23-47 VILLIERS STREET

NORTH MELBOURNE, VIC

PEDESTRIAN WIND STUDY

RWDI # 2402470

22 January 2025

SUBMITTED TO

Sentinel
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SUBMITTED BY

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DOCUMENT CONTROL

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RWDI

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QUALITY ASSURANCE

RWDI Australia Pty Ltd. operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015. This management system has been externally certified by SAI Global and License No. QEC 13457 has been issued for the following scope: The provision of consultancy services in acoustic engineering, air quality and wind engineering; and the sale, service, support and installation of acoustic monitoring and related systems and technologies.

Certified System
Quality
ISO 9001
SAI GLOBAL

EXECUTIVE SUMMARY

RWDI Australia Pty Ltd (RWDI) was engaged to conduct a pedestrian wind assessment for the Proposed Development located at 23-47 Villiers Street in North Melbourne, VIC. The pedestrian-level wind microclimate assessment was conducted for the following configurations of the site:

Existing Configuration:	Existing Site with Existing Surrounding Buildings
Proposed Configuration:	Proposed Development with Existing Surrounding Buildings

The pedestrian-level wind conditions within and around the Proposed Development were predicted using the results from a boundary-layer wind tunnel test combined with historical meteorological wind records for the region. The wind speeds have been evaluated against suitable criteria to assess the pedestrian wind comfort and safety conditions within and around the site.

The results of the test are summarised as follows:

Pedestrian Wind Safety

- Existing Configuration: Wind speeds exceeding safety thresholds were observed at the intersection of Harcourt Street and Little George Street, along Flemington Road, and at the eastern end of Villiers Street. These exceedances were caused by the interaction of northerly winds with the existing buildings along Flemington Road.
- Proposed Configuration: With the inclusion of the Proposed Development, the wind conditions at the eastern end of Villiers Street and at the intersection of the Harcourt Street and Little George Street improve over the existing site, satisfying the safety criteria. Safety exceedances caused by existing buildings along Flemington Road persist. High winds were observed at the western end of Harcourt Street, along Little George Street, and at the Harcourt Street / Little George Street corner balconies on the upper levels of Building B.

It is noted that the high winds at the intersection of the Harcourt Street and Little George Street from the existing configuration shifted west along Harcourt Street with the inclusion of the Proposed Development. Hence, the overall wind environment can be considered equivalent to the overall existing site. Additional details are provided within the report.

Pedestrian Wind Comfort

- Existing Configuration: The wind environment around the site was generally calm, with most areas meeting the criteria for sitting and standing use. However, wind speeds exceeding comfort criteria were recorded at the intersection of Harcourt Street / Little George Street and at the corner of Flemington Road and Villiers Street.
- Proposed Configuration: With the inclusion of the Proposed Development, the overall wind environment on the site improves with all ground level areas expected to meet their intended target conditions. High winds observed at the intersection of Harcourt Street / Little George Street for the existing configuration are also expected to be resolved with the inclusion of the proposed development. Additionally, wind conditions within the upper-level communal areas on Levels 1 and 2, as well as all private balconies, are expected to align with their intended uses.

Recommendations

Based on the findings of the wind tunnel study, the following in-principle wind mitigation strategies can be incorporated in the design of the development:

- It is recommended to include a localised awning/trellis along Little George Street near the loading bay. This can be a temporary measure as development on 87 – 89 Flemington is expected to improve conditions.
- It is recommended to Incorporate full-height porous or louvered screening (50% porosity) along one of the open aspects of the Harcourt Street / Little George Street corner balconies on Levels 9 and 10 of Building B.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

RWDI Australia Pty Ltd. (RWDI) was retained to undertake a pedestrian wind assessment of the Proposed Development located at 23-47 Villiers Street in North Melbourne, VIC. This report presents the project objectives, background, and approach, and discusses the results from RWDI's wind tunnel assessment. Commentary on conceptual wind control measures is also provided, if necessary.

The development site is bounded by Harcourt Street to the north, Villiers Street to the south, Little George Street to the east, and Mary Street to the west. The surrounding area primarily consists of low-rise residential, commercial, and school buildings, along with mid-rise residential buildings and an approved hotel located across Little George Street. The Proposed Development is a mixed-use Build-to-Rent (BTR) apartment complex comprising two interconnected 11-storey towers: Building A fronting Villiers Street and Building B fronting Harcourt Street.

Image 1: Site Location Plan

The objective of the study is to assess the wind comfort and safety conditions along pedestrian areas within and around the study site and provide recommendations for minimising adverse wind effects if needed. This quantitative assessment is based on wind speed measurements on a scale model of the Proposed Development and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared with the appropriate criteria to gauge the wind comfort and safety in pedestrian areas. The key outdoor pedestrian accessible areas of interest associated with the development include the pedestrian footpaths around the site, the entrances to the development, the communal open spaces on the ground floor and upper levels, and the private balconies.

2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

To assess the wind environment within and around the Proposed Development, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

Existing Configuration:	Existing Site with Existing Surrounding Buildings (Image 2A); and
Proposed Configuration:	Proposed Development with Existing Surrounding Buildings (Image 2B);

The wind tunnel model included all relevant surrounding buildings and topography within a radius of 360 m around the project site. This encompassed both existing structures and those currently under construction, with an expectation that these would likely be present or completed by the time the proposed subject development concludes. Additionally, the wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were simulated in RWDI's wind tunnel, incorporating spires and roughness blocks.

The wind tunnel model was instrumented with 90 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 1.5 – 2 m above local ground in pedestrian areas throughout the study site. The placement of wind measurement sensors was based on our experience and understanding of the pedestrian usage for this site. Wind speeds were measured for 36 directions in 10-degree increments. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model.

Note that no vegetation was included as part of the configuration tested in accordance with AWES Guidelines (2024). The method for testing scale models in the wind tunnel is consistent with internationally recognised good practice, and meets the requirements set out in the Australasian Wind Engineering Society Quality Assurance Manual (AWES-QAM-2019).

Image 2A: Wind Tunnel Study Model – Existing Configuration

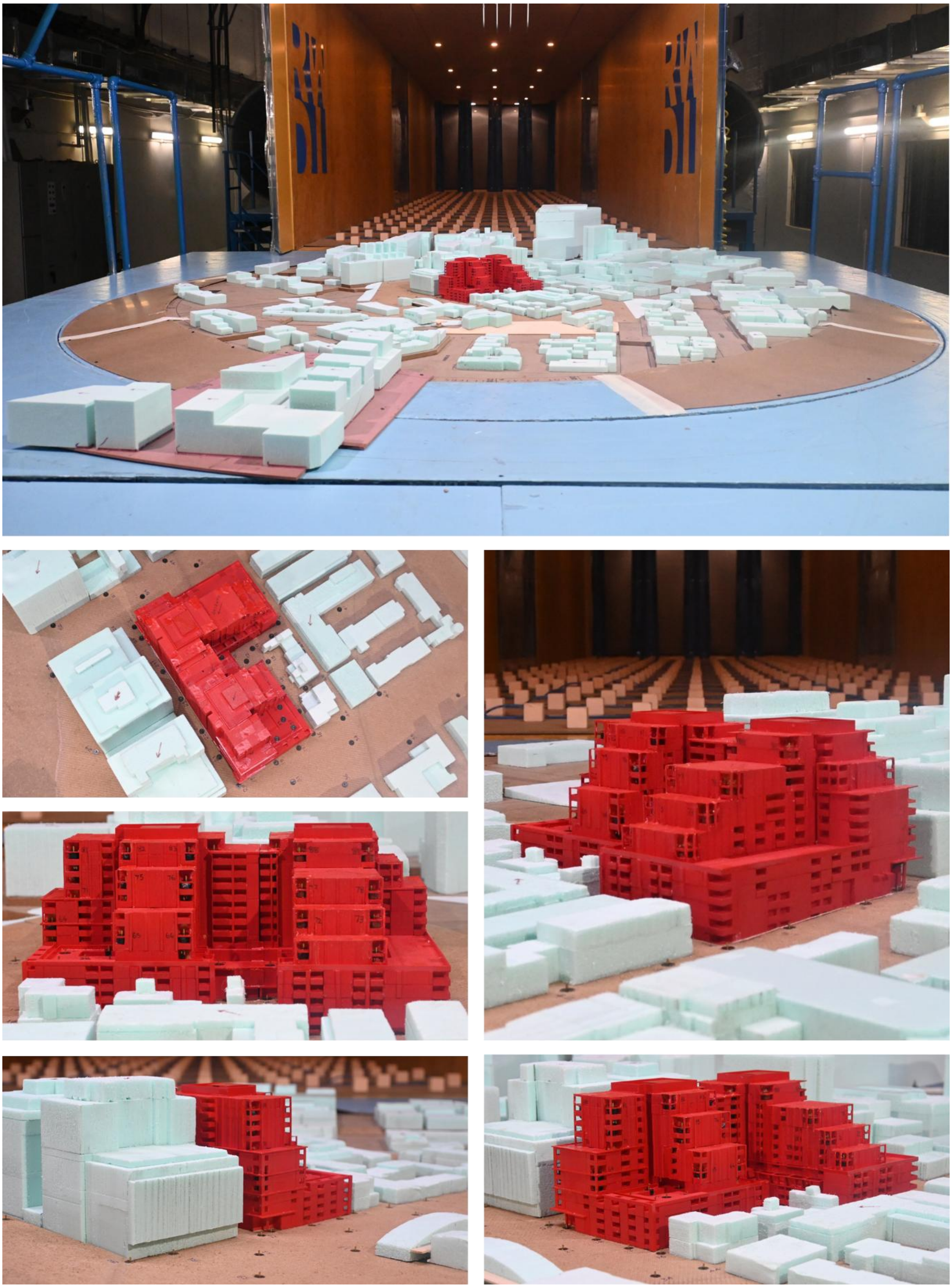

Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Meteorological Data

Wind statistics recorded at Melbourne Airport between 1995 and 2022 (inclusive) were analysed on an annual basis and used to assess the wind conditions in the study area. Image 3 graphically depicts the annual directional distribution of wind frequencies and speeds at the airport. Winds from the north are predominant in Melbourne with secondary winds from the south and west to south-west directions. Strong winds of a mean speed greater than 10 m/s measured at the airport (at an anemometer height of 10 m) occur 11.4% of the time on an annual basis and are mostly from the north.

Wind statistics were combined with the wind tunnel data to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the wind criteria for pedestrian comfort and safety, as described in Section 2.3.

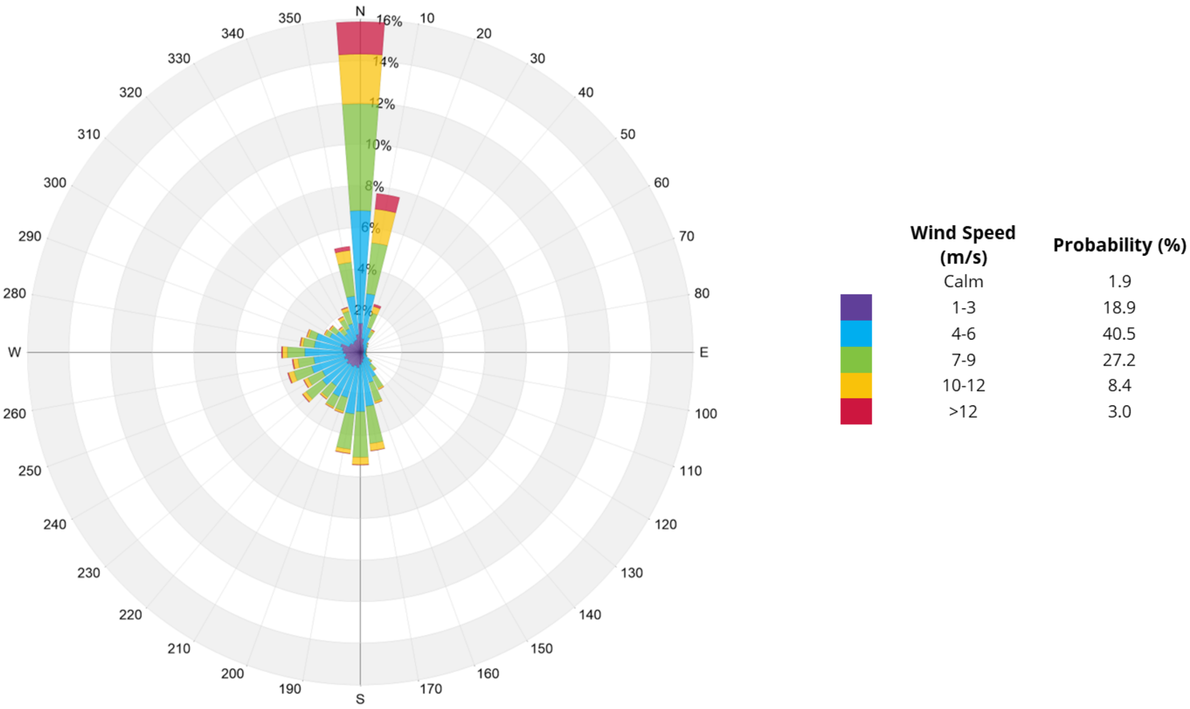

Image 3: Directional Distribution of Winds Approaching Melbourne Airport (1995 - 2022)

2.3 Pedestrian Wind Criteria

The pedestrian wind criteria specified below were used to assess wind comfort and safety conditions in the current study. The comfort and safety conditions for these criteria are based on gust-equivalent-mean (GEM) wind speeds and 3-second gust speeds, respectively.

Table: Pedestrian Wind Comfort and Safety Criteria

Comfort Category	GEM Speed (m/s)	Description
Sitting	≤ 3	Calm or light breezes are desired for outdoor restaurants and seating areas where one can read a paper without having it blown away.
Standing	3 - 4	Gentle breezes suitable for main building entrances, bus stops, communal and commercial terraces, and other places where pedestrians may linger.
Walking	4 - 5	Moderate to high winds suitable for private balconies and for strolling along downtown street, plaza, or park.
Uncomfortable	> 5	Strong winds of this magnitude are considered a nuisance for all pedestrian activities, and wind mitigation is typically recommended.

Notes:
(1) GEM speed = max (mean speed, gust speed/1.85); and Gust Speed = Mean Speed + 3*RMS Speed.
(2) Wind conditions are considered to be comfortable if the predicted GEM speeds are within the respective thresholds for at least 80% of the time.

Safety Criterion	Gust Speed (m/s)	Description
Exceeded	> 20	Excessive gust speeds can adversely affect a pedestrian's balance and footing. Wind mitigation is required.

Notes:
(1) Based on an annual exceedance of 9 hours or 0.1% of the time.
(2) Only gust speeds need to be considered in the wind safety criterion.

It is essential to highlight that the safety criterion proposed above leans towards a conservative stance when compared to other widely accepted standards in other regions. For instance, the wind safety criteria outlined in the Australasian Wind Engineering Society Guidelines for Pedestrian Wind Effects (2024) and by Melbourne (1978) rely on a peak 3-second gust wind speed of 23m/s, with an exceedance threshold of 0.1% of the time during the year. This criterion is the most widely used and agreed-upon safety standard in Australia. Moreover, alternative widely embraced criteria, such as those recommended by Soligo et al. (1998) and Arens et al. (2013), propose a peak 3-second gust of 25m/s (with an exceedance threshold of 0.1% of the time during the year). These criteria are more commonly used around the globe (e.g. Auckland, Middle East etc.). Therefore, it is advisable to contextualise the wind safety findings presented herein with respect to these other widely utilised criteria.

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on the plan figures in Figures 1A through 2.2B located in the “Figures” section of this report. These conditions and the associated wind speeds are also represented in Table 1, located in the “Tables” section of this report. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest. Note that wind tunnel tests have been carried out without any form of vegetation to establish a baseline understanding of the wind conditions around the site.

3.1 Generalised Wind Flows

In the discussion of wind conditions on and around the Proposed Development, reference may be made to the following generalised wind flows (see Image 4). If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable or potentially unsafe conditions. Design details such as setting back a tower from the edges of a podium, deep canopies close to ground level, windscreens / tall trees with dense landscaping, etc. as shown in Image 4 can help to reduce the high wind activity. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

Conversely, in areas where higher wind velocities are desired, design measures can be implemented to enhance wind flow. For instance, channels aligned with prevailing wind directions can be integrated into the design to promote increased wind infiltration in regions prone to stagnant conditions. Such measures are particularly beneficial in areas with generally milder climates and high humidity levels, such as those closer to the equator.

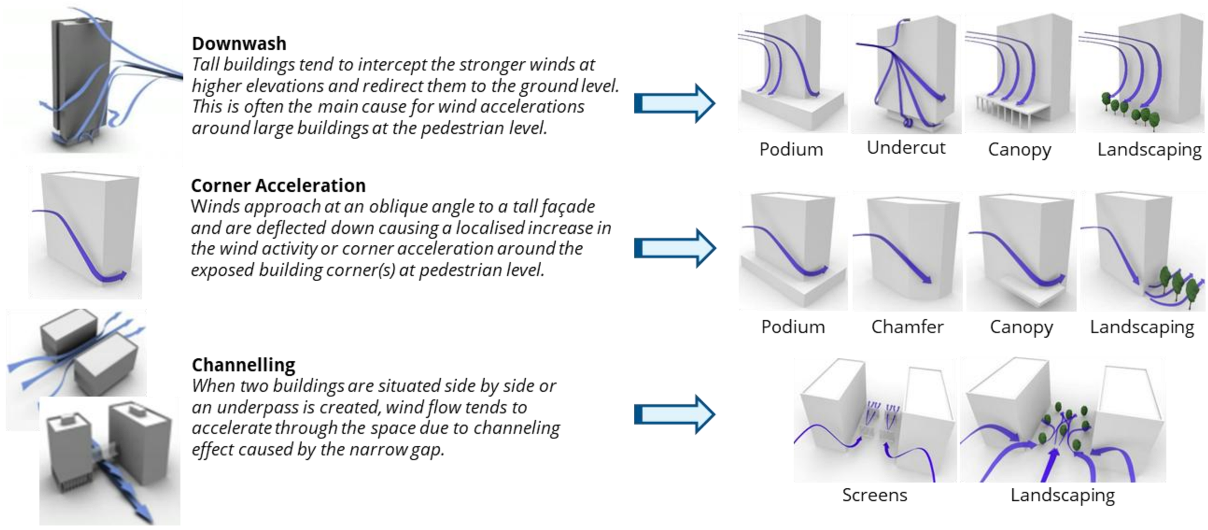

Image 4: General Wind Flows around Buildings and Examples of Wind Control Measures

3.2 Pedestrian Safety

The wind speeds were found to exceed the safety threshold for both the existing and proposed configurations of the site. The impacted areas are noted below:

- **Existing Configuration:** Wind speeds exceeding the wind safety limits were observed at the intersection of Harcourt Street and Little George Street (Sensors 19 and 20), along Flemington Road (Sensors 28 & 29), and at the eastern end of Villiers Street (Sensor 52). These are caused by the interaction of northerly winds with the existing buildings along Flemington Road. **These are the pre-existing wind conditions, not caused by the subject development.**
- **Proposed Configuration:** With the inclusion of the Proposed Development, improvements were observed at Villiers Street (Sensor 52) and at the Harcourt Street and Little George Street intersection (Sensors 19 and 20), where conditions meet the safety criteria. High winds persisted along Flemington Road due to the existing buildings along the road. However, it is noted that the inclusion of the Proposed Development has contributed to a reduction in wind speeds at these locations.
  Safety exceedances were identified at the following locations:
  - Along Harcourt Street (Sensors 17 and 44): The high winds observed at Sensors 17 and 41 along Harcourt Road in the proposed configuration are attributed to the redirection of northerly winds from the Harcourt Street and Little George Street intersection. This redirection is caused by the added massing of the development; however, note that such wind redirection is expected to be a typical outcome of introducing any new development with similar massing on this site.
    It is important to note that the total number of safety exceedances along Harcourt Road remains unchanged between the existing and proposed scenarios. In the existing configuration, exceedances were recorded at Sensors 19 and 20, while in the proposed configuration, these have shifted to Sensors 17 and 41.
    Crucially, the wind safety exceedances at Sensors 17 and 41 in the proposed configuration of the site are within the AWES safety criteria (<23 m/s). By contrast, wind speeds at Sensor 20 in the existing scenario exceeded the AWES safety threshold with gust wind speeds reaching approximately 24 m/s. This shift in high winds, combined with a reduction in overall wind speeds, indicates that the proposed configuration provides wind conditions at least comparable to, or an improvement over, the existing site conditions along Harcourt Street.
  - Little George Street (Sensor 23): High winds result from the channelling of northerly winds between the buildings along Flemington Road, impacting the newly extended Little George Street. Future development at 87-89 Flemington Road is expected to resolve this exceedance. However, a temporary measure might be necessary to alleviate the strong winds.
  - Harcourt Street / Little George Street corner balcony of Building B (Sensor 80): The high winds at this location are due to corner acceleration effects which likely impact the corner balconies on Levels 9 & 10 of Building B.

3.3 Pedestrian Comfort

Wind conditions suitable for walking use are appropriate for footpaths/walkways and areas where pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at building entrances & drop-off areas, bus stops and communal outdoor terraces. Wind speeds comfortable for sitting use are preferred for areas intended for passive long-duration activities such as outdoor dining or café seating. For private balconies, the spaces can be considered suitable for use if conditions are assessed to be within the comfort thresholds. This is primarily because the usage of these spaces is elective with occupants having the option to retreat indoors during events of high winds.

The following key observations can be made regarding the overall wind environment:

- **Existing Configuration:**
  - For the existing configuration, the wind conditions were observed to be generally calm with most areas assessed around the site achieving the criteria for sitting and standing use throughout the year.
  - Windier conditions, suitable for active walking use, were noted north of the site and at the junction of Flemington Road and Villiers Street.
  - Wind speeds exceeding the comfort criteria were observed to the north of the site at the intersection of Harcourt Street and Little George Street (Sensor 20) and the corner of Flemington Road and Villiers Street (Sensors 28).
- **Proposed Configuration:** With the inclusion of the Proposed Development, the overall wind environment was noted to remain comfortable for passive sitting to standing use at most of the locations assessed. The high mean winds noted at the intersection of Little George Street and Harcourt Road for the existing site (Sensor 20) are also eliminated with the inclusion of the Proposed Development. Wind environment around key areas is noted below:
  - The wind conditions around all entrances to the development achieved the target comfort criteria for standing or better.
  - Wind speeds suitable for active walking use were observed along Harcourt Street in the walkways/footpath and carpark, along Little George Street, and along Villiers Street in the carpark along the road.
  - The uncomfortable wind speeds at the junction of Villiers Street and Flemington Road persist from the existing configuration. Note that the Proposed Development does not contribute to this exceedance.
  - Wind conditions within the upper-level communal areas of the development on Levels 1 & 2 are expected to be calm and suitable for passive sitting to standing use.
  - Wind conditions within all private balconies are expected to be within the comfort limits.

3.4 Design Advice and Recommendations

Based on the findings of the wind tunnel study, the following in-principle wind mitigation strategies can be incorporated in the design of the development to improve the overall wind environment:

- Localised awning / trellis is recommended along Little George Street near the loading bay to capture the channelling winds impacting the new laneway. The awning should be at least 2 m deep and cover parts of the footpath where pedestrian can linger.
- Full-height porous or louvered screening with a maximum porosity of 50% is recommended along one of the open aspects of the Harcourt Street / Little George Street corner balconies of Building B on Levels 9 and 10.

4 STATEMENT OF LIMITATIONS

Limitations

This report entitled '*23-47 Villiers Street Pedestrian Wind Study*' was prepared by RWDI Australia Pty Ltd. ("RWDI") for Sentinel ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilise the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

Design Assumptions

RWDI confirms that the pedestrian wind assessment (the "**Assessmen**t") discussed herein was performed by RWDI in accordance with generally accepted professional standards at the time when the Assessment was performed and in the location of the Project. No other representations, warranties, or guarantees are made with respect to the accuracy or completeness of the information, findings, recommendations, or conclusions contained in this Report. This report is not a legal opinion regarding compliance with applicable laws.

The findings and recommendations set out in this report are based on the following information disclosed to RWDI. Drawings and information listed below were received and used to construct the scale model of the Proposed Development **("Project Data**").

File Name	File Type	Date Received
A-RVT01_TP-Sheet - A-1000 - Floor Plan - Basement 01	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1001 - Floor Plan - Lower Ground 2	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1002 - Floor Plan - Lower Ground 1	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1003 - Floor Plan - Ground Level	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1004 - Floor Plan - Level 01	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1005 - Floor Plan - Level 02	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1006 - Floor Plan - Level 03	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1007 - Floor Plan - Level 04	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1008 - Floor Plan - Level 05	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1009 - Floor Plan - Level 06	AutoCAD drawing	3 December 2024

File Name	File Type	Date Received
A-RVT01_TP-Sheet - A-1010 - Floor Plan - Level 07	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1011 - Floor Plan - Level 08	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1012 - Floor Plan - Level 09	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1013 - Floor Plan - Level 10	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1014 - Floor Plan - Roof Level	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-1015 - Floor Plan - Roof Plan	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-2001 - Elevations - Sheet 01 - North West	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-2002 - Elevations - Sheet 02 - South East	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-2003 - Elevations - Sheet 03 - North East	AutoCAD drawing	3 December 2024
A-RVT01_TP-Sheet - A-2004 - Elevations - Sheet 04 - South West	AutoCAD drawing	3 December 2024
A-RVT01_TP	Revit	3 December 2024

The recommendations and conclusions are based on the assumption that the Project Data and Climate Data are accurate and complete. RWDI assumes no responsibility for any inaccuracy or deficiency in information it has received from others. In addition, the recommendations and conclusions in this report are partially based on historical data and can be affected by a number of external factors, including but not limited to Project design, quality of materials and construction, site conditions, meteorological events, and climate change. As such, the conclusions and recommendations contained in this report do not list every possible outcome.

The opinions in this report can only be relied up on to the extent that the Project Data and Project Specific Conditions have not changed. Any change in the Project Data or Project Specific Conditions not reflected in this report can impact and/or alter the recommendations and conclusions in this report. Therefore, it is incumbent upon the Client and/or any other third party reviewing the recommendations and conclusions in this report to contact RWDI in the event of any change in the Project Data and Project Specific Conditions in order to determine whether any such change(s) may impact the assumptions upon which the recommendations and conclusions were made.

5 REFERENCES

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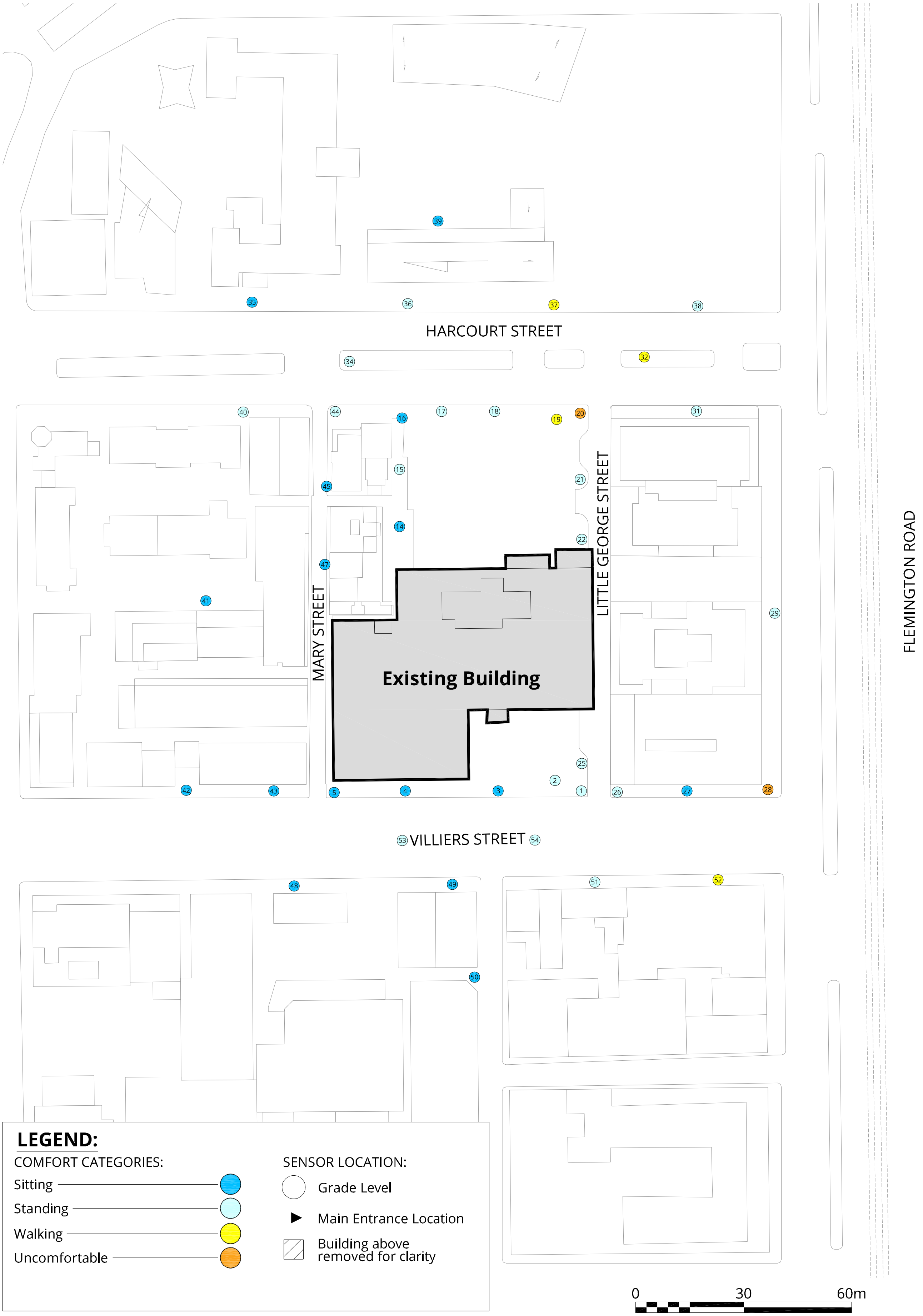
FIGURES



Pedestrian Wind Comfort Conditions
Existing Configuration
Annual (January to December, 0:00 to 23:00)

Lot 27-47 Villiers Street North - Melbourne, VIC

True North

Project #2402470

Drawn by:	SMJ	Figure:	1A
Approx. Scale:	1:1500		
Date Revised:	Jan. 13, 2025		

Pedestrian Wind Comfort Conditions
Proposed Configuration
Annual (January to December, 0:00 to 23:00)

Lot 27-47 Villiers Street North - Melbourne, VIC

True North

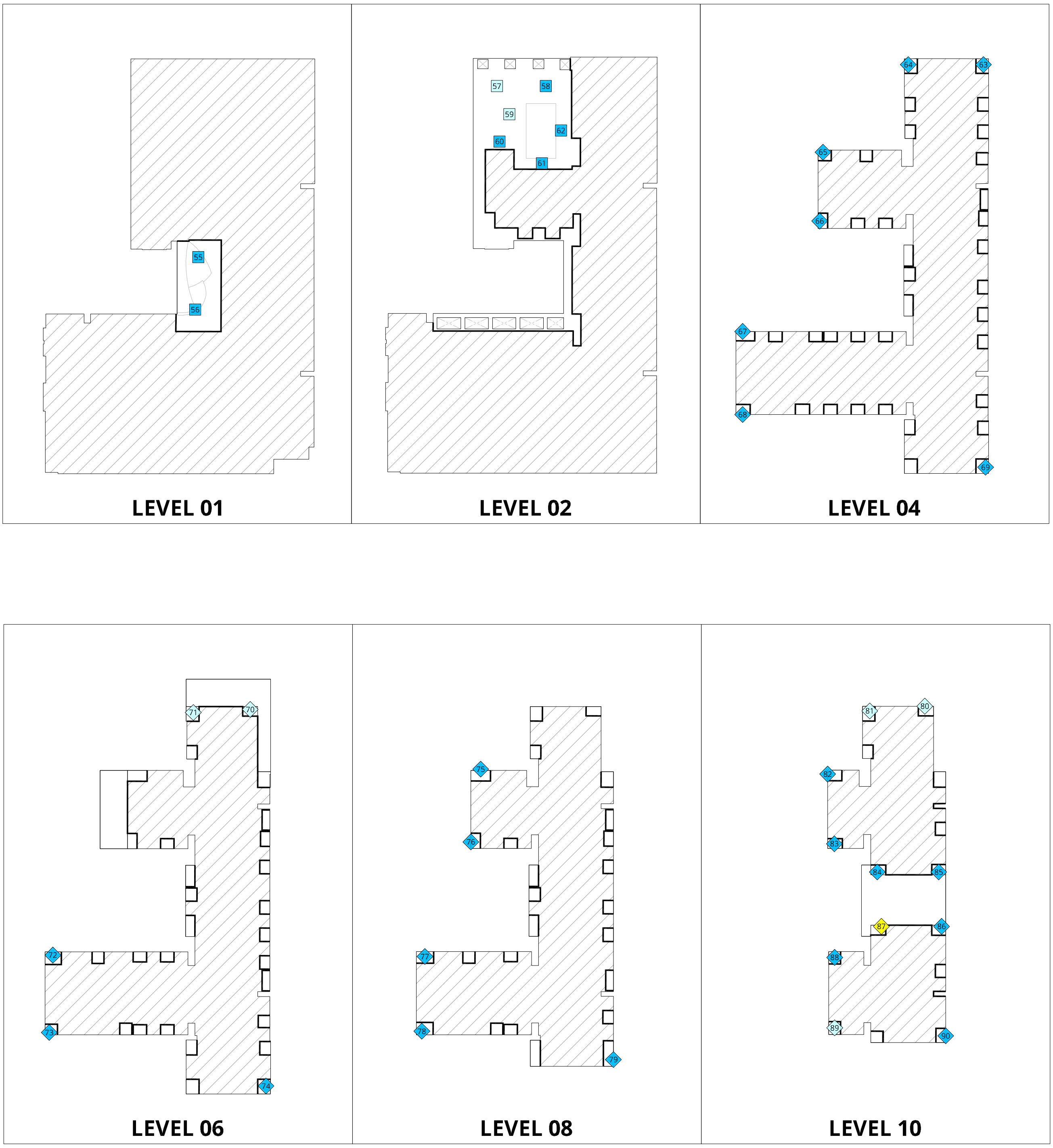
Project #2402470

Drawn by: SMJ

Figure: 1.1B

Approx. Scale: 1:1500

Date Revised: Jan. 13, 2025



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Terraces
- Balconies

0 30 60m

Pedestrian Wind Comfort Conditions

Proposed Configuration

Annual (January to December, 0:00 to 23:00)

Lot 27-47 Villiers Street North - Melbourne, VIC

True North

Project #2402470

Drawn by: SMJ	Figure: 1.2B
Approx. Scale:	1:1500
Date Revised:	Jan. 13, 2025

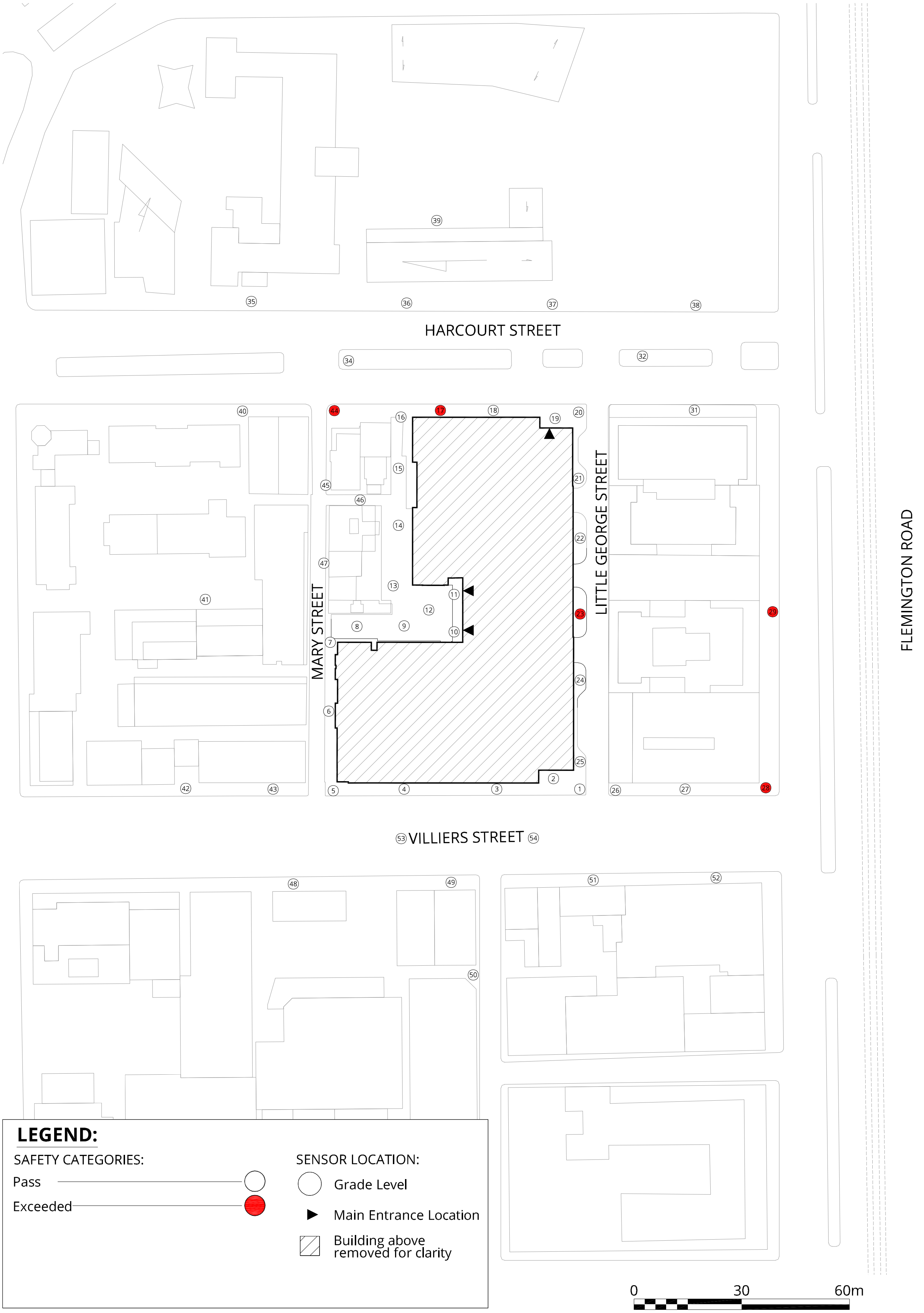
Pedestrian Wind Safety Conditions
Existing Configuration
Annual (January to December, 0:00 to 23:00)

Lot 27-47 Villiers Street North - Melbourne, VIC

True North

Project #2402470

Drawn by: SMJ	Figure: 2A
Approx. Scale: 1:1500	
Date Revised: Jan. 13, 2025	



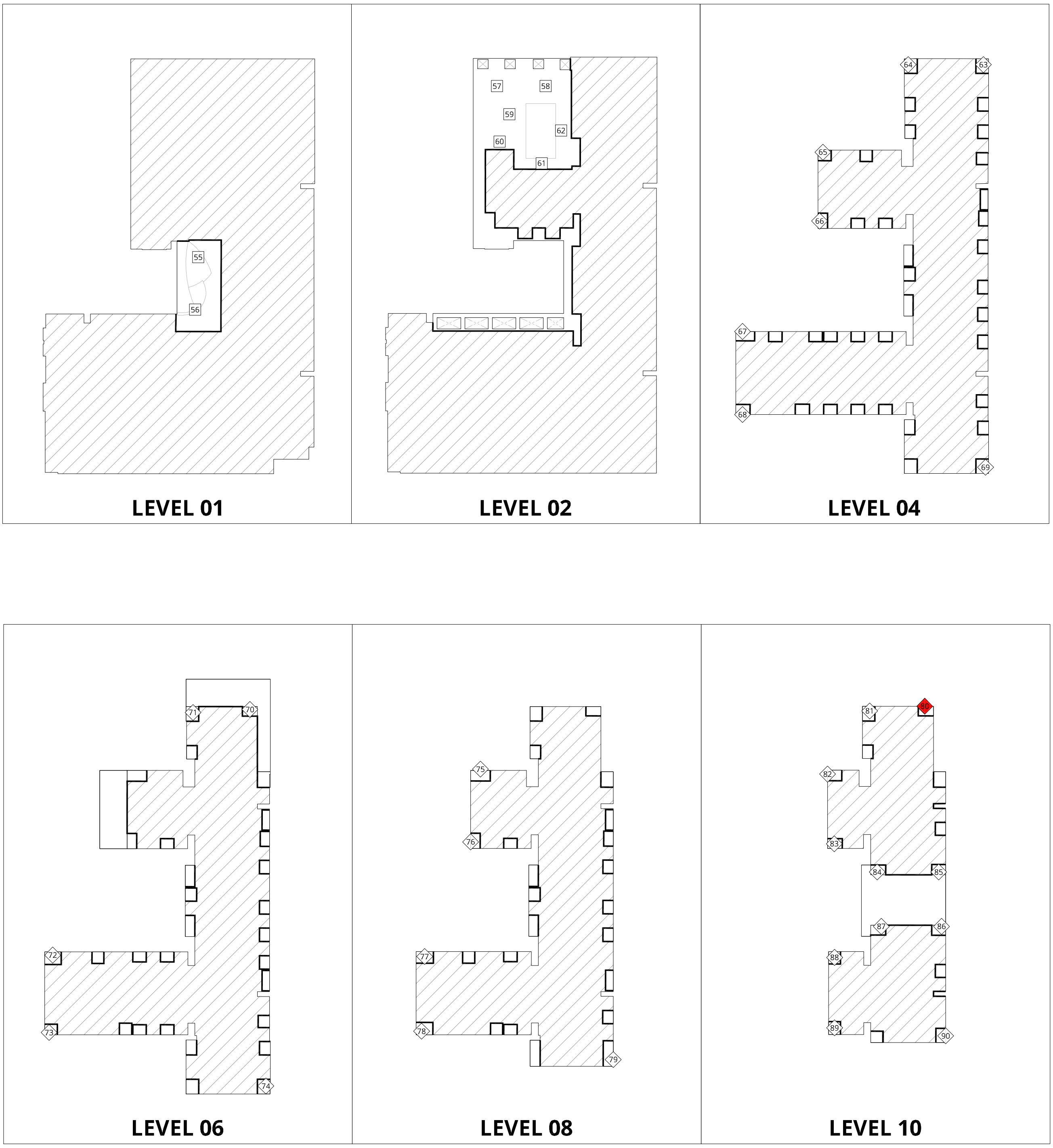
Pedestrian Wind Safety Conditions
Proposed Configuration
Annual (January to December, 0:00 to 23:00)

Lot 27-47 Villiers Street North - Melbourne, VIC

True North

Project #2402470

Drawn by: SMJ	Figure: 2.1B	
Approx. Scale:	1:1500	
Date Revised:	Jan. 13, 2025	



LEGEND:

SAFETY CATEGORIES:

- Pass
- Exceeded

SENSOR LOCATION:

- Terraces
- Balconies

0 30 60m

Pedestrian Wind Safety Conditions

Proposed Configuration

Annual (January to December, 0:00 to 23:00)

Lot 27-47 Villiers Street North - Melbourne, VIC

True North

Project #2402470

Drawn by: SMJ	Figure: 2.2B
Approx. Scale:	1:1500
Date Revised:	Jan. 13, 2025

TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Season	Configuration	Wind Comfort		Wind Safety	
			Speed	Rating	Speed	Rating
1	Annual	Existing Proposed	4.0 3.8	Standing Standing	18 15	Pass Pass
2	Annual	Existing Proposed	3.4 3.1	Standing Standing	17 12	Pass Pass
3	Annual	Existing Proposed	3.0 3.2	Sitting Standing	15 12	Pass Pass
4	Annual	Existing Proposed	2.7 2.3	Sitting Sitting	12 10	Pass Pass
5	Annual	Existing Proposed	2.7 2.8	Sitting Sitting	11 11	Pass Pass
6	Annual	Existing Proposed	- 2.2	N/A Sitting	- 9	N/A Pass
7	Annual	Existing Proposed	- 3.1	N/A Standing	- 12	N/A Pass
8	Annual	Existing Proposed	- 3.1	N/A Standing	- 12	N/A Pass
9	Annual	Existing Proposed	- 2.6	N/A Sitting	- 10	N/A Pass
10	Annual	Existing Proposed	- 1.4	N/A Sitting	- 5	N/A Pass
11	Annual	Existing Proposed	- 1.6	N/A Sitting	- 7	N/A Pass
12	Annual	Existing Proposed	- 1.9	N/A Sitting	- 10	N/A Pass
13	Annual	Existing Proposed	3.0 2.0	Sitting Sitting	16 9	Pass Pass
14	Annual	Existing Proposed	2.6 2.2	Sitting Sitting	14 10	Pass Pass
15	Annual	Existing Proposed	3.3 2.9	Standing Sitting	17 13	Pass Pass
16	Annual	Existing Proposed	3.0 3.9	Sitting Standing	16 17	Pass Pass
17	Annual	Existing Proposed	3.1 3.8	Standing Standing	16 21	Pass Exceeded
18	Annual	Existing Proposed	3.7 3.7	Standing Standing	19 19	Pass Pass
19	Annual	Existing Proposed	4.5 3.2	Walking Standing	21 15	Exceeded Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Season	Configuration	Wind Comfort		Wind Safety	
			Speed	Rating	Speed	Rating
20	Annual	Existing Proposed	5.5 3.8	Uncomfortable Standing	24 20	Exceeded Pass
21	Annual	Existing Proposed	3.1 3.1	Standing Standing	12 15	Pass Pass
22	Annual	Existing Proposed	3.1 3.3	Standing Standing	12 16	Pass Pass
23	Annual	Existing Proposed	- 4.2	N/A Walking	- 22	N/A Exceeded
24	Annual	Existing Proposed	- 3.7	N/A Standing	- 18	N/A Pass
25	Annual	Existing Proposed	3.2 3.6	Standing Standing	13 16	Pass Pass
26	Annual	Existing Proposed	3.6 2.8	Standing Sitting	15 11	Pass Pass
27	Annual	Existing Proposed	2.9 3.2	Sitting Standing	13 13	Pass Pass
28	Annual	Existing Proposed	5.1 5.1	Uncomfortable Uncomfortable	26 25	Exceeded Exceeded
29	Annual	Existing Proposed	3.9 3.5	Standing Standing	21 21	Exceeded Exceeded
31	Annual	Existing Proposed	3.3 3.5	Standing Standing	17 16	Pass Pass
32	Annual	Existing Proposed	4.4 3.8	Walking Standing	18 19	Pass Pass
34	Annual	Existing Proposed	3.6 4.2	Standing Walking	17 19	Pass Pass
35	Annual	Existing Proposed	2.7 2.9	Sitting Sitting	11 11	Pass Pass
36	Annual	Existing Proposed	3.4 4.0	Standing Standing	16 17	Pass Pass
37	Annual	Existing Proposed	4.1 4.0	Walking Standing	17 16	Pass Pass
38	Annual	Existing Proposed	3.4 3.1	Standing Standing	14 13	Pass Pass
39	Annual	Existing Proposed	2.4 2.5	Sitting Sitting	11 10	Pass Pass
40	Annual	Existing Proposed	3.2 3.4	Standing Standing	17 18	Pass Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Season	Configuration	Wind Comfort		Wind Safety	
			Speed	Rating	Speed	Rating
41	Annual	Existing Proposed	2.2 2.2	Sitting Sitting	10 10	Pass Pass
42	Annual	Existing Proposed	2.4 2.2	Sitting Sitting	10 9	Pass Pass
43	Annual	Existing Proposed	2.7 2.7	Sitting Sitting	10 10	Pass Pass
44	Annual	Existing Proposed	3.4 4.1	Standing Walking	17 21	Pass Exceeded
45	Annual	Existing Proposed	2.6 3.3	Sitting Standing	11 16	Pass Pass
46	Annual	Existing Proposed	2.7 2.7	Sitting Sitting	14 12	Pass Pass
47	Annual	Existing Proposed	2.1 2.2	Sitting Sitting	10 10	Pass Pass
48	Annual	Existing Proposed	2.6 2.3	Sitting Sitting	11 12	Pass Pass
49	Annual	Existing Proposed	2.9 2.9	Sitting Sitting	17 14	Pass Pass
50	Annual	Existing Proposed	2.5 2.0	Sitting Sitting	11 11	Pass Pass
51	Annual	Existing Proposed	3.3 3.7	Standing Standing	17 18	Pass Pass
52	Annual	Existing Proposed	4.1 3.4	Walking Standing	22 20	Exceeded Pass
53	Annual	Existing Proposed	3.2 3.3	Standing Standing	17 13	Pass Pass
54	Annual	Existing Proposed	3.4 4.2	Standing Walking	19 17	Pass Pass
55	Annual	Existing Proposed	- 1.9	N/A Sitting	- 9	N/A Pass
56	Annual	Existing Proposed	- 2.0	N/A Sitting	- 8	N/A Pass
57	Annual	Existing Proposed	- 3.6	N/A Standing	- 15	N/A Pass
58	Annual	Existing Proposed	- 2.6	N/A Sitting	- 11	N/A Pass
59	Annual	Existing Proposed	- 3.1	N/A Standing	- 15	N/A Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Season	Configuration	Wind Comfort		Wind Safety	
			Speed	Rating	Speed	Rating
60	Annual	Existing Proposed	- 2.6	N/A Sitting	- 14	N/A Pass
61	Annual	Existing Proposed	- 1.8	N/A Sitting	- 9	N/A Pass
62	Annual	Existing Proposed	- 2.1	N/A Sitting	- 10	N/A Pass
63	Annual	Existing Proposed	- 2.3	N/A Sitting	- 12	N/A Pass
64	Annual	Existing Proposed	- 2.3	N/A Sitting	- 12	N/A Pass
65	Annual	Existing Proposed	- 2.7	N/A Sitting	- 14	N/A Pass
66	Annual	Existing Proposed	- 1.8	N/A Sitting	- 7	N/A Pass
67	Annual	Existing Proposed	- 1.8	N/A Sitting	- 11	N/A Pass
68	Annual	Existing Proposed	- 2.0	N/A Sitting	- 9	N/A Pass
69	Annual	Existing Proposed	- 2.3	N/A Sitting	- 11	N/A Pass
70	Annual	Existing Proposed	- 3.1	N/A Standing	- 17	N/A Pass
71	Annual	Existing Proposed	- 3.3	N/A Standing	- 16	N/A Pass
72	Annual	Existing Proposed	- 2.1	N/A Sitting	- 13	N/A Pass
73	Annual	Existing Proposed	- 2.0	N/A Sitting	- 10	N/A Pass
74	Annual	Existing Proposed	- 2.2	N/A Sitting	- 12	N/A Pass
75	Annual	Existing Proposed	- 2.1	N/A Sitting	- 10	N/A Pass
76	Annual	Existing Proposed	- 2.0	N/A Sitting	- 9	N/A Pass
77	Annual	Existing Proposed	- 2.4	N/A Sitting	- 12	N/A Pass
78	Annual	Existing Proposed	- 2.2	N/A Sitting	- 10	N/A Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Season	Configuration	Wind Comfort		Wind Safety	
			Speed	Rating	Speed	Rating
79	Annual	Existing Proposed	- 2.5	N/A Sitting	- 15	N/A Pass
80	Annual	Existing Proposed	- 3.9	N/A Standing	- 21	N/A Exceeded
81	Annual	Existing Proposed	- 3.2	N/A Standing	- 15	N/A Pass
82	Annual	Existing Proposed	- 2.5	N/A Sitting	- 13	N/A Pass
83	Annual	Existing Proposed	- 2.3	N/A Sitting	- 10	N/A Pass
84	Annual	Existing Proposed	- 2.5	N/A Sitting	- 11	N/A Pass
85	Annual	Existing Proposed	- 2.5	N/A Sitting	- 14	N/A Pass
86	Annual	Existing Proposed	- 2.3	N/A Sitting	- 12	N/A Pass
87	Annual	Existing Proposed	- 4.6	N/A Walking	- 19	N/A Pass
88	Annual	Existing Proposed	- 2.5	N/A Sitting	- 15	N/A Pass
89	Annual	Existing Proposed	- 3.1	N/A Standing	- 14	N/A Pass
90	Annual	Existing Proposed	- 2.8	N/A Sitting	- 16	N/A Pass

Seasons	Months	Hours	Wind Comfort (m/s)		Wind Safety (m/s)	
Annual	January - December	0:00 - 23:00	≤ 3	Sitting	≤ 20	Pass
			≤ 4	Standing	> 20	Exceeded
			≤ 5	Walking		
			> 5	Uncomfortable		

Configurations

Existing	Existing site and surroundings
Proposed	Project with existing surroundings