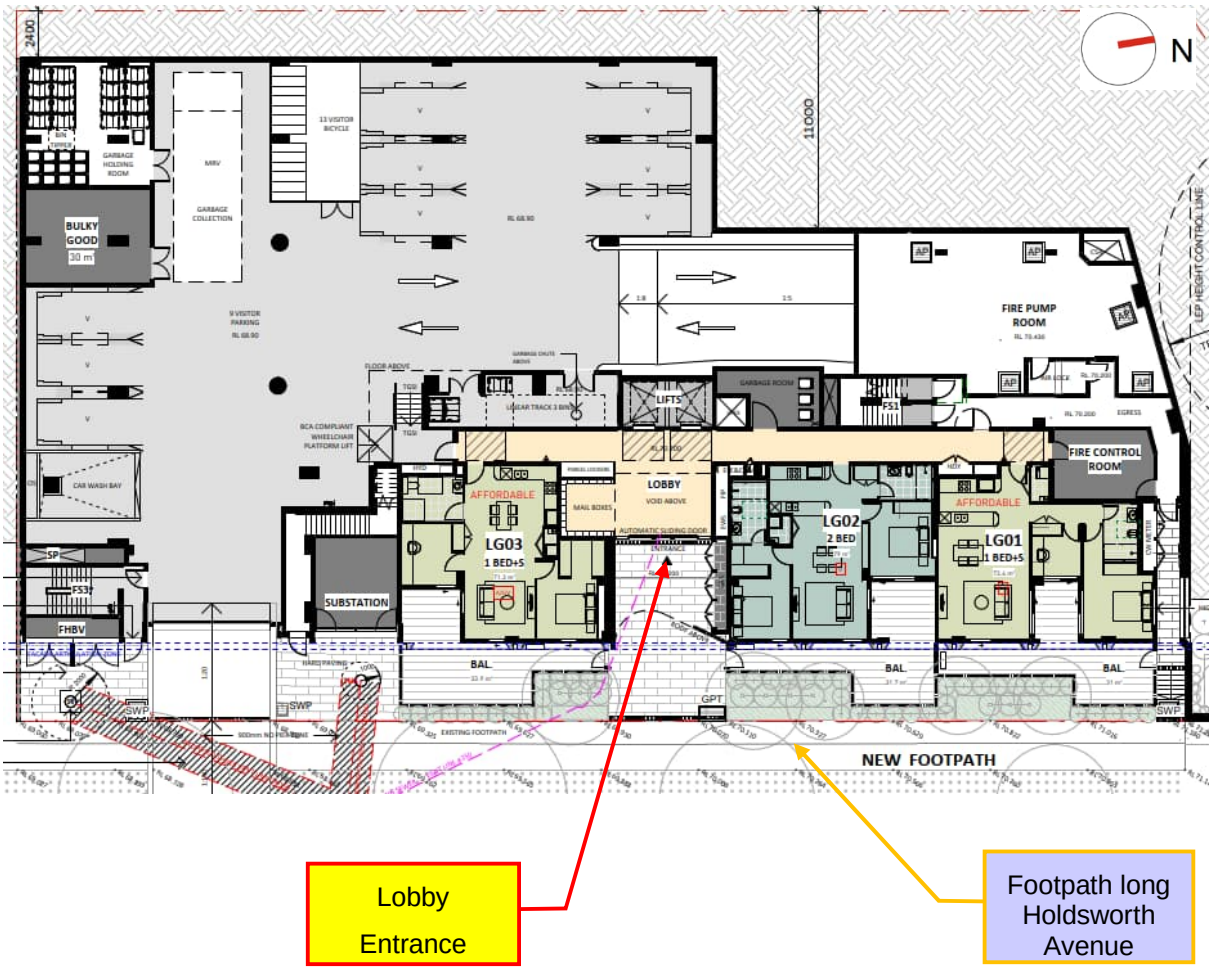
From the plans provided the proposed Development comprises the following:

- Four levels of basement car parking;
- Lower Ground Level with Holdsworth Avenue lobby entry, residential apartments and the car park entrance;
- Upper Ground Level with residential apartments, plant spaces and public open space;
- Level 1 with residential apartments and communal open space;
- Level 2-14 with residential apartments;
- Level 15 with residential apartment and outdoor communal space; and
- Level 16 with residential apartments;
- Roof.

Representative floor plans of the proposed development are shown in **Figure 2**.

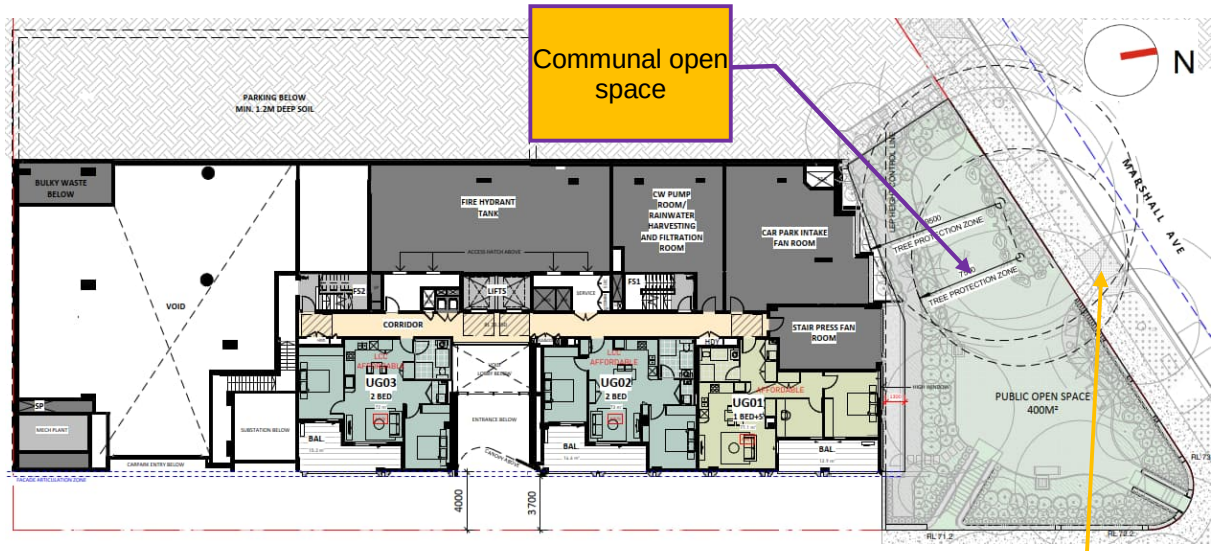
Figure 2 Representative Plans of the Proposed Development

Lower Ground Level



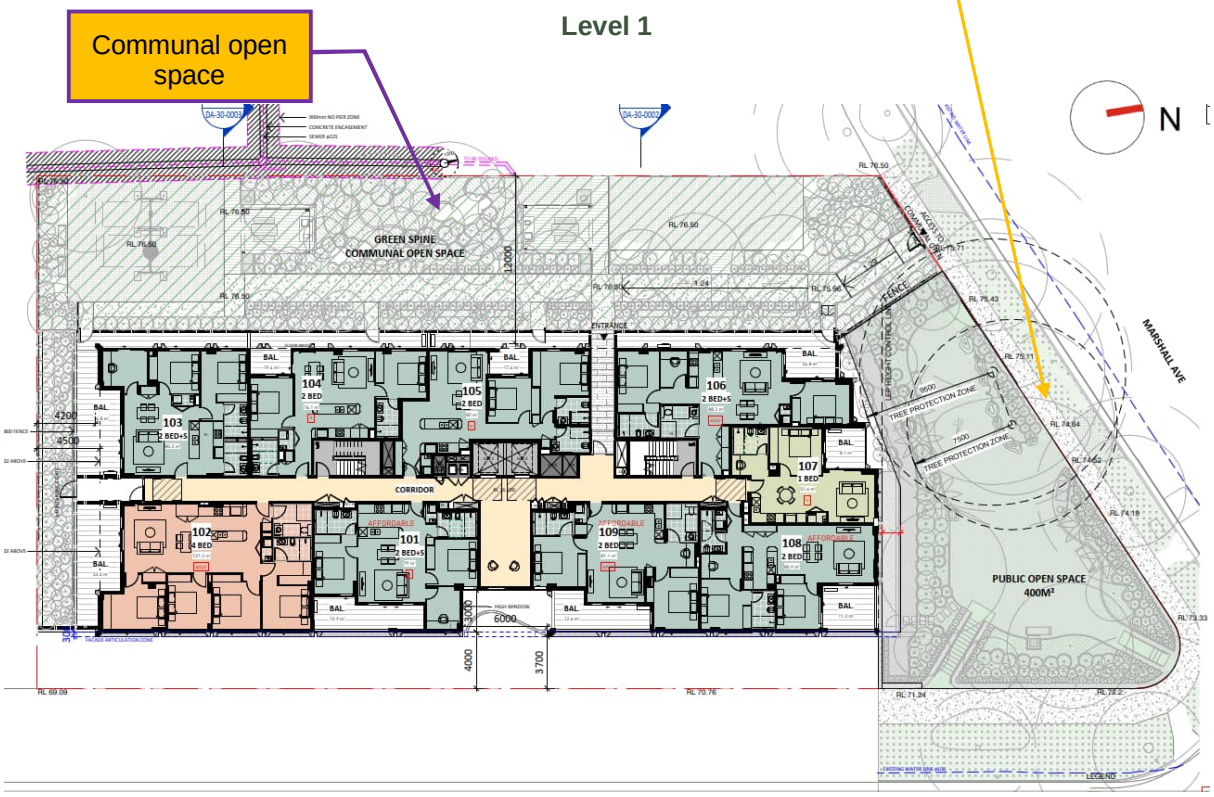
(Fig. 2 cont'd)

Upper Ground Level



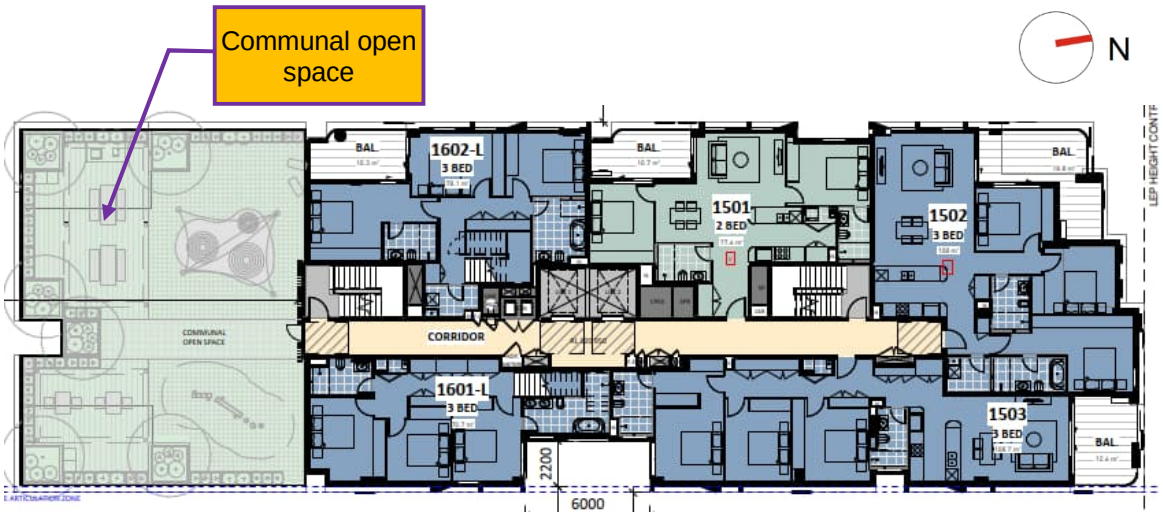
Footpath long Marshal Avenue

Level 1



(Fig. 2 cont'd)

Level 15



2.2 Surrounding Built Environment

In terms of the surrounding terrain and topography (refer **Figure 3**):

- The surrounding built environment features mid to high -rise residential and commercial buildings to the north and northeast,
- Low-rise residential blocks to the west, south and southwest and mid-rise buildings along the northern site boundary.
- There are future plans for mid to high-rise buildings to the east of the site
- The neighbouring topography exhibits moderate variation along Marshall Avenue, with a downward slope from the west to the east.

Figure 3 Project Site Surrounds

3.0 SYDNEY'S WIND CLIMATE

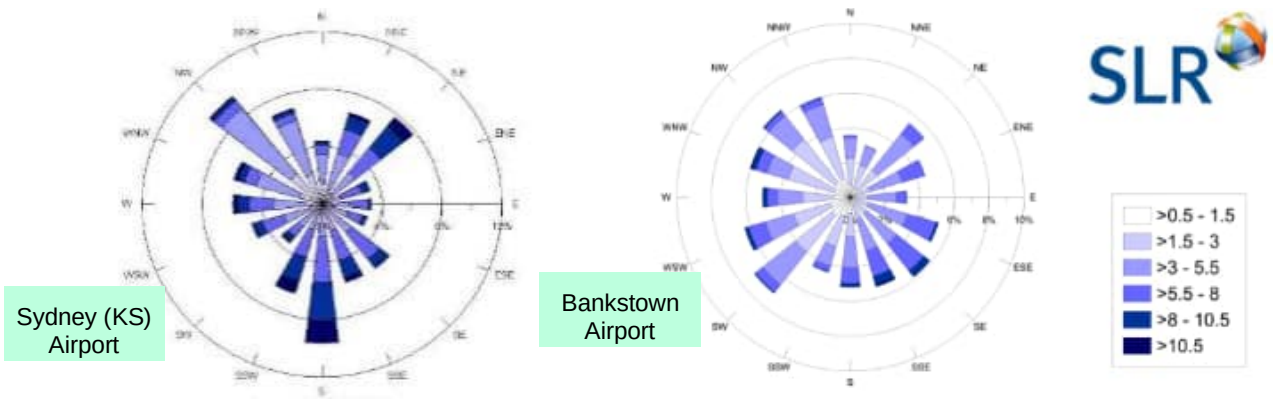
The data of interest in this study are the mean hourly wind speeds and largest gusts experienced throughout the year (especially higher, less frequent winds), how these winds vary with azimuth, and the seasonal break-up of winds into the primary Sydney Region wind seasons.

3.1 Annual and Seasonal Variations

Key characteristics of Sydney's Regional Wind Climate are illustrated in two representative wind roses shown in **Figure 4** taken from Bureau of Meteorology (BoM) data recorded during the period 1999-2017 at Sydney (Kingsford Smith) Airport and Bankstown Airport. A review of the associated seasonal wind roses (refer **Appendix A**) shows that Sydney is affected by two primary wind seasons with relatively short (1-2 month) transition periods in between:

- 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. Both northeast winds (as sea breezes) and stronger southerly winds associated with "Southerly Busters" and "East Coast Lows" typically have a significantly greater impact along the coastline. Inland, these systems lose strength and have altered wind direction characteristics.
- Winter/Early Spring winds occur mainly from west quadrants and to a lesser extent from the south. West quadrant winds provide the strongest winds during winter and in fact for the whole year, particularly at locations away from the coast.

Figure 4 Annual Wind Roses for Sydney (KS) Airport and Bankstown Airport (BoM Data)



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, topography and built environment, all of which influence the "local" wind environment.

- As noted in **Section 1.3**, the site is currently surrounded by a mix of typically low—to mid-rise buildings to the west, east and south side of the site.
- The site will benefit from moderate wind shielding at both upper and lower levels because of the high-rise developments on the north and northeast sides.

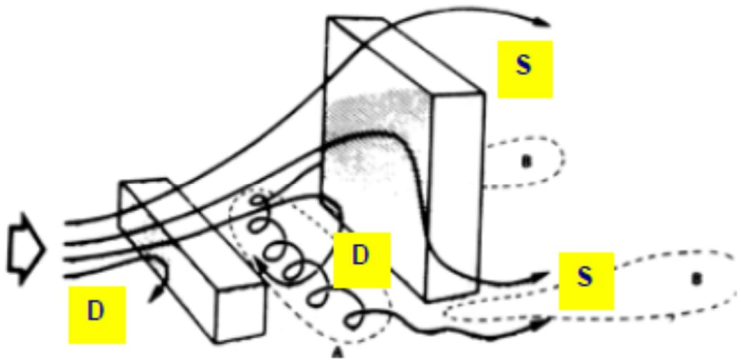
4.0 BUILDING-WIND INTERACTION – GENERAL OBSERVATIONS

The impact of wind flowing past buildings has well known general impacts at ground level – refer **Figure 5**. 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.

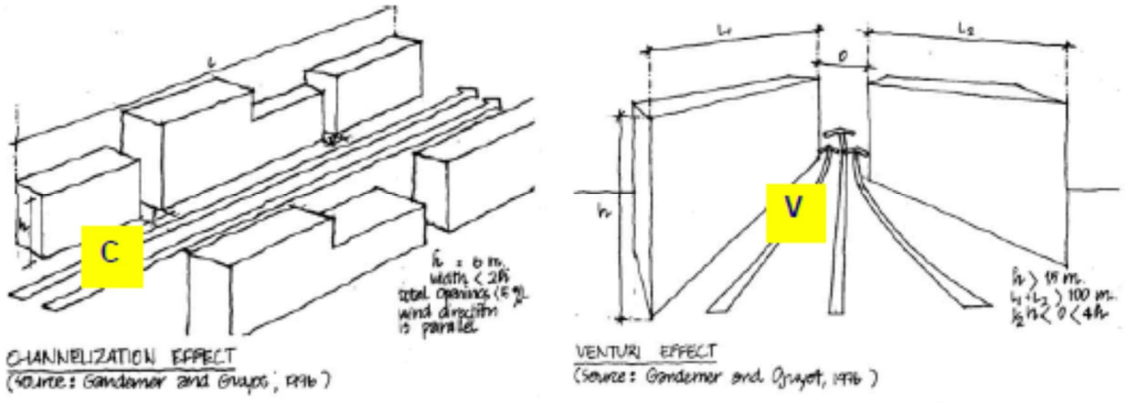
Figure 5 Windflow Patterns Past Regular-Shaped Buildings



The grouping of buildings can also have an impact on resulting pedestrian winds – refer to **Figure 6.**

- **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

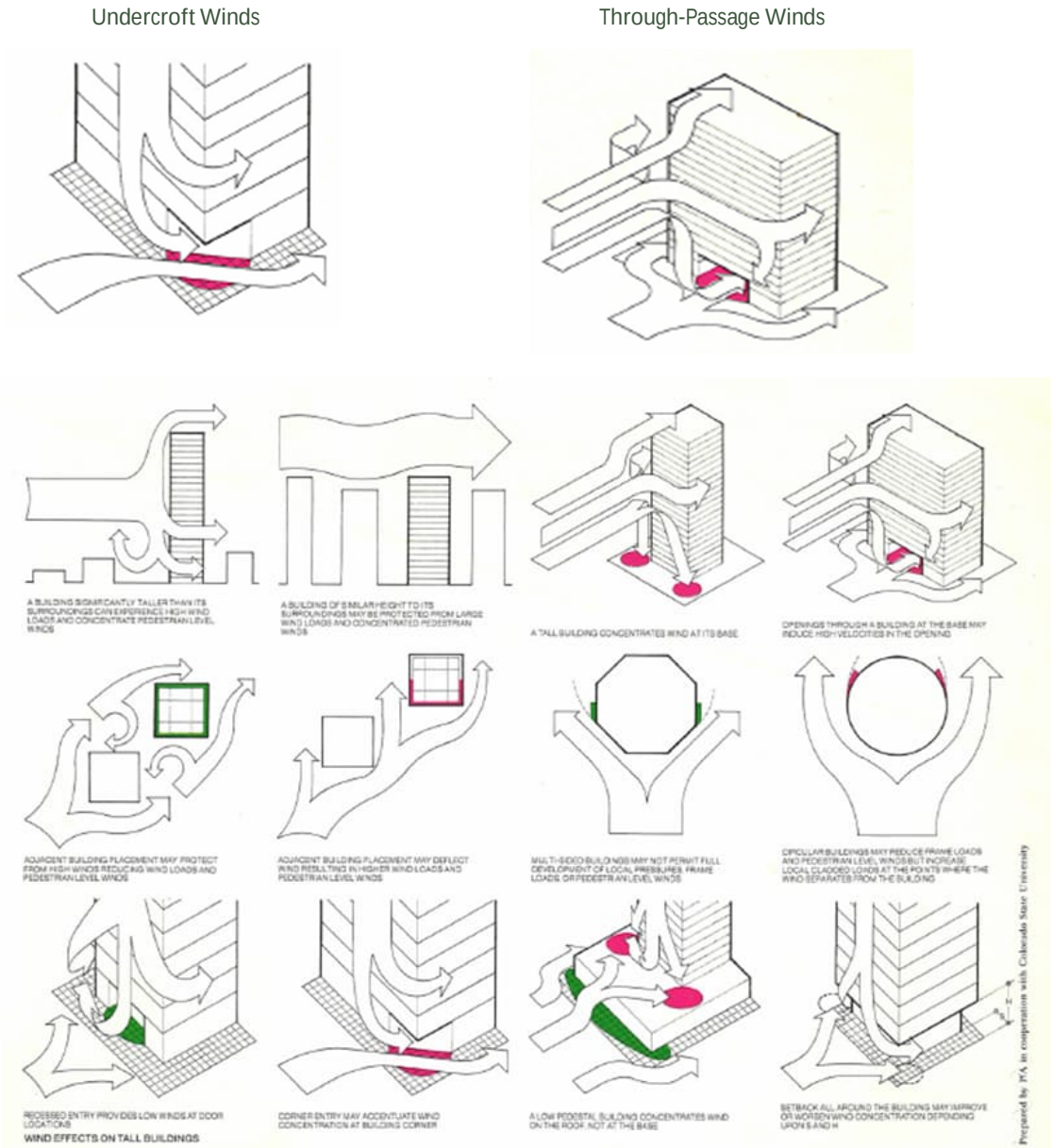


Local building details can also influence winds in the immediate vicinity – refer **Figure 7**.

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 7**.

Figure 7 Undercroft Winds and Through-Passage Winds



5.0 Wind Acceptability Criteria

5.1 Standard Local Government Criteria

The choice of suitable criteria for evaluating the acceptability of particular ground level conditions has been the subject of international research over the past few decades. One of the commonly accepted set of acceptability criteria developed from this research, currently referenced by many Australian Local Government Development Control Plans, is summarised in **Table 1**. The limiting wind speed criteria in **Table 1** are based on the maximum wind gust occurring (on average) once per year.

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/s “Walking Comfort” criterion. Whilst this magnitude may appear somewhat arbitrary, its value represents a level of wind intensity above 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”.

5.2 Application of Wind Criteria

The criteria provided in Table 1 (especially in relation to Comfort) 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 considerably 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.

6.0 wind impacts of the proposed redevelopment

6.1 Areas of Interest in Relation to Wind Impact

Based on the updated design many aspects of the proposed development have been designed in such way as to avoid direct exposure to the stronger prevailing winds impacting the site. The previous section provided guidance as to the areas where the adopted wind acceptability criteria had the potential to be exceeded and an indication as to the likely local optimum wind treatment strategy, eg 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). In the absence of dedicated wind mitigation solutions, the wind conditions of potential concern in relation to the proposed development include:

- The adjacent pedestrian walkways
- The elevated communal open areas
- Elevated corner balconies

6.2 Future Wind Impact at All Areas of Interest

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

The key directions analysed are:

- NE and S/SE winds for summer months and
- SW-NW (Westerly) winds for winter months.

The predicted wind environment at the site is examined in terms of both the:

- Existing Winds, and
- Future Winds with the addition of the proposed development.

The above predictions are made on the basis of our best engineering judgement and (decades of) experience in carrying out Environmental Wind Tunnel Testing and CFD Simulation Studies.

The above predictions are made without necessarily assuming any benefit from the already planned landscaping for the proposed development.

Prevailing Wind Direction:
NORTHEAST Winds

Period of Annual Cycle:
Summer

Location	Existing Compliance	Future Compliance	Key Factors
Marshall Avenue Footpath	**Likely comply**	**Likely comply**	NE winds are generally mild. The proposed development's Marshall Avenue façades are set back a minimum 10 m from the footpath, with generous landscaping from the proposed trees and the building height
Holdsworth Avenue Footpath	**Likely comply**	**Likely comply**	The potential for downwash and wind channelling onto this area exists with the proposed development. Consequently, effective wind mitigation strategies are essential in this zone to diminish the wind levels. Landscaping planned for this area will assist in mitigating these winds.
Holdsworth Avenue lobby entry	**Likely comply**	**Likely comply with the proposed mitigation measures**	Although NE winds are generally mild, downwash from building facades above may create wind conditions that are close to limits for building entry points (standing comfort) facing east or north.
Upper Ground Communal open space	Locations not relevant to "existing" built environment	**Likely comply**	This area could encounter heightened winds from the NE. Additionally, the proposed buildings may create some downwash onto this area. However, the existing trees will minimize the impact of prevailing winds and reduce their effects on this area.
Level 1 Communal open space		**Likely comply**	While the alignment of the development will limit the influence of prevailing winds, there is a possibility of high-speed winds swirling around the corners of the proposed building. However, this impact will be alleviated by the large trees with a generous canopy and landscaping along the footpath.
Elevated communal open area on Level 14		**Likely comply**	The communal open spaces are not exposed to strong winds from NE, but NE winds swirling around the corners of the proposed building can increase the wind level in this area. This impact will be alleviated by the proposed trees and vertical windbreak around the outer edge of this area.
Upper Level Corner Balconies		**Likely comply**	Given the elevated corner balcony's exposure to strong prevailing winds, an effective wind mitigation strategy is essential to lessen their impact on this area. The proposed vertical windbreaks around the outer edge of these spaces will help to moderate these winds.

Prevailing Wind Direction:
SOUTHEAST (& SOUTH) Winds

Period of Annual Cycle:
Summer (Southeast) All-Year-Round (South)

Location	Existing Compliance	Future Compliance	Key Factors
Marshall Avenue Footpath	**Likely comply**	**Moderate Increase Same level of compliance**	SE wind downwash may create adverse wind conditions in terms of long-exposure stationary activities (sitting, dining, etc). Planned trees at seating areas will assist in moderating these winds.
Holdsworth Avenue Footpath	**Likely comply**	**Borderline Compliance**	The orientation of Holdsworth Avenue allows for wind channelling of S and SE winds in the existing built environment. The proposed Development's Holdsworth Avenue façades are set back from the footpath (4m), thereby limiting downwash effects along the footpath; with generous landscaping from the proposed trees.
Holdsworth Avenue lobby entry	**Likely comply**	**Likely comply**	The Holdsworth Avenue entrance is impacted by southerly winds due to the channelling effect along the avenue. However, the deep setback in front of the entrance will provide adequate shielding.
Upper Ground Communal open space	Locations not relevant to "existing" built environment	**Likely comply with the proposed mitigation measures**	The communal open area on ground level is well shielded from direct southern winds due to the presence of the proposed development. Furthermore, the existence of the planned trees and landscaping, leading to limited exposure to southern winds within the area.
Level 1 Communal open space		**Likely comply with the proposed mitigation measures**	This open communal space is unlikely to experience increased SE/S winds because the building's positioning and the propose trees/landscaping within the open areas provide protection against prevailing winds from the SE/S.
Elevated communal open area on Level 14		**Likely comply with the proposed mitigation measures**	This elevated communal open area might experience increased winds coming from both the north and south directions, with minimal shielding from incoming elements. However, with the proposed wind mitigation measures, the wind comfort criteria are achieved.
Upper Level Corner Balconies		**Likely comply**	Given the elevated corner balcony's exposure to strong prevailing winds, an effective wind mitigation strategy is essential to lessen their impact on this area. The proposed vertical windbreaks around the outer edge of these spaces will help to moderate these winds.

Prevailing Wind Direction:
WESTERLY Winds (SW-NW)

Period of Annual Cycle:
Winter / Early Spring

Location	Existing Compliance	Future Compliance	Key Factors
Marshall Avenue Footpath	**Likely comply**	**Likely comply with the proposed mitigation measures**	The street orientation amplifies wind speed-up and there is a potential exists for the proposed developments to induce wind channelling onto this walkway during west winds. This impact can be alleviated by the presence of mature trees and landscaping along the street footpath.
Holdsworth Avenue Footpath	**Likely comply**	**Likely comply**	The Holdsworth Avenue Footpath will be well-protected by the shielding offered by the proposed building from W winds. Moreover, the presence of dense trees on the western and northern sides of the site will additionally limit the influence of the prevailing winds.
Holdsworth Avenue lobby entry	**Likely comply**	**Likely comply with the proposed mitigation measures**	The main entry is protected from westward winds by the upcoming building, as well as the substantial setback.
Upper Ground Communal open space	Locations not relevant to "existing" built environment	**Likely comply with the proposed mitigation measures**	The potential for wind channelling onto this area exists with the proposed development. Consequently, effective wind mitigation strategies are essential in this zone to diminish the wind levels. Landscaping planned for this area will assist in mitigating these winds.
Level 1 Communal open space		**Likely comply with the proposed mitigation measures**	Downwash from building facades above may create wind conditions that are close to limits for communal open area (standing comfort). However, the proposed trees and landscaping plan in these areas will help to mitigate these winds.
Elevated Communal open area on Level 14		**Likely comply with the proposed mitigation measures**	The area faces winds with a moderate degree of protection because of low to mid-rise neighbouring development situated on the west side of the development. However, the planned vertical windbreaks along the perimeter of this area will help mitigate the winds
Upper Level Corner Balconies		**Likely comply with the proposed mitigation measures**	SW and NW winds may experience accelerated shearflow as they pass through the elevated communal spaces. However, the proposed vertical windbreaks around the seating areas aim to mitigate the effects of these prevailing wind

7.0 MITIGATION AND TREATMENT RECOMMENDATIONS

On the basis of the expected wind impacts outlined in **Section 6**, the following recommendations for wind amelioration features are made in areas where winds are expected to approach or exceed the relevant 10 m/s, 13 m/s or 16 m/s criterion depending on the designed use for that area.

Lower and Upper Ground Levels – refer Figure 8 and Figure 9

- keep the trees/landscaping on the sides of the development to mitigate the impact of local wind speeds. It is recommended that the majority of recommended (or proposed) landscaping to be densely foliating to maintain its effectiveness throughout the year.
- Maintain setbacks on ground level building entry to diminish wind speeds potentially caused by downwash and redirecting airflow on the pathways.

Communal open areas on upper ground level and Level 1 – refer Figure 10

- Uphold the proposed trees/landscaping on the sides of the development on upper level and level 1 to mitigate the impact of local wind speeds. It is recommended that the majority of proposed landscaping to be densely foliating to maintain its effectiveness throughout the year.
- It is recommended that any seating areas within publicly accessible spaces be positioned beneath the generous canopy of the proposed trees in this space to mitigate the downwash effect from the building facade.
- Given that there is a seating area within the elevated communal open space on level 1, it is advisable to maintain the proposed horizontal windbreaks around the seating area to mitigate downwash.

Communal open areas on Level 15 – refer Figure 11

- Keep the proposed 1.8m high glazed balustrade around the perimeter of elevated communal spaces on Level 15.
- Maintain the proposed pergola around the seating area to help reduce the incoming wind speed.
- Uphold the proposed tall trees with a generous canopy around the designated seating area in this location.

Elevate Private Balconies – refer Figure 12

- Ensure vertical windbreaks are installed around the edges of individual balconies.
- Provision of moveable or fixed screens currently provided should be retained as currently proposed on latest architectural plans.

Figure 8 Wind Mitigation for the Development – Lower Ground Level

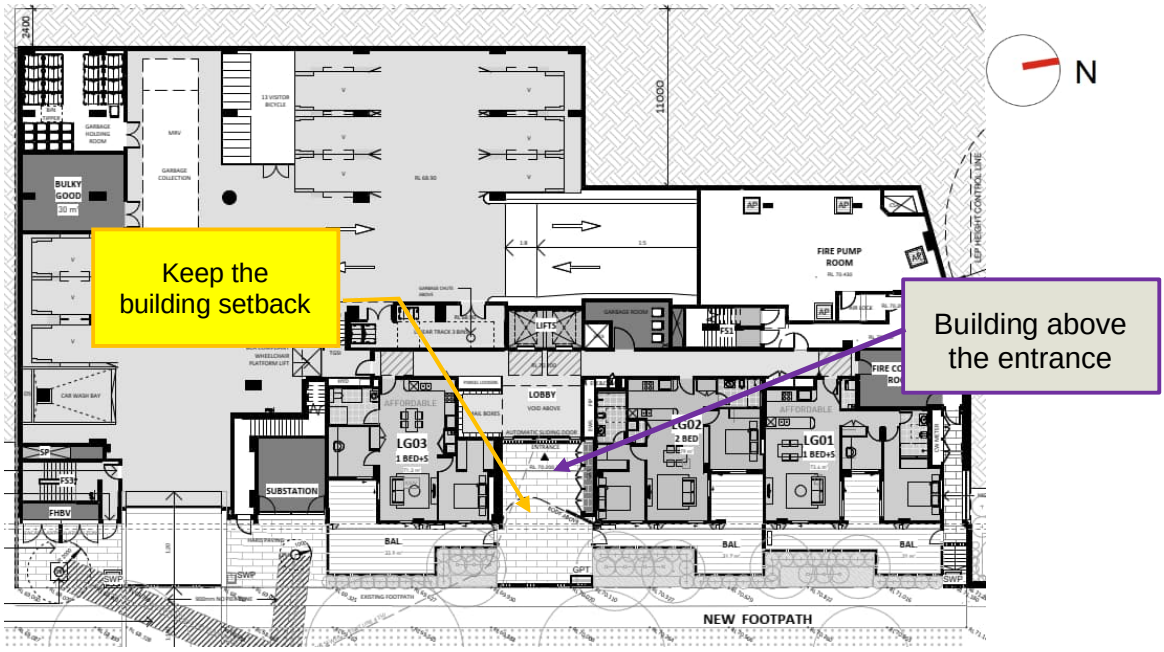


Figure 9 Wind Mitigation for the Development – Upper Ground Level

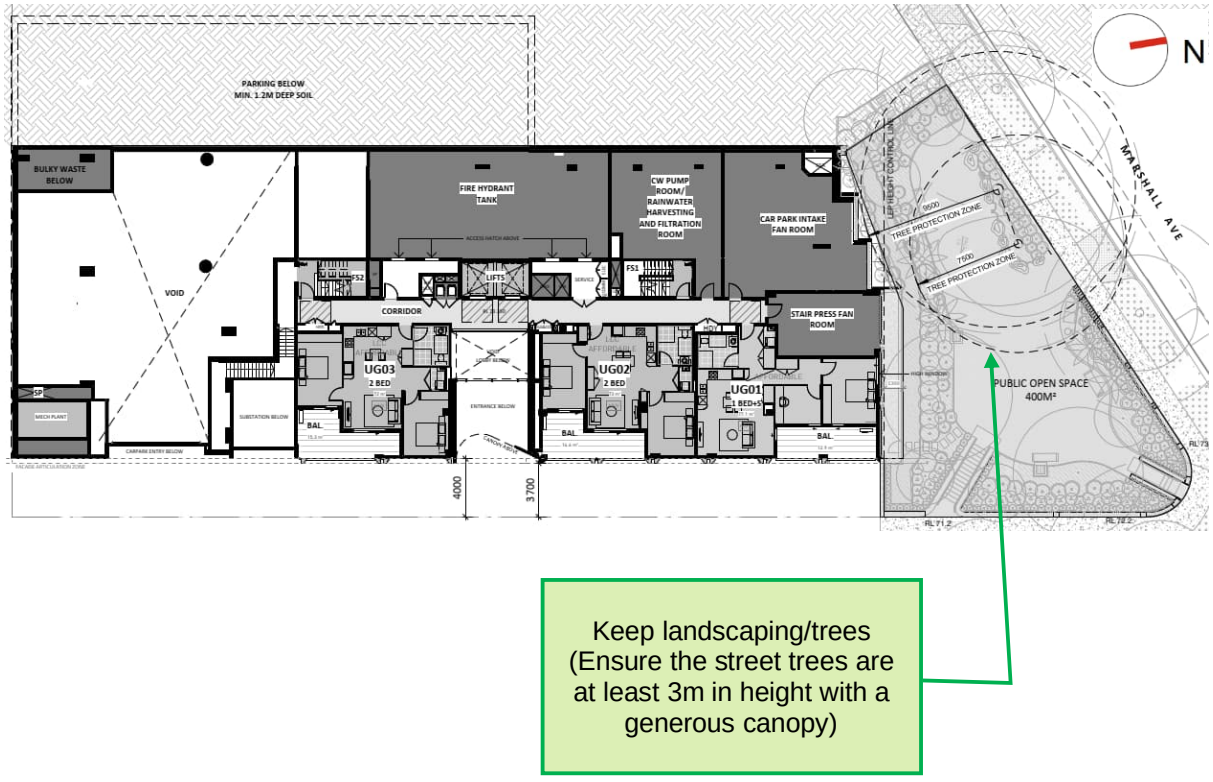


Figure 10 Wind Mitigation for the Development – Level 1

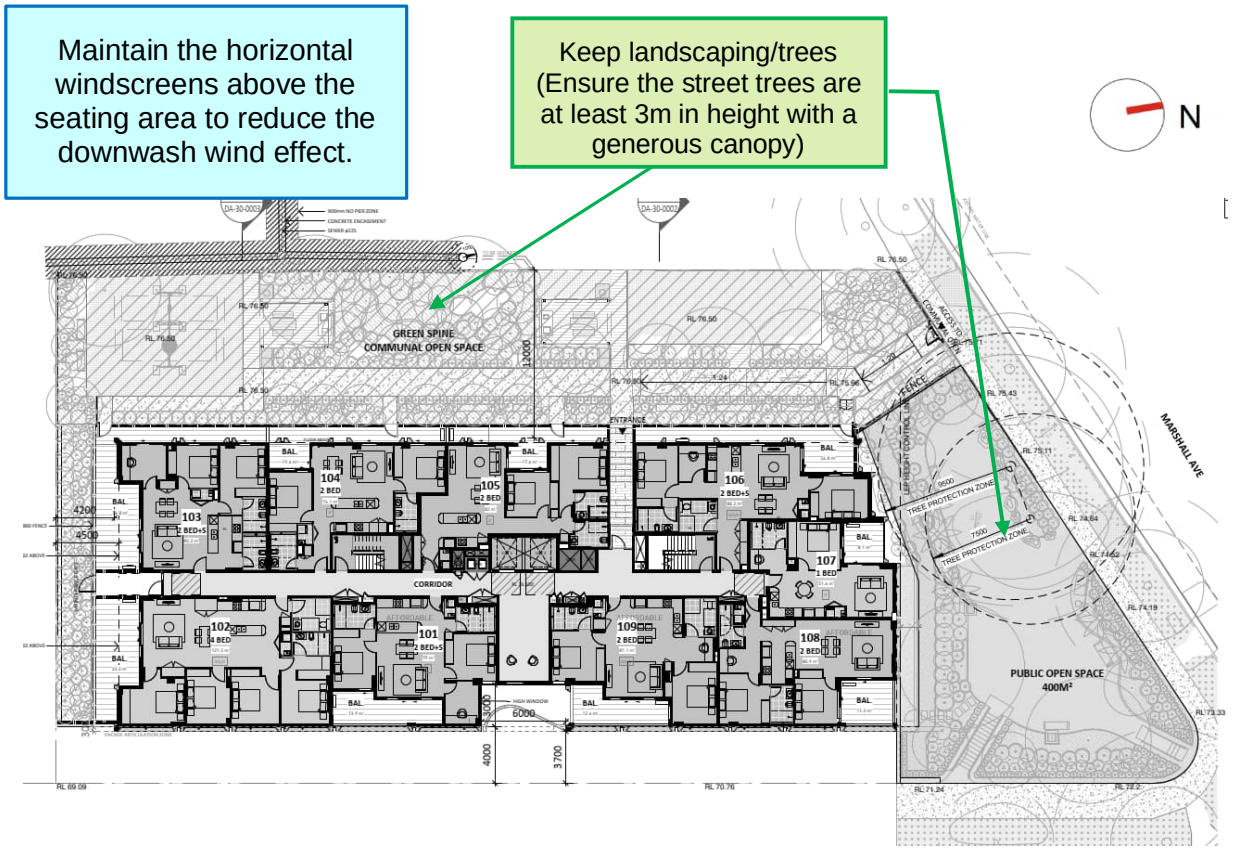


Figure 11 Wind Mitigation for the Development – Level 15

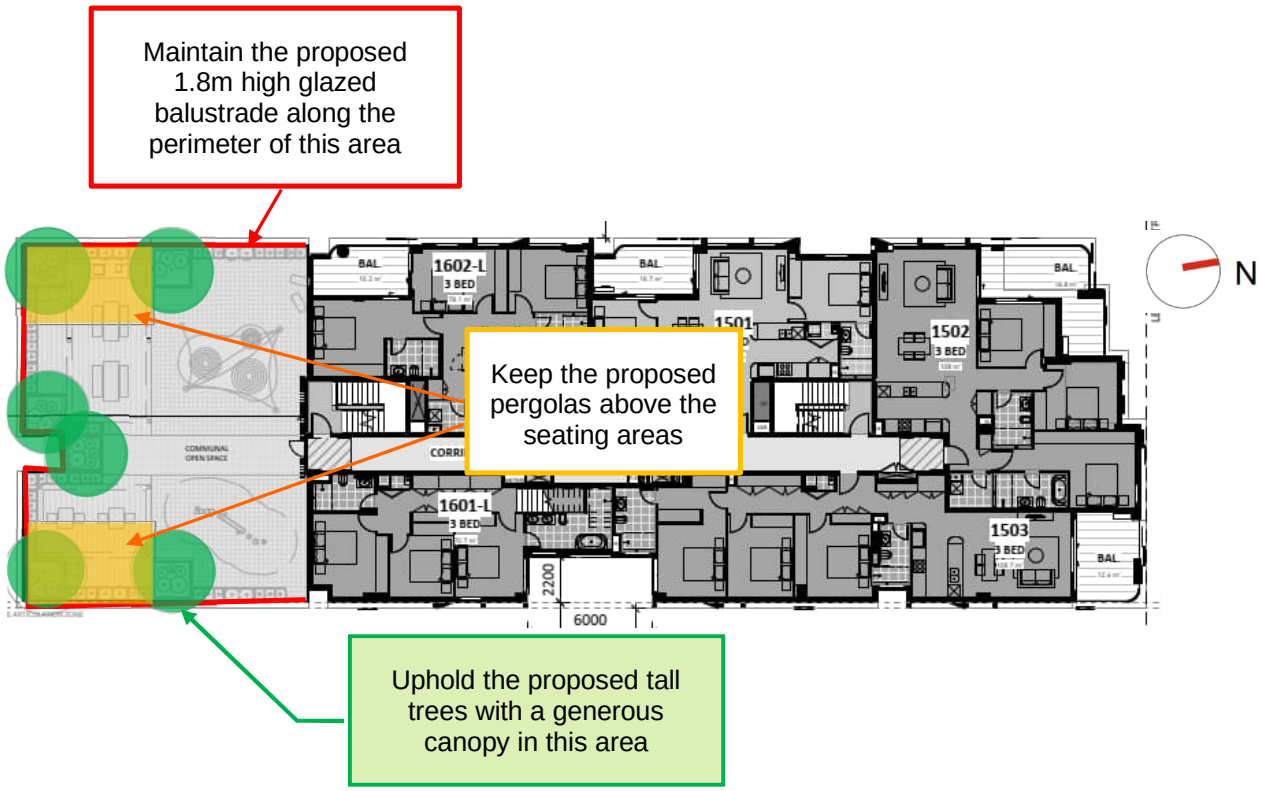
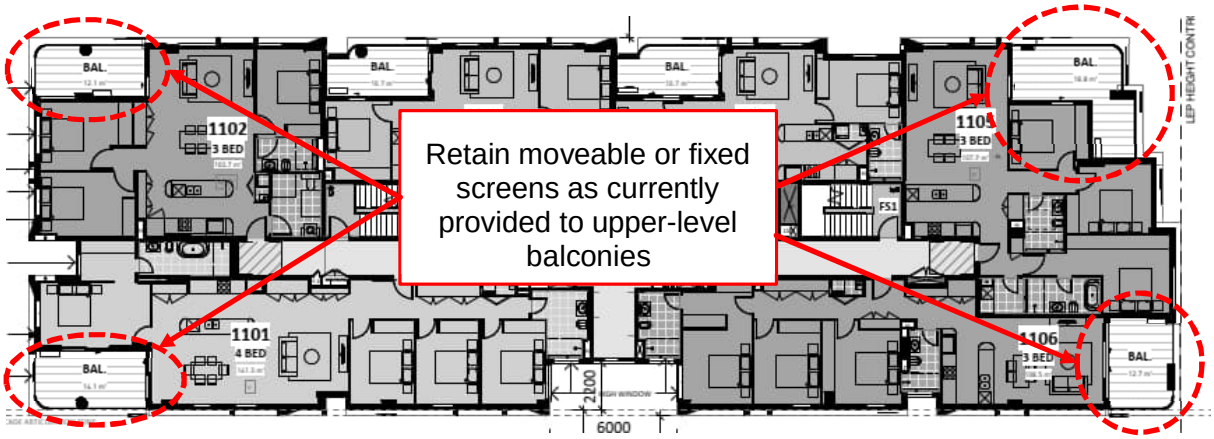


Figure 12 Wind Mitigation for the Development Elevated Corner Balconies (Levels 4 and above)

Level 4 and above



8.0 Conclusion

SLR Consulting Australia Pty Ltd (SLR) has been engaged by New Golden Leonards Pty Ltd to provide a qualitative (expert opinion) study assessing the environmental wind impact of a proposed development at 3 Holdsworth Avenue, St Leonards.

The assessment has been made on the basis of our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation analysis of a range of similar scale developments.

The proposed building at 3 Holdsworth Avenue, St Leonards, is bordered by Holdsworth Avenue to the east, Marshall Avenue to the north, and existing low-rise residential development in the other directions. The surrounding built environment consists of mid to high-rise residential and commercial buildings to the north and northeast, low-rise residential blocks to the west, south, and southwest, and mid-rise buildings along the northern site boundary. There are future plans for mid to high-rise buildings to the east of the site. The neighbouring topography along Marshall Avenue shows moderate variation, featuring a downward slope from west to east.

St Leonards Wind Climate

Using long-term wind records obtained from nearby Bureau of Meteorology stations at Bankstown Airport and Sydney Kingsford Smith Airport, SLR has determined that determined that St Leonards has local winds characteristics somewhat closer to Sydney (KS) Airport than Bankstown Airport, given the project site's distance inland from the coast. Accordingly, key prevailing wind directions of interest are the northeast, southeast and south for summer and mainly west quadrant winds for winter.

Existing Wind Environment

Close to the ground, the "regional" wind patterns described above are affected by the local terrain, topography and built environment, all of which influence the "local" wind environment.

- As noted in **Section 1.3**, the site is currently surrounded by a mix of typically low—to mid-rise buildings to the west, east and south side of the site.
- The site will benefit from moderate wind shielding at both upper and lower levels because of the high-rise developments on the north and northeast sides.

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:

- Maintain the proposed trees and landscaping within and around the development on lower and upper ground levels to reduce the impact of local wind speeds. It is recommended that the majority of landscaping be densely foliated to ensure year-round effectiveness – refer **Figure 8**.

- Preserve setbacks at lower ground-level building entrances to minimize wind speeds that may result from downwash and redirect airflow along pathways – refer **Figure 8**.

- For seating areas in publicly accessible upper-level spaces, it is advisable to place them beneath the generous canopy of the proposed trees to mitigate the downwash effect from the building façade – refer **Figure 9.**

- Maintain the proposed trees and pergola around the seating area in the communal open space on level 1 – refer **Figure 10**.
- Keep the proposed 1.8m high glazed balustrade around the outer edge of the communal open space on level 15 to 1.8m. Additionally, retain the proposed tall trees in this area and the pergola above the designated seating area on this level – refer **Figure 11**.

- Ensure vertical windbreaks are installed along the edges of individual balconies.

- Keep the recommended solid or glazed balustrades on elevated corner balconies, with fixed louvres or glazing for protection on the west and south sides. Additionally, keep one side of the elevated balconies open – refer **Figure 12**.

With the incorporation of proposed windbreak mitigation treatments, all amenity locations within the proposed development including ground and all terrace level locations are expected to achieve the target Lawson Comfort Criteria and Melbourne Safety Criterion established for the project.

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 can be quantified using wind tunnel testing or computational fluid dynamics analysis.

Summary

On the basis of the above, the overall effect of the proposed development on the local wind microclimate is predicted to be “not significant” (refer **Section 3.2**) and the proposed development should satisfy the nominated Wind Acceptability criteria for the project.

9.0 Feedback

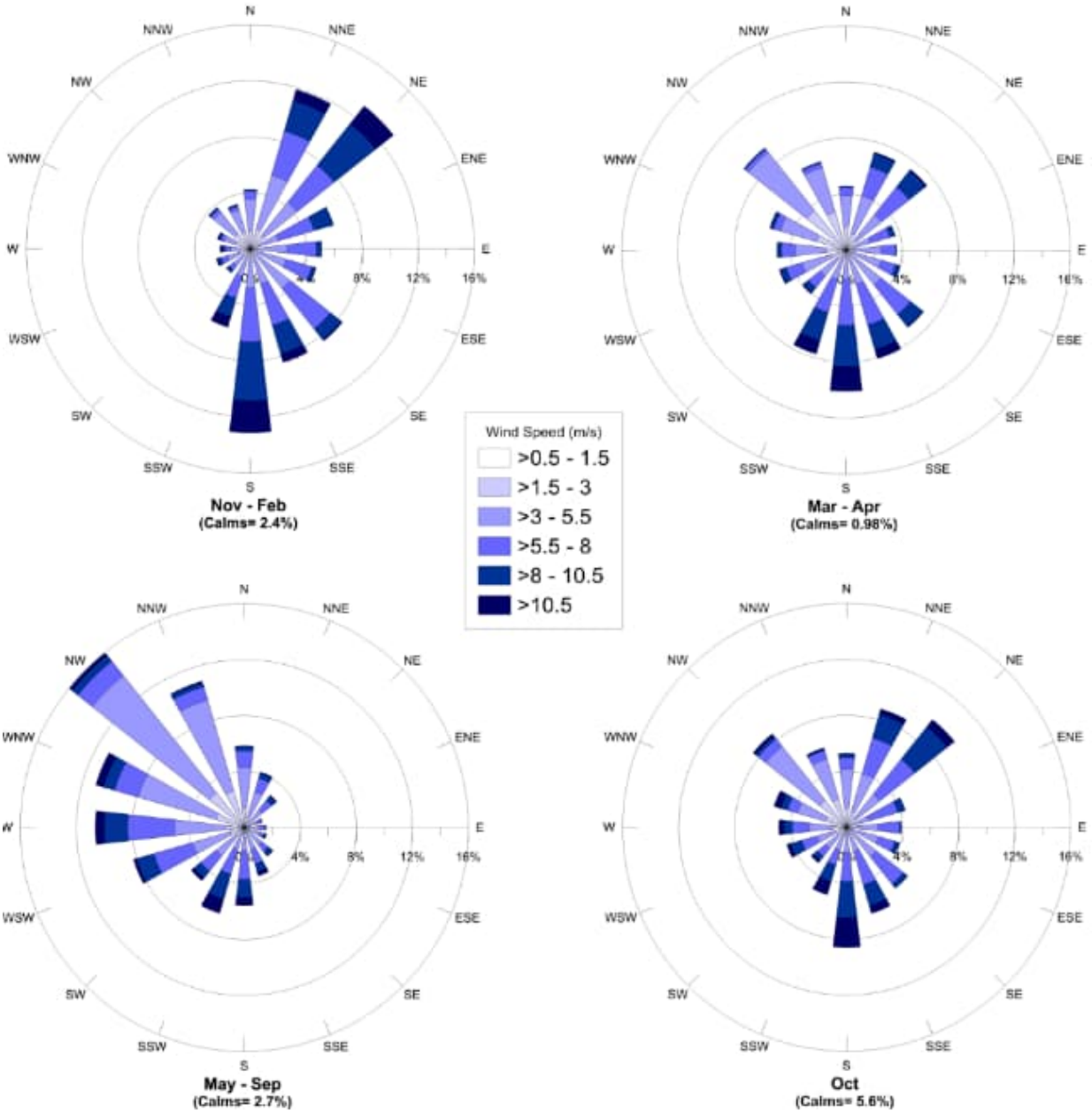
At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback.

We recognise the value of your time and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.

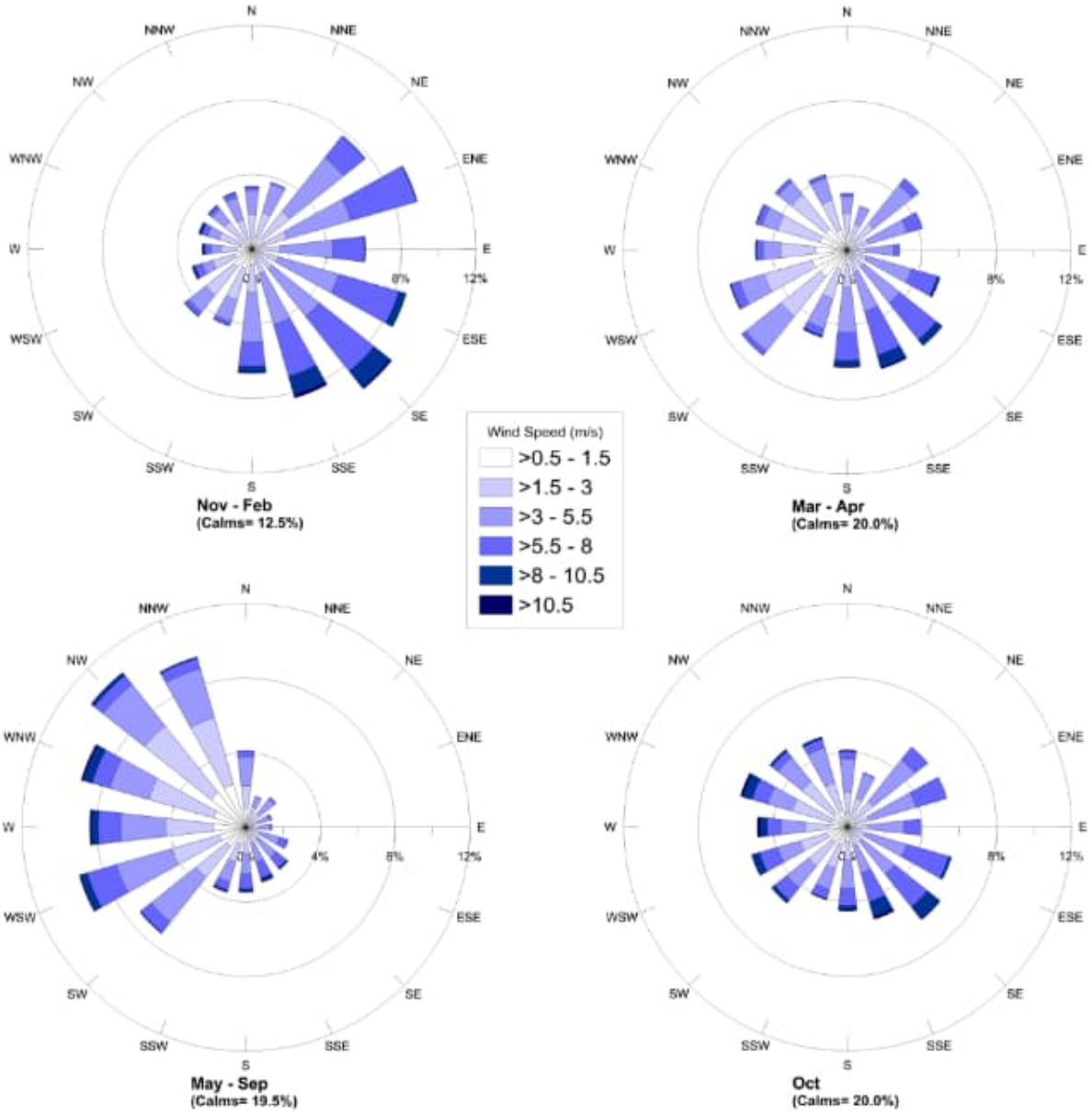
Appendix A Seasonal Wind Roses for Bureau of Meteorology Met Stations at Sydney (Kingsford Smith) Airport and Bankstown Airport

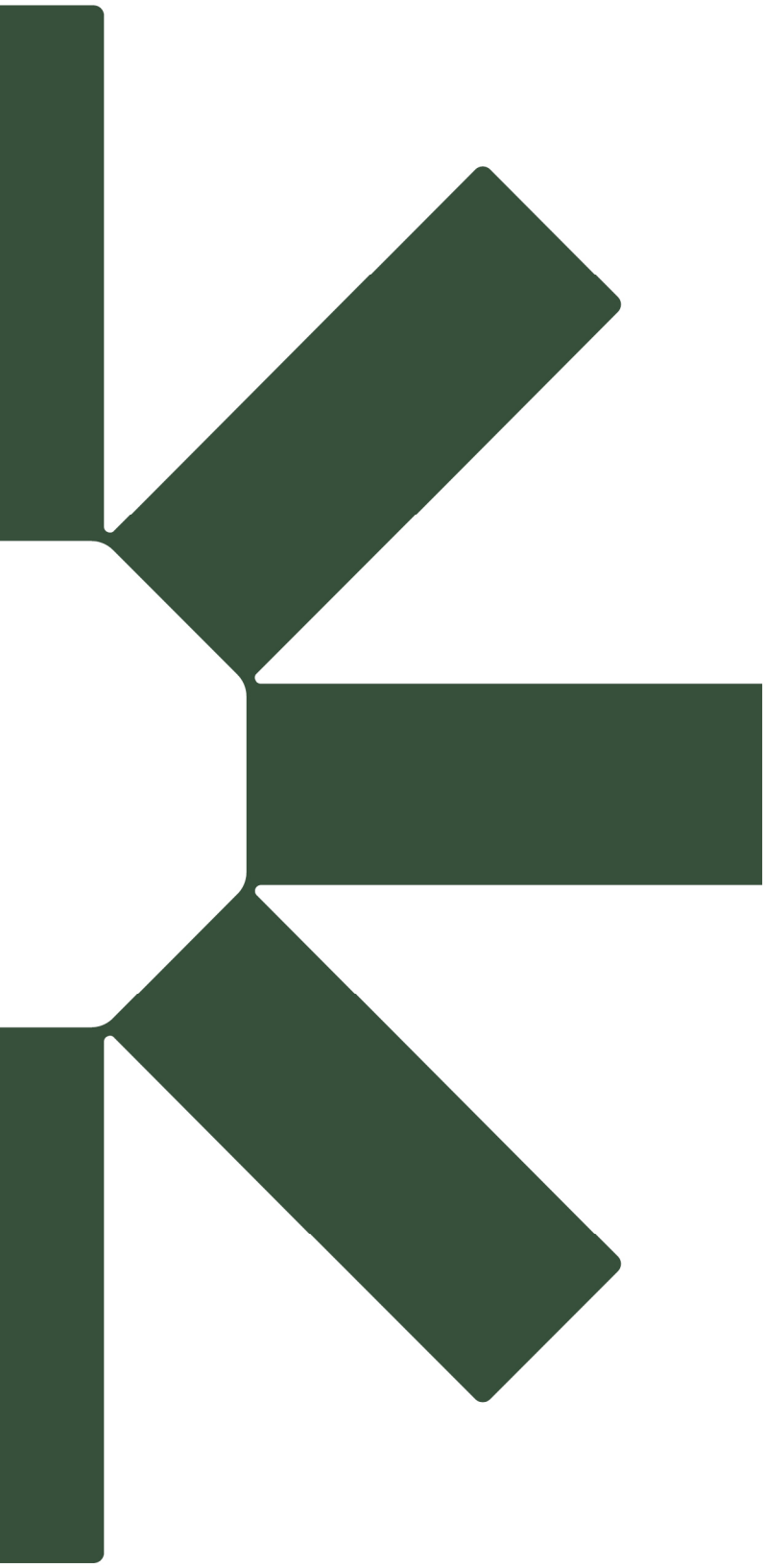
Sydney Airport AWS
(Observations)
1999-2017
600.09300



Bankstown Airport AWS
(Observations)
1999-2017
600.09300

Bankstown Airport AWS
(Observations)
1999-2017
600.09300





Making Sustainability Happen