QUALITATIVE WIND ASSESSMENT

3 Holdsworth Avenue, St Leonards

Prepared for:

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

SLR

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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 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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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30393.00000-R02-v4.0	21 June 2022	James Cleary	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
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EXECUTIVE SUMMARY

SLR Consulting Pty Ltd (SLR) has been engaged by New Golden Leonards Pty Ltd to undertake a qualitative study assessing the wind impact of a proposed development at 3 Holdsworth Avenue, St Leonards. The proposed development is located in St Leonards bounded by Marshall Avenue to the north and Holdsworth Avenue to the east. This assessment forms part of the Development Application to Lane Cove Council.

Wind Climate

On the basis of long-term wind records obtained from Bureau of Meteorology stations at Bankstown Airport and Sydney Kingsford Smith Airport, SLR has determined that project site has local winds characteristics closer to Sydney (KS) Airport than Bankstown Airport, given the project 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

Existing street level wind conditions in the vicinity of the site could approach the 16 m/s "walking comfort" criterion for some prevailing wind directions given the orientation of the site and the spacing of upstream shielding afforded to the site, by surrounding buildings and vegetation. In particular adverse winds of more than 16 m/s may occur from the south due to reduced wind shielding.

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 winds along the surrounding footpaths should remain at similar levels.
- Awnings are recommended to be retained over the lower-level entries to reduce downwash.
- Landscaping and vegetation are recommended to be retained to communal and public outdoor spaces.
- Planter boxes are recommended to be retained for the larger balconies on Level 5.
- Moveable and fixed screens are recommended to be retained to balconies.
- Additional windbreaks have been recommended to the Level 11 communal open space.

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. Detailed wind flow modelling via either Wind Tunnel Testing or Computational Fluid Dynamics (CFD) Simulation can be used during detailed design to confirm wind speed levels at specific locations and determine the extent of treatment required.

EXECUTIVE SUMMARY

Accordingly, it has been predicted that ground levels wind speeds within all public access areas surrounding the development should remain at their present levels or be reduced with the addition of the proposed development and its planned wind mitigation treatments to be determined through quantitative testing.

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1 Introduction

SLR Consulting Pty Ltd (SLR) has been engaged by New Golden Leonards Pty Ltd to undertake a qualitative study assessing the wind impact of a proposed development at 3 Holdsworth Avenue, St Leonards. The proposed development is located in St Leonards bounded by Marshall Avenue to the north and Holdsworth Avenue to the east.

This assessment forms part of the Development Application to Lane Cove Council.

The assessment has been made based on our best engineering judgment and on the experience gained from scale-model Wind Tunnel Testing and CFD Simulation analysis of a range of commercial and residential developments.

1.1 Development Site Location

The proposed development is located in St Leonards just to the south of the Pacific Highway and approximately 150 metres west of the train line.

Figure 1 Development Site Location



Image: Nearmap (May 2021)

1.2 Proposed 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 2-10 with residential apartments;
- Level 11 with residential apartment and outdoor communal space; and
- Level 12 with residential apartments.

Figure 2 shows a typical floor plan for the proposed site.

Figure 2 Level 3 Floor Plan



2 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.

2.1 Annual and Seasonal Variations

Key characteristics of Sydney's Regional Wind Climate are illustrated in two representative wind roses shown in **Figure 3**, 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 3 Annual Wind Roses for Sydney (KS) Airport and Bankstown Airport (BoM Data)

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, all of which influence the "local" wind environment.

- The site is currently surrounded by a number of mid and high-rise developments to the north, north east and east and there is also significant vegetation with a number of large trees close to the site
- The site will therefore receive reasonable wind shielding to some of the prevailing wind directions with some greater wind shielding provided to the north east.

2.3 Design Wind Speeds

SLR has carried out a detailed study of Sydney Basin wind speeds using continuous records of wind speed and direction measured at the Bureau of Meteorology's (BoM) Sydney weather stations. The above analysis is described in detail in:

• SLR Technical Note: "9300-TN-CW&E-v2.0 Sydney Region Design Winds", March 2018.

In particular, SLR has determined statistical wind information for locations not situated in close proximity (ie within say approximately a kilometre) of BoM weather stations. Particular emphasis was given to weather stations with a "clean" surrounding exposure, ie stations such as Sydney (Kingsford Smith) Airport and Bankstown Airport, which are relatively free of immediately surrounding obstacles such as buildings, vegetation, trees, etc, which would otherwise distort the winds seen by the weather station anemometer.

For St Leonards, SLR has determined that local upper level winds reflective of the weather systems experienced at the site are to be closer to that of Sydney (KS) Airport, given the site's distance (8 km) westward from the coast compared to Bankstown Airport (25 km) and Sydney (KS) Airport (5 km).

By inspecting the greater surrounding area, the adopted St Leodards wind model has slightly lower strength characteristics from the south compared to Sydney (Kingsford Smith) Airport and similar strengths from the north east and westerly directions.

3 Wind Acceptable 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**.

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

Table 1 Standard Local Government Wind Acceptability Criteria

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 Practical Application of 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 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.

Finally, it is noted that the limiting wind speed criteria in Error! Reference source not found. are based on the m aximum 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/s would experience winds throughout the year of a generally very mild nature, conducive to stationary activities (seating, dining, etc).

4 Building-Wind Interactions – 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 4 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 5 Windflow Patterns Past Groups of Buildings



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 6 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 approach the 16 m/s "walking comfort" criterion for some prevailing wind directions given the orientation of the site and the spacing of upstream shielding afforded to the site, by surrounding buildings and vegetation. In particular adverse winds of more than 16 m/s may occur from the south due to reduced wind shielding.

Northeast Winds

There are many medium and high level developments to the northeast of the development. 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. Existing vegetation should provide further shielding to the current environment.

South and South Easterly Winds

The site has some shielding to the southeast and south with most of that available being low level. There may be some expectation for exceeding of the 16m/s walking criterion for adjoining pedestrian pathways, with potential for channelling of winds along the Holdsworth Avenue although there will be shielding from the existing vegetation.

Westerly Winds

There is predominantly low residential development to the west of the proposed site. The ground level should generally have reasonable shielding to winds approaching the site from the west.

Upper Level Winds

Existing upper level wind conditions at the site are likely to exceed the 10 m/sec comfort criterion for some of the stronger prevailing wind directions (eg south, southeast and southwest and west).

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 7** to **Figure 9**.

Figure 7 Areas of Interest – Lower Ground Floor





Figure 9 Areas of Interest – Level 11



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 and south east and Westerly winds.

Location: Wind Speed Ta	Holdsworth Av arget: 16 m/s Walkin	ו Avenue Footpath Iking Comfort	
Direction	Existing Compliance	Future Compliance	Key Factors
North East	Likely comply	Likely comply	This area will receive good shielding from upstream buildings and existing vegetation.
South & South East	May not comply	May not comply	This area may experience channelling along Holdsworth Avenue but could be mitigated by the existing vegetation.
Westerly	Likely comply	Likely comply	These is some low level shielding which will be enhanced by the proposed development.

Location:Ground Level Entry areaWind Speed Target:13 m/s Standing Comfort

Direction	Existing Compliance	Future Compliance	Key Factors
North East	Likely comply	Likely comply	This area will receive some shielding from upstream buildings.
South & South East	Likely comply	Likely comply	This area is slightly setback into the building and will receive some shielding from the development itself as well as upstream shielding from existing vegetation.
Westerly	Likely comply	Likely comply	These is some low level shielding which will be enhanced by the proposed development.

Location:Marshall Avenue FootpathWind Speed Target:16 m/s Walking Comfort

Direction	Existing Compliance	Future Compliance	Key Factors
North East	Likely comply	Likely comply	This area will receive good shielding from upstream buildings and existing vegetation.
South & South East	Likely comply	Likely comply	These is some low level shielding which will be enhanced by the proposed development.
Westerly	May not comply	May not comply	The area is slightly more open in this direction but is still likely to have some shielding from upstream buildings and vegetation.

Location:Level 1 Entry areaWind Speed Target:13 m/s Standing Comfort

Direction	Existing Compliance	Future Compliance	Key Factors
North East	Likely comply	Likely comply	This area will receive some shielding from upstream buildings, vegetation and the development itself.
South & South East	Likely comply	Likely comply	This area will receive some shielding from upstream buildings, vegetation and the development itself.
Westerly	Likely comply	Likely comply	These is some low level upstream shielding and setback from levels above should protect space from downwash winds.

Location:Communal Open SpaceWind Speed Target:10 m/s Seated, Outdoor Dining Comfort

Direction	Existing Compliance	Future Compliance	Key Factors
North East	N/A	Likely comply	This area will receive good shielding from upstream buildings and existing vegetation.
South & South East	N/A	Likely comply	Upstream trees will provide good shielding to this area.
Westerly	N/A	Likely comply	These is some low level upstream shielding. This area could be impacted by downwash winds, the provided landscaping and tree canopy should provide sufficient shielding.

Location:Public Open SpaceWind Speed Target:10 m/s Seated, Outdoor Dining

Direction	Existing Compliance	Future Compliance	Key Factors
North East	N/A	Likely comply	This area will receive good shielding from upstream buildings and existing vegetation.
South & South East	N/A	Likely comply	These is some low level shielding which will be enhanced by the proposed development.
Westerly	N/A	Likely comply	The area is slightly more open in this direction but is still likely to have some shielding from upstream buildings and generously provided or retained vegetation.

Location:Level 4 East BalconiesWind Speed Target:10 m/s Seated, Outdoor Dining

Direction	Existing Compliance	Future Compliance	Key Factors
North East	N/A	Likely comply	Balconies will receive shielding from winds in this direction.
South & South East	N/A	Likely comply	Could be high wind speeds from this direction, proposed planter and balustrade should mitigate adverse conditions.
Westerly	N/A	Likely comply	Balconies will be shielded by the development itself.

Location:General BalconiesWind Speed Target:10 m/s Seated, Outdoor Dining

Direction	Existing Compliance	Future Compliance	Key Factors
North East	N/A	Likely comply	Could be high wind speeds from this direction, proposed moveable screens should mitigate adverse conditions.
South & South East	N/A	Likely comply	Could be high wind speeds from this direction, proposed moveable screens should mitigate adverse conditions.
Westerly	N/A	Likely comply	Could be high wind speeds from this direction, proposed moveable screens should mitigate adverse conditions.

Location: Wind Speed Target:

Level 11 Communal Open Space 10 m/s Seated, Outdoor Dining

Direction	Existing Compliance	Future Compliance	Key Factors
North East	N/A	Likely comply	The development itself should provide sufficient shielding to this directions.
South & South East	N/A	May not comply	Reduced upper level shielding combined with higher upper level wind speeds could lead to exceedances of the seating criterion.
Westerly	N/A	May not comply	Reduced upper level shielding combined with higher upper level wind speeds could lead to exceedances of the seating criterion.

6 WIND MITIGATION RECOMMENDATIONS

Section 5 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 cause of exceedance, 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).

The areas of potential concern in relation to the proposed development include:

- Pedestrians areas along the east and north of the site
- Patrons using communal areas

6.1 Wind Mitigation Recommendations

On the basis of the expected wind impacts outlined in **Section 5**, 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 or expected use for that area.

Holdsworth Avenue Footpath

• Wind speeds along the footpath will be similar to the current conditions.

Marshall Avenue Footpath

• Wind speeds along the footpath will be similar to the current conditions.

Level 1 Entry

• Setback from levels above should insulate entry from adverse wind conditions.

Communal and Public Open Areas

• Vegetation and landscaping should be retained through the area.

Level 5 East Balconies

• Provision of balustrades planters and screens should be retained as currently proposed on latest architectural plans.

General Balconies

• Provision of moveable or fixed screens currently provided should be retained as currently proposed on latest architectural plans.

Level 11 Communal Space

- Vegetation and landscaping should be retained through the area.
- Additional vertical windbreaks of 1.5-1.8m should be provided. Windbreaks can be comprised of balustrades, glazing, wind screens, planting or any combination of these or other practical wind shielding.

Figure 10 Mitigation Recommendations – Ground Levels



Figure 11 Mitigation Recommendations – Level 4



Figure 12 Mitigation Recommendations – Level 11



Figure 13 Mitigation Recommendations – Balconies





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