BLOCK 9 SECTION 132

CASEY, ACT

PEDESTRIAN WIND ASSESSMENT

PROJECT # 2206556

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SUBMITTED TO

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1. INTRODUCTION

RWDI Australia Pty Ltd (RWDI) was retained to undertake a pedestrian wind assessment of the proposed development located at Block 9, Section 132 in Casey, ACT. The project site is located towards the northern fringes of the city, approximately 13km to the north of the Canberra CBD. The proposed development is located to the southeast of the Casey Market Town and the west of the Casey Pond at the intersection of Horse Park Drive and Clarrie Hermes Drive. The location of the site within its broader context is shown in Image 1.

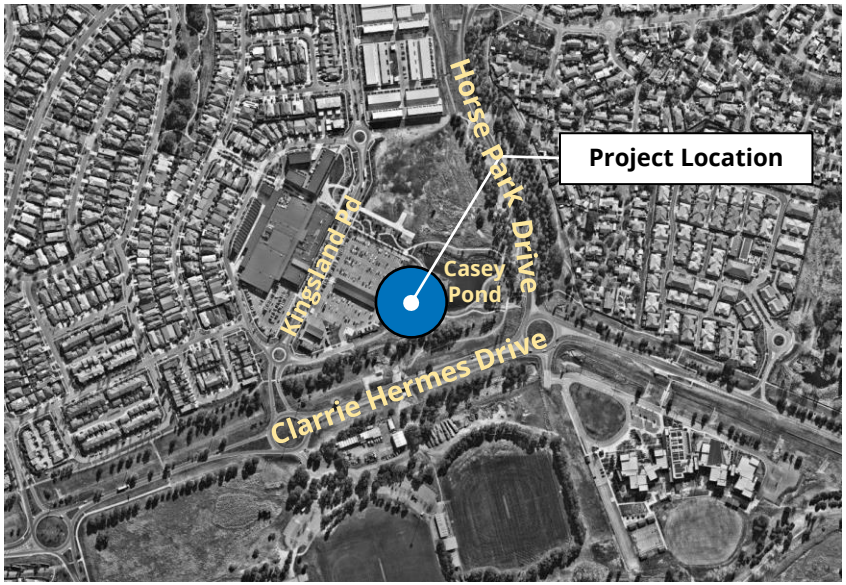


Image 1: Aerial View of the Existing Site and Surroundings
Source: Nearmap

The proposed development is a 11-storey residential-led building with ground level retail, basement parking, and rooftop sky terrace apartments. The proposed building has a triangular planform with a lower-level central communal courtyard, as shown in Image 2. The key outdoor pedestrian accessible areas of interest associated with the development include the pedestrian footpaths around the site, entrance to the building, and the various amenity spaces on ground and upper levels.

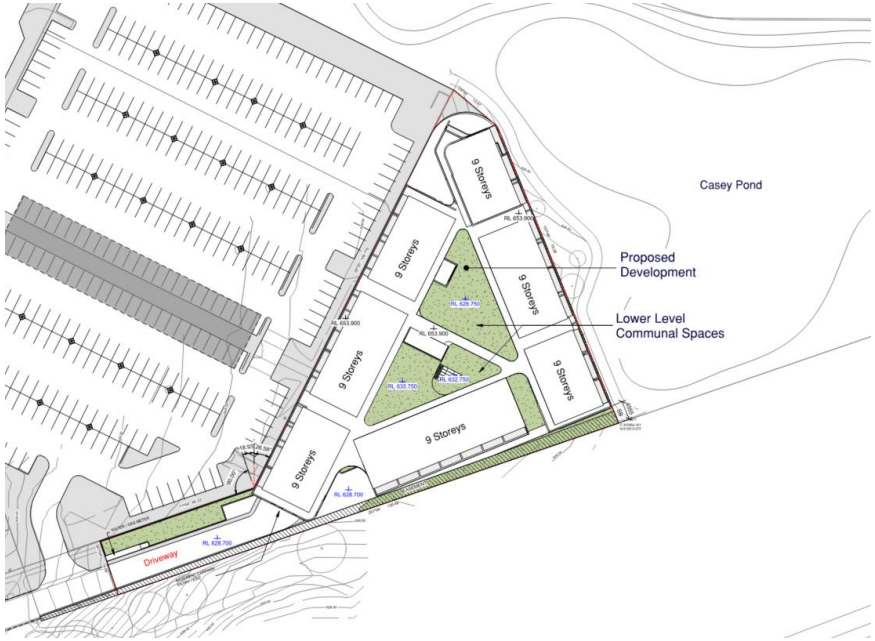


Image 2: Site Plan of the Proposed Development

2. METHODOLOGY

Predicting wind speeds and occurrence frequencies around a building is a complex process and involves the combined assessment of building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies and CFD assessments on pedestrian wind conditions around buildings, yielding a broad knowledge base of potential flow behaviour. In some situations, this knowledge and experience, together with literature, allows for a reliable, consistent and efficient desktop estimation of pedestrian wind conditions without wind-tunnel testing.

This qualitative approach provides a screening-level estimation of potential wind conditions and offers conceptual wind control measures to improve wind comfort, where deemed necessary. In order to quantify and confirm the predicted conditions or to refine any of the suggested conceptual wind control measures, physical scale model tests in a boundary-layer wind tunnel would be required.

RWDI's assessment is based on the following:

- A review of the regional long-term meteorological data;
- Drawings received by RWDI in September 2022 and January 2023.
- Use of RWDI's proprietary software (*WindEstimator*[1]) for providing a screening-level numerical estimation of potential wind conditions around generalised building forms;
- Wind-tunnel studies and desktop assessments undertaken by the team for projects in the region;
- Our engineering judgement, experience, and expert knowledge of wind flows around buildings[2, 3]; and,
- RWDI Criteria for pedestrian wind comfort and safety.

Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, building air quality, noise, vibration, etc. are not part of the scope of this assessment.

1. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", ASCE Structure Congress 2004, Nashville, Tennessee.
2. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", Journal of Wind Engineering and Industrial Aerodynamics, vol.104-106, pp.397-407.
3. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", 10th International Conference on Wind Engineering, Copenhagen, Denmark.

3. METEOROLOGICAL DATA

Meteorological data recorded at Canberra Airport from 1998 to 2018 were used as a reference for the wind conditions in the area. The distributions of wind frequency and directionality for the summer (Nov - Apr) and winter (May - Oct) seasons are shown in Image 3.

The records indicate that in the summer months winds approach most frequently from the northwest and east to southeast quadrants. During the winters, winds approach predominantly from the northwest quadrant with secondary winds from the southeast quadrant.

Strong winds of a mean speed greater than 30 km/h measured at the airports (at an anemometer height of 10 m) occur more often in the winter and are from the northwest quadrant. These winds could potentially be the source of uncomfortable wind conditions, depending on the site exposure or development design. The analysis methods have accounted for all wind directions.

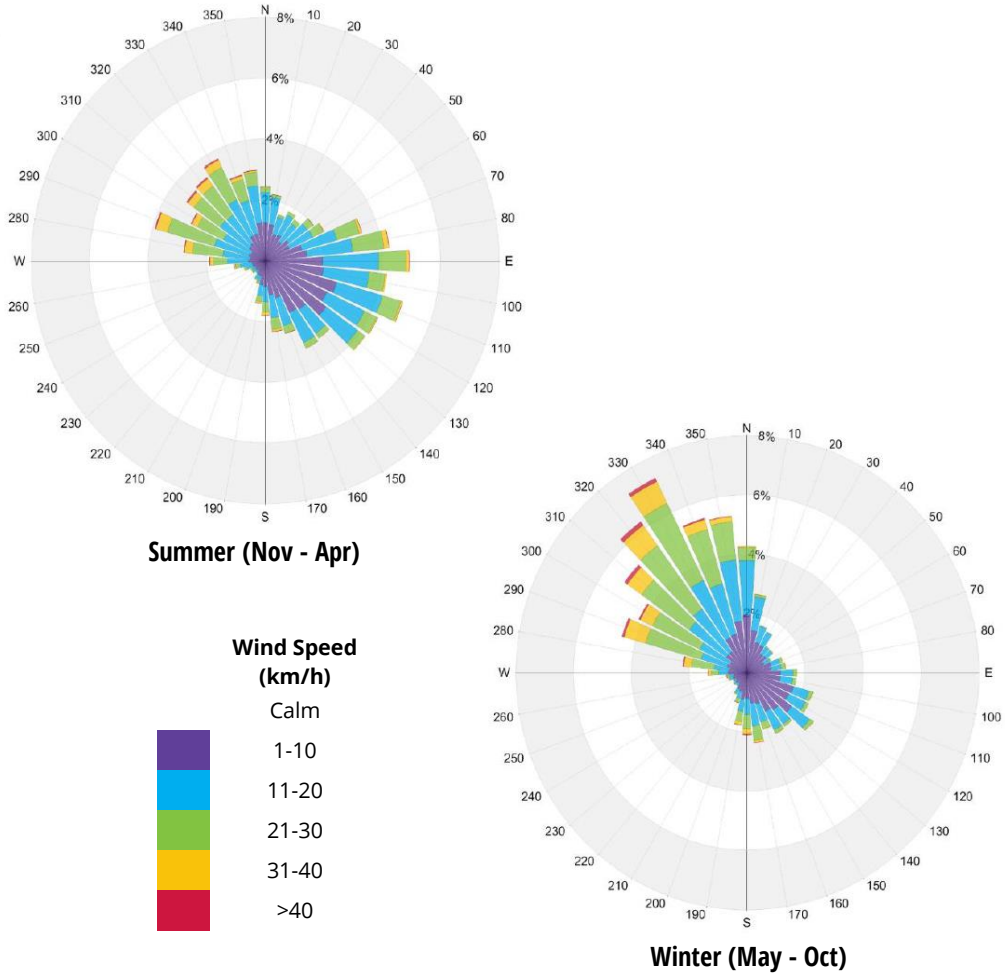


Image 4: Directional Distribution of Winds Approaching Canberra Airport Recorded from 1998-2018

4. RWDI PEDESTRIAN WIND CRITERIA

4.1 Safety Criterion

Pedestrian safety is associated with excessive gusts that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance (83 km/h) occur more than 0.1% of the time or 9 hours per year, the wind conditions are considered severe. These generally coincide with areas of high wind activity noted in the report.

4.2 Pedestrian Comfort Criteria

The RWDI pedestrian wind comfort criteria, depicted in Image 4, are used in the current study. These criteria have been developed by RWDI through research and consulting practice since 1974 and have also been widely accepted by municipal authorities, building designers and the city planning community worldwide. These are categorised based on typical / intended pedestrian activities.

Note that wind conditions are assessed at a typical pedestrian chest height and are considered suitable for the intended use of the space if the associated mean winds are expected for at least 80% of the time. Wind control measures are typically required at locations where winds are rated as uncomfortable or they exceed the wind safety criterion.

Furthermore, note that these criteria for wind forces represent average wind tolerance. These are sometimes subjective with regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. also affecting people's perception of the wind climate. For a full assessment of comfort, it is recommended that a thermal comfort study be undertaken.

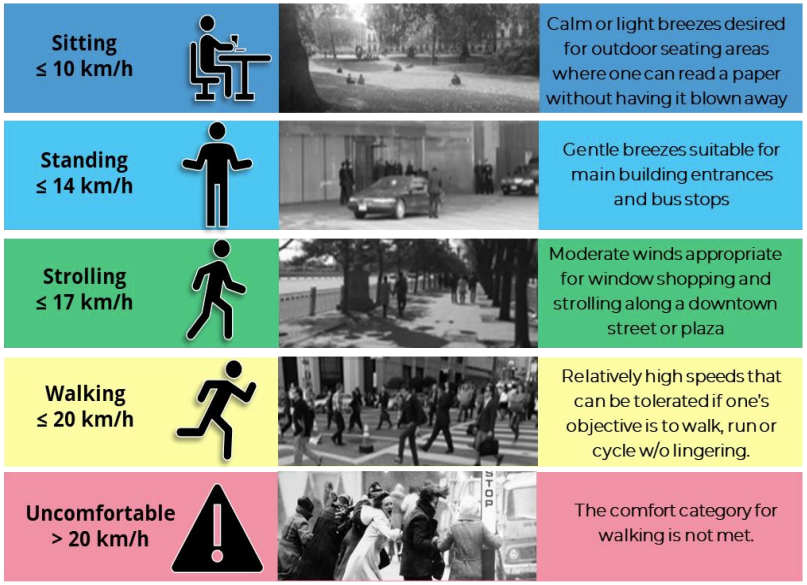


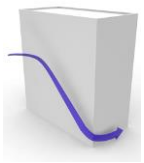
Image 4: RWDI Pedestrian Wind Comfort Criteria

5. RESULTS AND DISCUSSION

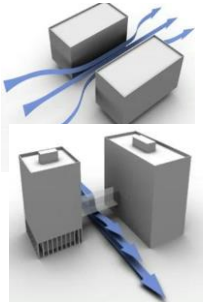
5.1 General Wind Flow around Buildings

In our discussion of wind conditions on and around the proposed development, reference may be made to the following generalised wind flows (see Image 5). 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, wind screens / tall trees with dense landscaping, etc. (Image 6) can help reduce 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.

Downwashing
Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



Corner Acceleration
Winds approach at an oblique angle to a tall façade and are deflected down causing a localised increase in the wind activity or corner acceleration around the exposed building corner(s) at pedestrian level.



Channelling
When two buildings are situated side by side or an underpass is created, wind flow tends to accelerate through the space due to channeling effect caused by the narrow gap.

Image 5: General Wind Flow around Buildings

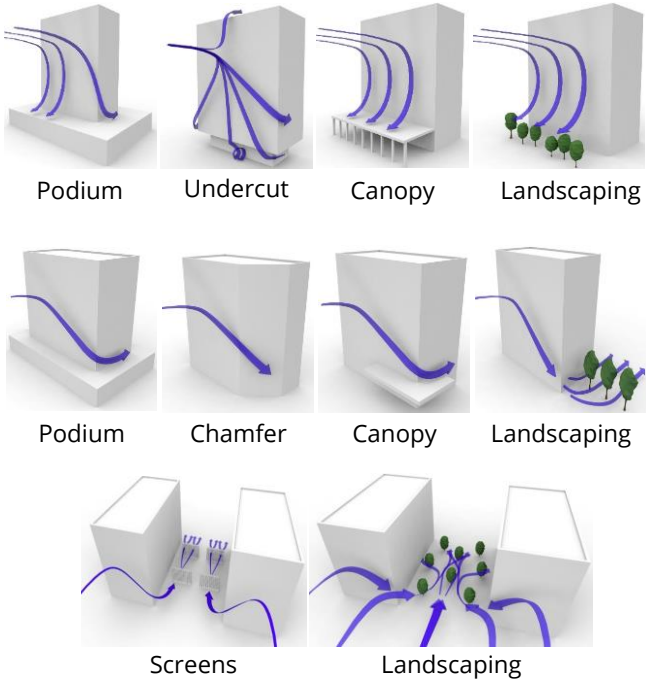


Image 6: Examples of Common Wind Control Measures

5. RESULTS AND DISCUSSION

5.2 Existing Site Conditions

The existing site is currently vacant with a line of dense trees to the south. The site is generally exposed to unimpeded winds from the prevailing northwest direction throughout the year. The downward slope across the site going south might reduce the overall wind speeds from this direction. The tree-lines to the south and along Horse Park Drive are likely to protect the existing site from the prevailing easterly and southeasterly sector winds. Wind conditions are likely to be suitable for passive use at the site during summers with higher wind activity suitable for active use anticipated during windier times of the year.

5.3 Proposed Wind Conditions

The exposure of the proposed development site to the regional prevailing winds and the expected wind conditions are noted in Image 7. The southerly and easterly winds are likely to have a negligible impact on site conditions due to the existing trees to the south and east along Horse Park Drive as well as the mild nature of the winds approaching from these directions. The moderate height of the building is also likely to reduce the overall impact from these winds. The triangular planform will also protect the internal courtyard space on the lower levels of the building from direct wind exposure. Some internal recirculation is possible, however the proposed landscape within the courtyard is expected reduce the overall impact.

5.3.1 Ground Level

The orientation of the building and alignment with the prevailing northwesterly winds is likely to create downwash effect. However, the awning along the western aspect of the building and the recessed form of the retail units and the primary entrance is likely to create comfortable pockets in front of the retail units, as shown in Image 8. The proposed landscaping at the southwest corner of the building along Bentley Place will also likely provide sufficient barrier to the movement of winds at this location.

Due to relatively little shielding from upstream built-forms, the northwest winds are likely to accelerate around the northern corner of the building. This can create wind activity at the location that is likely suitable for active use during windier times of the year. It is recommended that the entrance to the Retail Unit G-20 and any seating areas, if planned, be situated away from the corner. Portable screening elements can also be used to ensure comfortable wind amenity is achieved for the space.

5.3.2 Private Balconies

A majority of the private balconies are inset within the planform and, therefore, benefit from a single aspect design. All corner balconies also employ screening elements that will reduce the likelihood of winds rapidly accelerating around the corners. Wind conditions are expected to be comfortable for passive use throughout the year.

5. RESULTS AND DISCUSSION

Image 7: Exposure of Site to Regional Prevailing Winds

Relatively open exposure to the prevailing northwesterly winds. The orientation of the building is likely to lead to downwash of these winds. The slight angle to the winds during winters can create wind conditions to the southwest of the site that is likely suitable for active use.

Alignment of building to the easterly and southerly winds likely to lead to downwash. However, the overall moderate height of the building and the relative strength of these winds along with the tree-line along Horse Park Drive and to the south of the site are likely to reduce the overall impact.

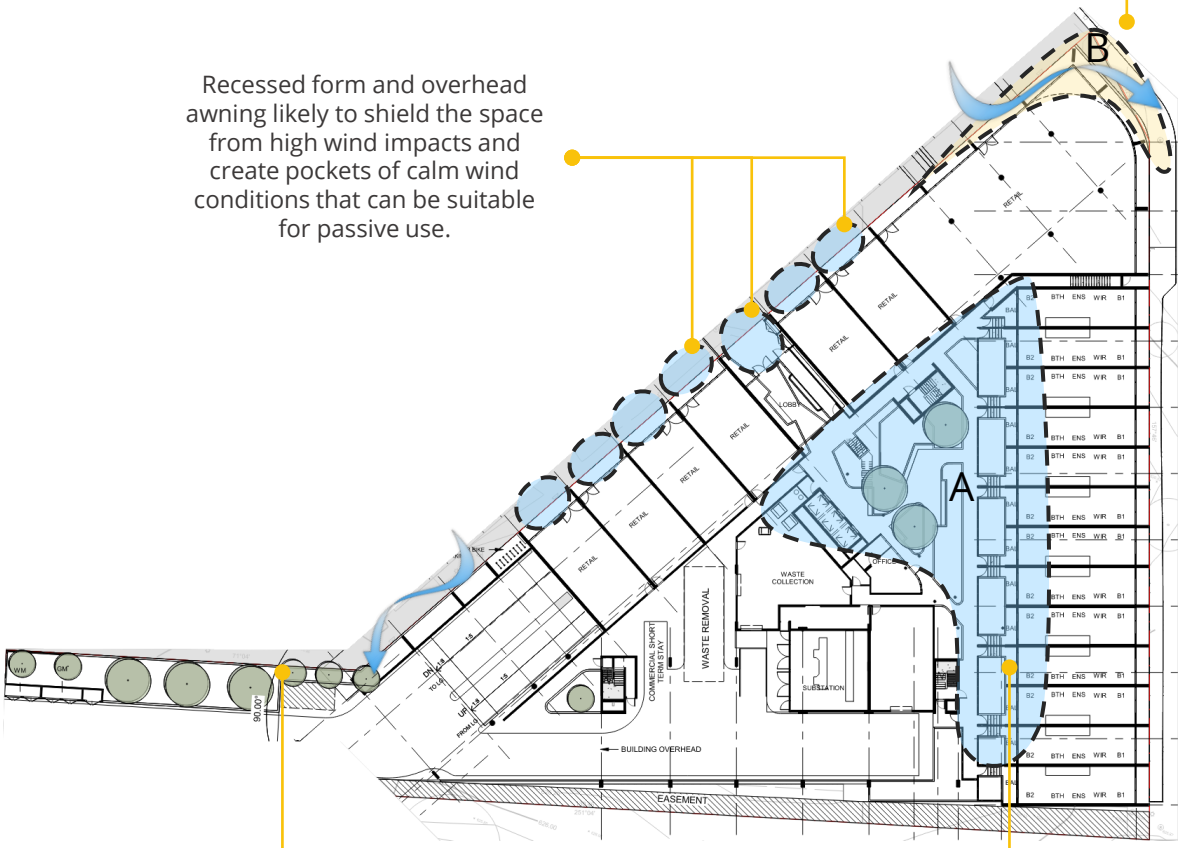
Lower-level central courtyard is generally shielded from prevailing winds.

5. RESULTS AND DISCUSSION

Image 8: Expected Wind Conditions on the Ground Level

A — Generally calm. Well-sheltered areas suitable for any use. Be aware of the potential for overheating (in absence of shading) or accumulation of pollutants (in the absence of adequate ventilation).

B — Moderately windy. Likely to be suitable for standing use (e.g., footpaths, bus stops) during calmer times and active use during windier times of the year. Area will generally be perceived as too windy for comfortable amenity use unless mitigation measures are implemented.



5.3.3 Internal Laneways

The various wings of the proposed development have interconnected passageways that link the different parts of the development together. These are generally open to the elements. Most of these areas are relatively sheltered and are shielded from direct wind exposure. However, the gaps along the full height of the development between the western and eastern wings (between Levels 2-7) as well as the gaps in the massing on Level 8 of the west wing are likely to create localised channelling effect due to the alignment with the prevailing northwesterly winds. This is indicated in Image 9. The semi-internal nature of these passageways can also increase the sensitivity to these winds. Therefore, it is recommended to incorporate 1.5-2m high screening (porous or impermeable) along the northern periphery of the open channels to improve the amenity within the passageways.

Image 9: Expected Wind Flow Patterns and Wind Conditions within the Internal Passageways

6. SUMMARY

Wind conditions on and around the proposed development located at Block 9, Section 132 in Casey, ACT are discussed in this report. The qualitative assessment is based on the review of local wind climate and the current design of the proposed development. The impact of the surrounding buildings and the local land topography has also been considered. The assessment is based on our experience with wind tunnel testing and CFD analysis of similar buildings within the region.

The proposed development includes several positive design features including the triangular planform, the use of awnings along the exposed aspects, inset balconies, recessed primary entrance, and the strategic use of landscaping on ground level and within the lower-level communal spaces. These elements, along with the location of the site, are expected to allow majority of the areas in and around the proposed development to be suitable and safe for intended pedestrian use. However, due to the semi-internal nature of the passageways between the various wings of the development, channelling effects through the gaps are likely to be perceived as too windy for the intended passive use of these space. Wind control measures have, therefore, been discussed in the report and are expected to improve the wind conditions within these areas.

This qualitative approach provides a screening-level estimation of potential wind conditions around the site and offers conceptual wind control measures and design advice suitable for early design of buildings. Wind tunnel testing is recommended to quantify and confirm the predicted conditions discussed in the report. The conceptual wind control measures can be further refined as part of the wind tunnel study.

Note that the assessed wind forces only represent the average wind tolerance of occupants and is only one metric to understand comfort. Wind comfort is also sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, exposure to sunlight and shading etc. can also affect person's perception of the wind climate. Therefore, it is recommended that a thermal comfort assessment be carried out for a holistic understanding of comfort around the site. Undertaking such an assessment can provide an exceptional level of insight into the combination of unique factors that impact a person's comfort, including temperature, humidity, wind, solar radiation, and how the space will be used. The information gained can be used to better plan the usage of outdoor spaces. RWDI can assist the design team with this study if needed.

7. APPLICABILITY OF ASSESSMENT

The assessment discussed in this report pertains to the proposed development in accordance with the drawings and information received in September 2022 and January 2023. In the event of any significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.

Statement of Limitations

This report entitled '*Casey Tower Pedestrian Wind Assessment*', dated January 10, 2023 was prepared by RWDI Australia Pty Ltd ("RWDI"). 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. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

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 utilize 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.