390-422 Harris Street and 273 Pyrmont Street, Ultimo (DigiCo)

Environmental Wind Impact - Desktop Study

HDI SYD1 Property Holdings Pty Limited (DigiCo)

400 Harris Street
Sydney, NSW 2000

Prepared by:

SLR Consulting Australia

SLR Project No.: 610.032121.00001

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28 February 2025

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
R01-v1.0	28 February 2025	Dr Farzin Ghanadi	Dr Peter Georgiou	
	Click to enter a date.			
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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 HDI SYD1 Property Holdings Pty Limited (DigiCo) (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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1.0 INTRODUCTION and PROJECT DESCRIPTION

1.1 Purpose of this Report

This qualitative (desktop) wind assessment report has been prepared by SLR Consulting Australia Pty Ltd (SLR) on behalf of HDI SYD1 Property Holdings Pty Limited (DigiCo) in support of a State Significant Development Application (SSDA) submitted to the Department of Planning, Housing and Infrastructure (DPHI) under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979).

The SSDA seeks approval for intensification of the existing data centre development at the site. Specifically, the SSDA seeks consent for the vertical expansion of two existing data centres at the site known as SYD1W (western facility) and SYD1E (eastern facility). The vertical expansion would allow for the intensification of the data centre to provide for a 88MW facility.

This report provides an assessment of wind comfort and responds to the Secretary's Environmental Assessment Requirements (SEARs) issued by DPHI on 8 May 2024 in relation to the project.

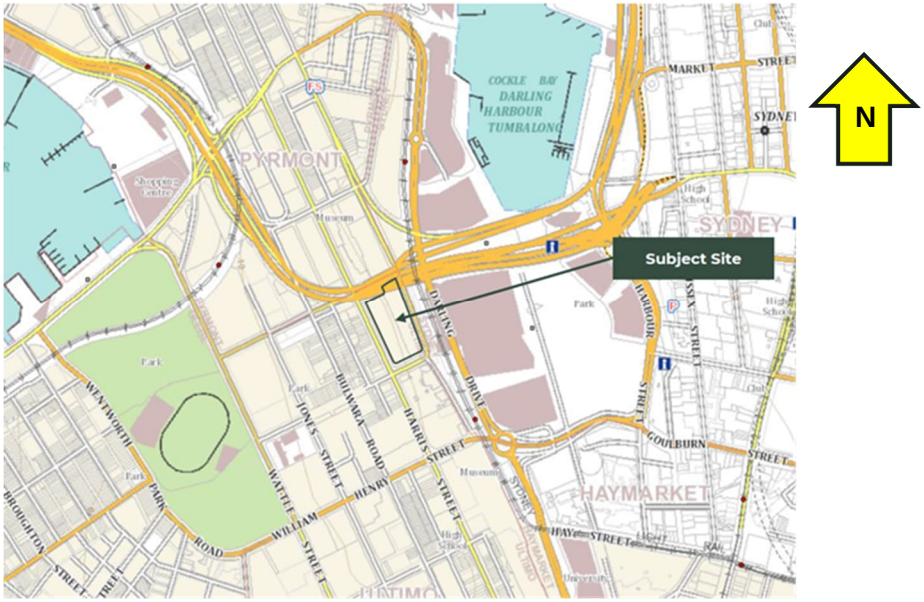
The assessment has been made based on our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation analysis of a range of similar scale developments. The desktop study will be followed up with a detailed Environmental Wind Tunnel Study.

1.2 Site Location and Context

The site is located within the suburb of Ultimo, within the City of Sydney Local Government Area (LGA). The locality is characterised by a mix of uses, as shown in **Figure 1**. This includes lower density terrace housing with heritage value on the west side of Harris Street, mid-rise residential development to the south, the International Convention Centre to the east, and higher residential densities and tourist accommodation buildings to the north. The site is less than 1km from the Sydney CBD and Darling Harbour which contain high rise commercial and residential towers, waterfront areas, public reserves, and numerous shops and entertainment premises.

The subject site is within a highly accessible locality, less than 250m from the Exhibition Centre light rail stop which connects to Central Station, and approximately 800m from Pyrmont Bay ferries. The location will also be an approximate 10 minute walk from the future Pyrmont metro station along the Sydney Metro West route.

Figure 1 Project Site Location



1.3 Development Description

The subject site comprises an entire block and is made up of two parcels of land, known as 392-422 Harris Street (on the western side) and 273 Pyrmont Street (on the eastern side). The western side comprises the data centre referred to as SYD1W, and the eastern side comprises the data centre referred to as SYD1E.

As shown in **Figure 2** below, the site is generally in a rectangular form, with frontages to Harris Street to the west, Quarry Street to the south, Pyrmont Street to the east, and both Fig Street and the Western Distributor to the north (with the Western Distributor constructed in a viaduct above Fig Street)

Figure 2 Arial View of the Site

1.4 Overview of proposed development

SSDA seeks approval for intensification of the existing data centre development at the site. Specifically, the SSDA will seek consent for the vertical expansion of two existing data centres at the site known as SYD1W (western facility) and SYD1E (eastern facility) and data hall densification works. The vertical expansion would allow for the intensification of the data centre to provide for a 88MW facility

In summary, approval for the following is sought for development comprising:

- Augmentation and vertical extension to the data centre facilitating the installation of electrical and mechanical equipment;
- Conversion of existing building floor space into additional electrical rooms or conversion of plant/mechanical space;
- Increase in the total megawattage of the data centre from 42.5MW to 88MW;
- Installation of an additional 24 generators, achieving a total of 66 generators across the site.

1.5 Surrounding Built Environment

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

- The surrounding built environment features mid-rise development to the north and south of the project site
- There are few low-rise developments to the west side of the site
- High-rise towers are located on the east and northeast sides of the site.
- The neighbouring topography features a downward slope from west to east along Fig Street, as well as a downward slope along Quarry Street.

Figure 3 Project Site Surrounds

Image: Courtesy Nearmap, January 2025

2.0 SYDNEY'S WIND CLIMATE

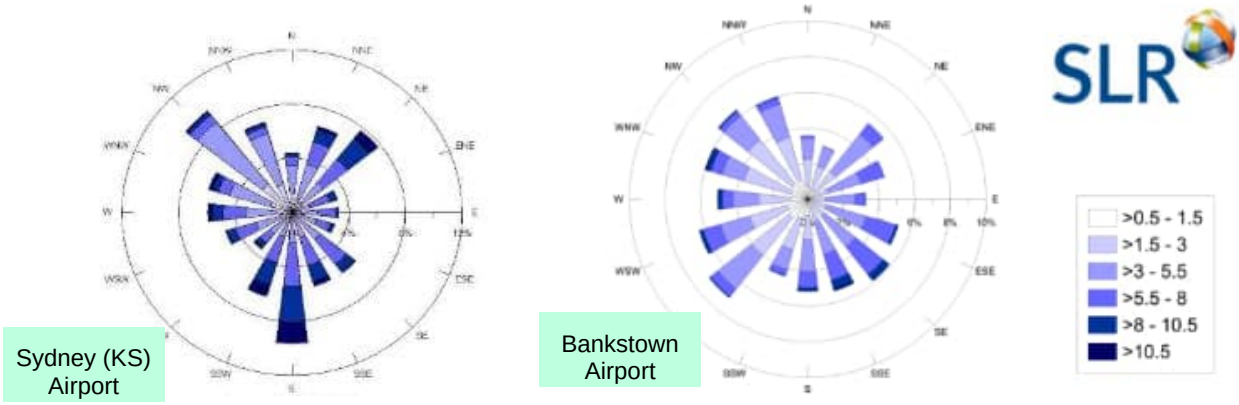
The data of interest in this study are the mean hourly wind speeds and largest gusts experienced throughout the year (especially higher, less frequent winds), how these winds vary with azimuth, and the seasonal break-up of winds into the primary Sydney Region wind seasons.

2.1 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)



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.

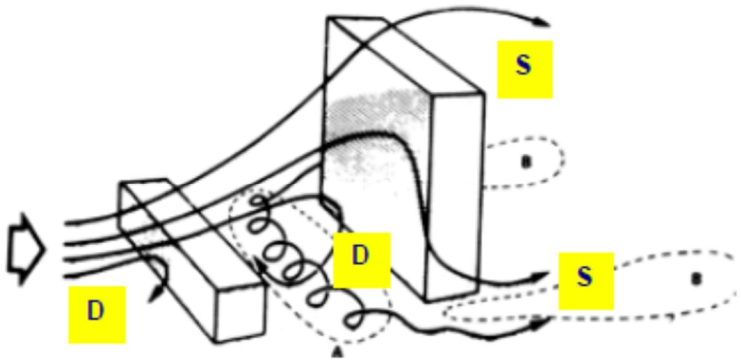
- As noted in **Section 1.3**, the site is currently surrounded by low rise development from west quadrants and mid to high rise development in other directions.
- The site will, therefore, will have reasonable wind shielding at lower levels from east quadrants, leaving it exposed to stronger winds from the west.

3.0 BUILDING-WIND INTERACTION – 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.

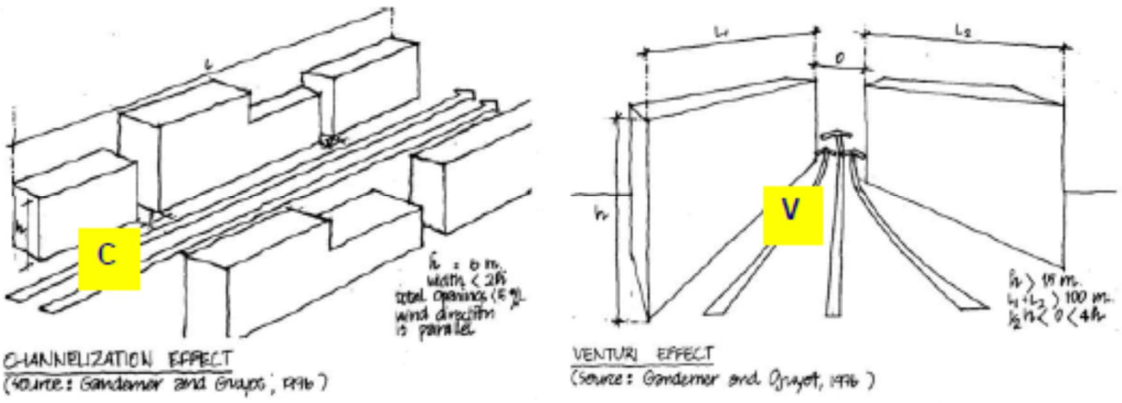
Figure 5 Windflow Patterns Past Regular-Shaped Buildings



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

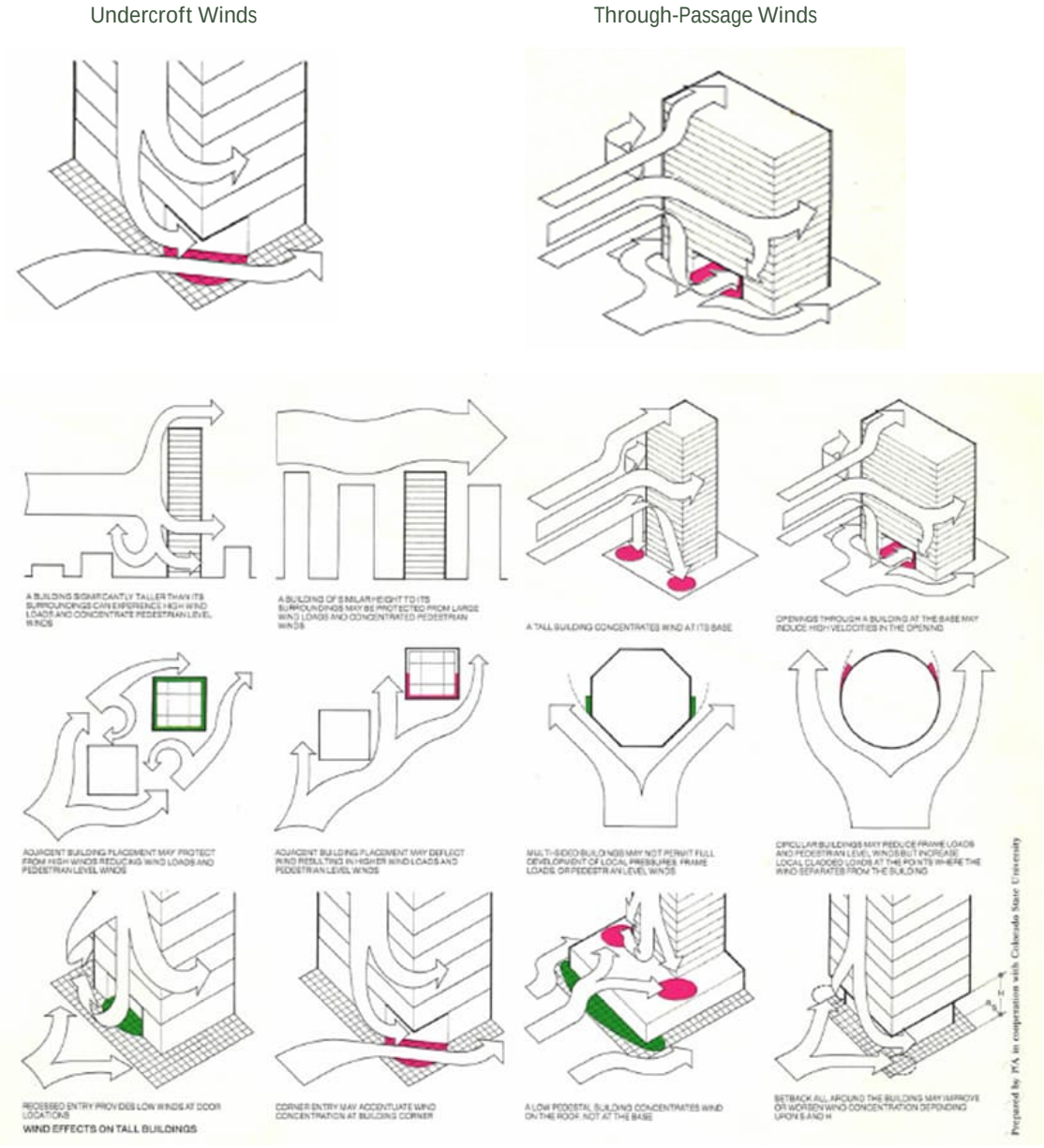


Local building details can also influence winds in the immediate vicinity – refer **Figure 7**.

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



4.0 Wind Acceptability Criteria

4.1 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 sets of acceptability criteria developed from this research, currently referenced by many Australian Local Government Development Control Plans and suited to desktop wind assessments, 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 not exacerbate existing adverse wind 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”.

4.2 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, less trafficked areas provided the general site satisfies the relevant criteria.

5.0 WIND IMPACT ASSESSMENT FOR PLANNING PROPOSAL CONSIDERATION

5.1 Areas of Interest in Relation to Wind Impact

The wind conditions of interest to this study are:

- Surrounding pedestrian walkways
- Building entry point

5.2 Future Wind Impact at All Areas of Interest

The future development's wind impact is described by examining the impact of key prevailing wind conditions on areas of interest within and outside 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:

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

The above predictions are made based on our best engineering judgment 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 proposal development.

Prevailing Wind Direction:
NORTHEAST Winds

Period of Annual Cycle:
Summer

Location	Key Factors	
Pyrmont Street	While NE winds are typically mild, the development may cause wind channelling and downwash along the adjacent pathways. High-rise towers upstream to the northeast will provide high-level shielding to this area.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply
Fig Street	NE winds are typically mild. Furthermore, the elevated walkway running along the northern perimeter of the site is shielded by the overpass sections of the Western Distributor.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply
Harris Street	NE winds are typically mild and Harris Street footpaths will be shielded by the development itself for NE winds.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply
Quarry Street	NE winds are typically mild and Quarry Street footpaths will be shielded by the development itself for NE winds.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply
Building Entry WEST	The Harris Street entry point will be shielded from NE winds by the development itself.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply

Prevailing Wind Direction: **SOUTHEAST (& SOUTH) Winds**

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

Location	Key Factors	
Pyrmont Street	There is potential for the existing building to channel winds onto this area during S/SE winds. However, the proposed evergreen trees close to Quarry Street , along with existing deciduous trees, will help to partially mitigate the impact.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply
Fig Street	This elevated walkway running along the northern perimeter of the site is shielded by the development itself.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply
Harris Street	The existing building may channel S/SE winds onto this street. The presence of the awning could amplify this effect by restraining the wind to lower levels, increasing its intensity along the east-side footpath. However, the trees along the street footpath will help reduce this impact. The effectiveness of these measures can be confirmed through wind tunnel testing.	
	Compliance of existing wind speeds	Likely Just Complies
	Impact of proposed development	No change; Will continue to just comply
Quarry Street	The existing building may cause downwash from southerly winds in this area, with the impact being more pronounced around the building's corner, even with the existing trees. This street is primarily used for business walking, so more stringent criteria for standing or seating are not relevant, and the wind conditions, even with the existing trees, including some deciduous ones, may meet the required comfort criteria, which will be verified through the proposed wind tunnel testing.	
	Compliance of existing wind speeds	Borderline compliance
	Impact of proposed development	No change – continued borderline compliance
Building Entry WEST	There is potential for the existing building to channel winds onto this entry point under southerly wind conditions. However, the impact will be reduced by the existing trees along the street footpath.	
	Compliance of existing wind speeds	Borderline compliance
	Impact of proposed development	No change – continued borderline compliance

Prevailing Wind Direction:
WESTERLY Winds (SW-NW)

Period of Annual Cycle:
Winter / Early Spring

Location	Key Factors	
Pyrmont Street	The impact of west quadrant winds on this area will be blocked by the building itself.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	No change; Will continue to comply
Fig Street	This elevated walkway is sheltered by the overpass sections of the Western Distributor. As a result, even high-level westerly winds channelled into this area are unlikely to exceed pedestrian comfort criteria, though this can be confirmed through wind tunnel testing.	
	Compliance of existing wind speeds	Should comply
	Impact of proposed development	No change; should continue to comply
Harris Street	The street orientation may enhance downwash wind speeds onto footpaths below. However, the existing trees, and the awning above the pedestrian walkway will help mitigate this effect.	
	Compliance of existing wind speeds	Complies
	Impact of proposed development	Minimal change
Quarry Street	The building could intensify westerly wind channelling along the street. However, the existing trees may help mitigate the impact of high-level winds on the pedestrian walkway. This can be verified through wind tunnel testing.	
	Compliance of existing wind speeds	Borderline compliance
	Impact of proposed development	No change; maintains borderline compliance
Building Entry WEST	This entry point may face stronger west and southwest winds, with potential downwash winds. While the existing trees and the awning provide some shielding, adding more trees may be needed, as confirmed by wind tunnel testing.	
	Compliance of existing wind speeds	Borderline compliance
	Impact of proposed development	No change; maintains borderline compliance

6.0 MITIGATION AND TREATMENT RECOMMENDATIONS

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).

The above will be confirmed via the detailed Environmental Wind Tunnel Testing that will be carried out for the Project.

In the meantime, in the absence of dedicated wind mitigation solutions, the following are the areas of potential interest in relation to the wind impact of the proposed development:

- Pyrmont Street (SE winds)
- Harris Street (NW/SW winds)
- Quarry Street (W winds)
- Building Entry WEST (SE winds, W quadrant winds)

There are no areas where EXISTING wind conditions are predicted to comply with the relevant comfort criteria and where the proposed development is expected to increase wind speeds such that the criteria are exceeded.

Accordingly, the following preliminary recommendations for wind amelioration features are made in areas where winds may ALREADY be exceeding the relevant comfort criteria for walking, standing, etc, that area, so as to ensure that wind speeds do not increase with the proposed expansion of the site. This will be confirmed via Wind Tunnel Testing.

Surrounding Pedestrian Walkways – refer Figure 8, Figure 9 and Figure 10

- Retain the existing trees on all sides of the development which will mitigate the impact of local wind speeds.
- The existing tree on the corner of Pyrmont and Quarry Streets is deciduous. The current landscape proposal is to remove this tree and replace it with three evergreens (Angophoras). This will enhance the wind environment at this location.
- Westerly and southerly winds may still cause issues in areas with deciduous trees, particularly since there are no trees at the corner of Harris and Quarry Street. While these locations are intended for business walking and do not require stricter criteria, the wind conditions and potential need for additional mitigation measures, such as horizontal windbreaks, should be assessed and confirmed through wind tunnel testing.
- Maintain the awning above the pedestrian walkway along Harris Street, as it will help mitigate the downwash effect caused by westerly winds.

Building Entrance– refer Figure 8, Figure 9 and Figure 10

- The existing setbacks and awning at the ground-level building entry, which will help reduce future wind conditions.
- There are also existing trees close to the entry which will mitigate the impact of local wind speeds.

Figure 8 Wind Mitigation Recommendations – Ground Level

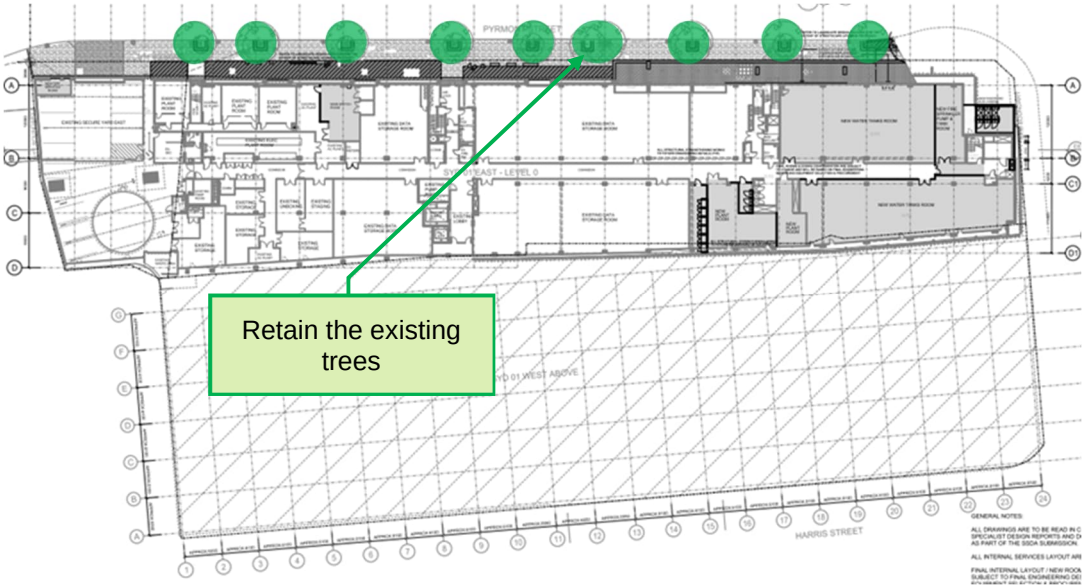


Figure 9 Wind Mitigation Recommendations – Level 1

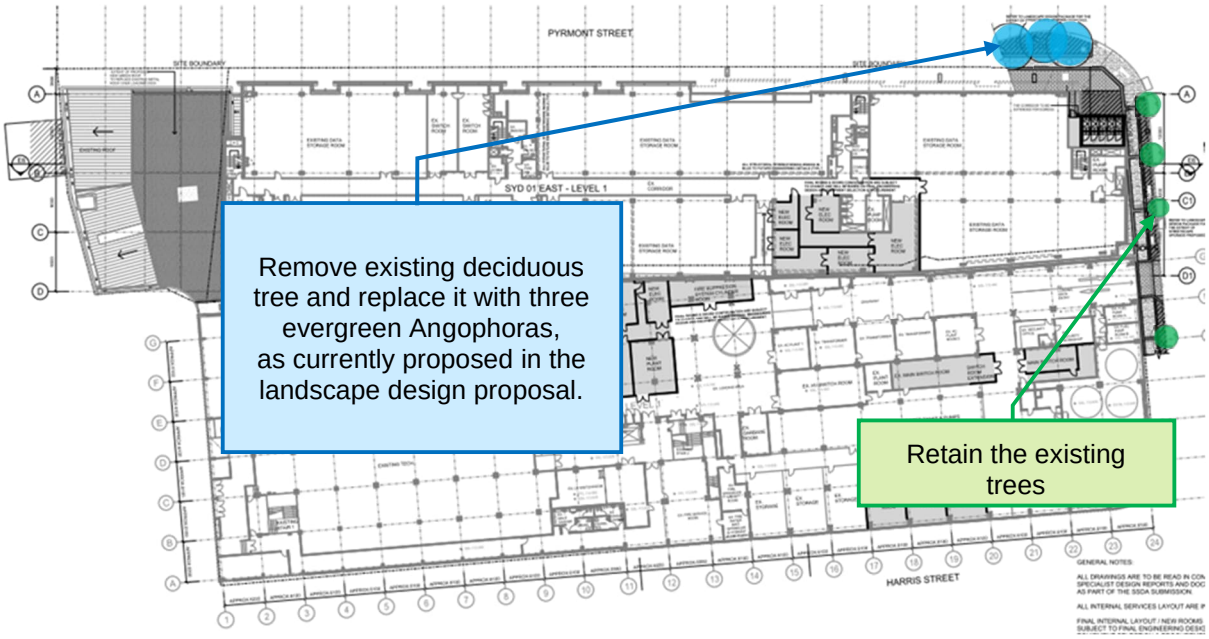
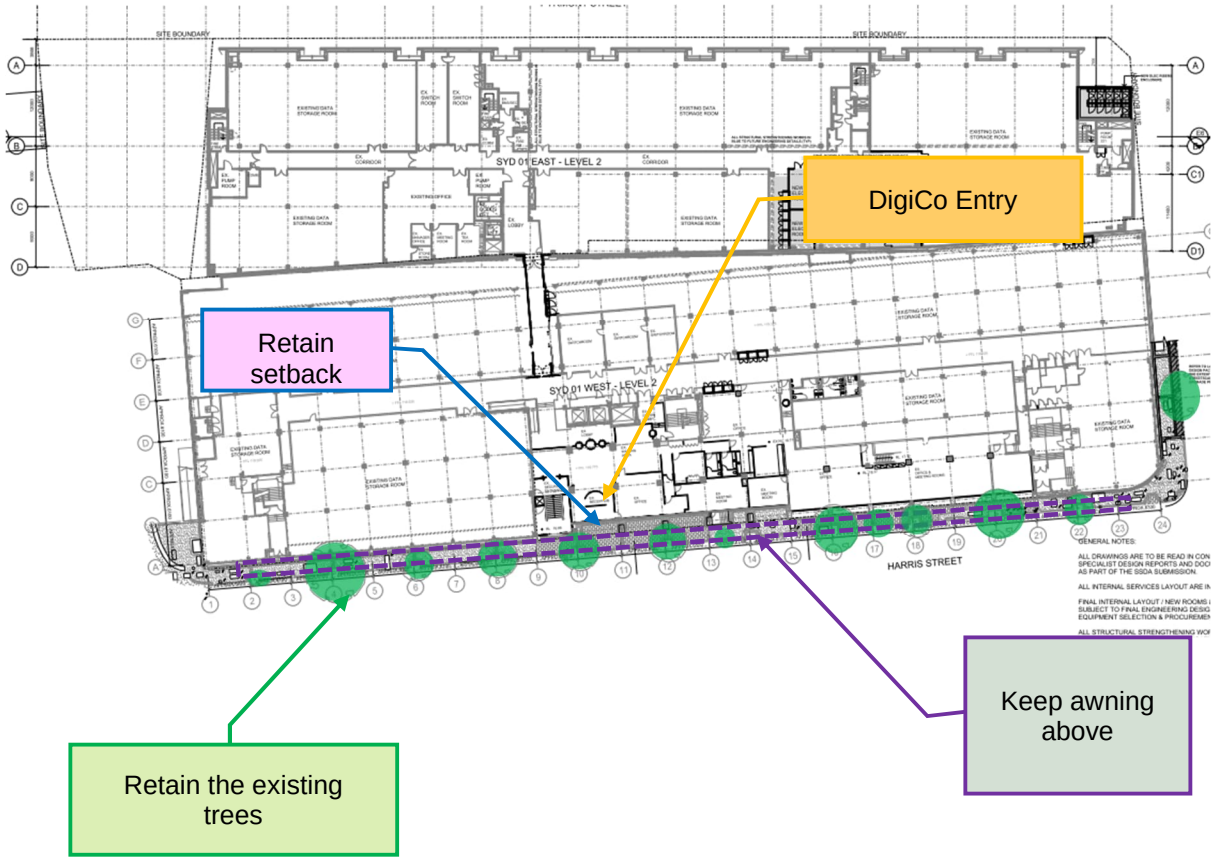


Figure 10 Wind Mitigation Recommendations – Level 2



7.0 Conclusion

This qualitative (desktop) wind assessment report has been prepared by SLR Consulting Australia Pty Ltd (SLR) on behalf of HDI SYD1 Property Holdings Pty Limited (DigiCo) in support of a State Significant Development Application (SSDA) submitted to the Department of Planning, Housing and Infrastructure (DPHI) under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979).

The SSDA seeks approval for intensification of the existing data centre development at the site. Specifically, the SSDA seeks consent for the vertical expansion of two existing data centres at the site known as SYD1W (western facility) and SYD1E (eastern facility). The vertical expansion would allow for the intensification of the data centre to provide for a 88MW facility.

This report provides an assessment of wind comfort and responds to the Secretary's Environmental Assessment Requirements (SEARs) issued by DPHI on 8 May 2024 in relation to the project.

The assessment has been made based on 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 desktop study will be followed up with a detailed Environmental Wind Tunnel Study.

Local Site 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 the development 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 low rise development from west quadrants and mid to high rise development in other directions.
- The site will, therefore, will have reasonable wind shielding at lower levels from east quadrants, leaving it exposed to stronger winds from the west.

Future Wind Environment

In terms of the *future* wind environment with the proposed development expansion, the following preliminary recommendations for wind amelioration features are made in areas (to be confirmed via Wind Tunnel Testing) where winds are expected to approach or exceed the relevant criterion depending on the designed use for that area:

- Retain the existing trees surrounding the development, as they help mitigate local wind speeds – refer **Figure 8** and **Figure 9** and **Figure 10**.
- Replace the existing deciduous tree at the corner of Pyrmont Street and Quarry Street and replace with the three proposed evergreen trees (Angophoras) to help reduce wind levels from the west and south – refer **Figure 10**.

- Westerly and southerly winds may still pose challenges in areas with deciduous trees, particularly at the corner of Harris and Quarry Street, where no trees are currently present. Although these areas are primarily for business walking and do not require stricter criteria, the wind conditions and potential need for any additional measures should be evaluated and confirmed through wind tunnel testing – refer **Figure 9.**
- Maintain the awning above the pedestrian walkway along Harris Street to reduce the downwash effect caused by westerly winds – refer **Figure 10.**
- The existing setbacks and awning at the ground-level building entry will contribute to reducing future wind conditions – refer **Figure 10.**
- Retain the existing trees near the entry to further mitigate the impact of local wind speeds – refer **Figure 10.**

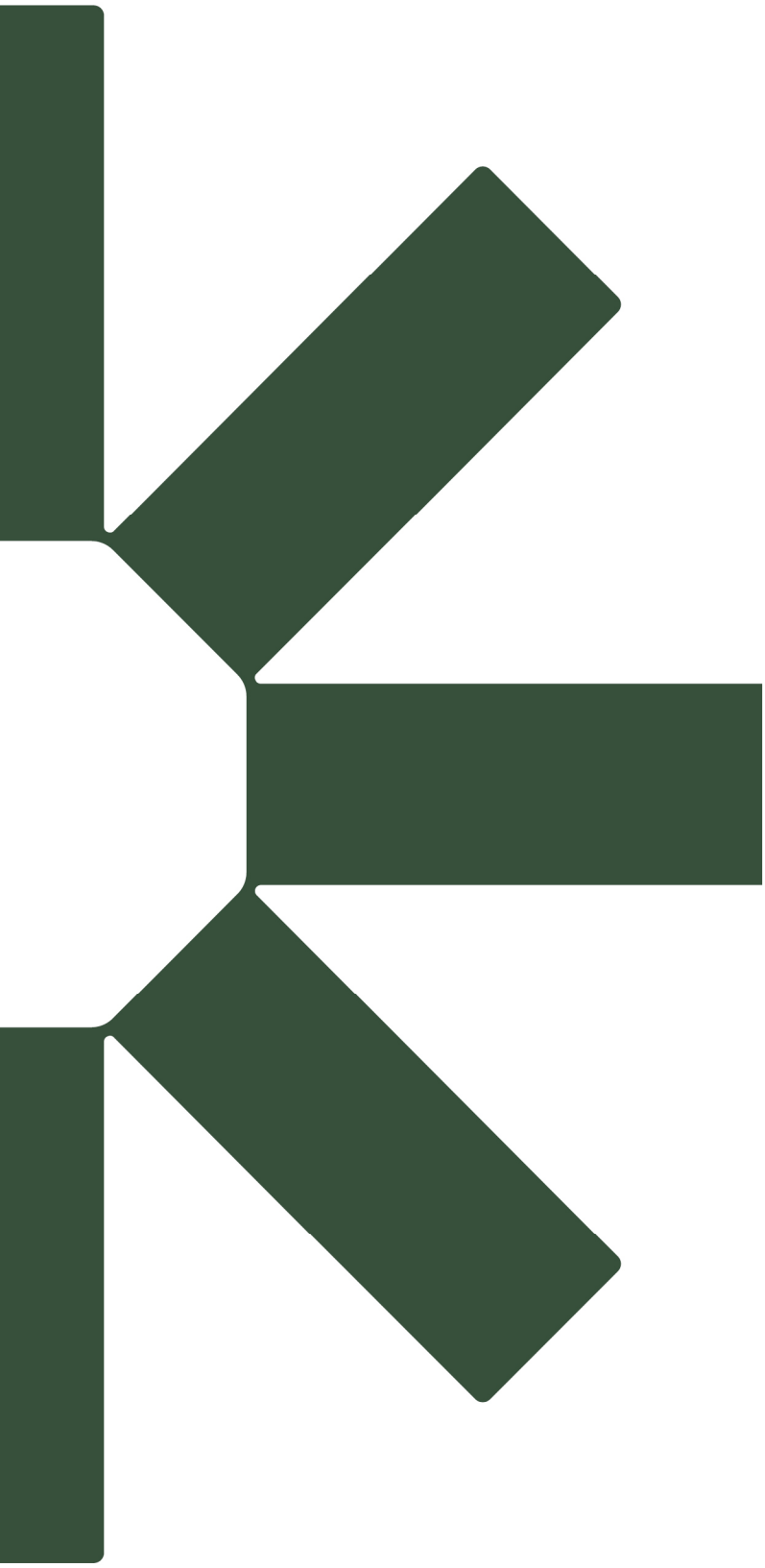
The above analysis has been made on the basis of our best engineering judgment and on the experience gained from scale model wind tunnel testing or computational fluid dynamics analysis of a range of developments. The preliminary conclusions of this SLR report will be quantified using wind tunnel testing.

8.0 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.



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