WINDTECH

PEDESTRIAN WIND ENVIRONMENT STATEMENT

46-52 NICHOLSON STREET AND 59-67 CHRISTIE STREET, ST LEONARDS

WJ489-03F01(REV0)- WS REPORT

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Prepared for:

Coronation Property

Level 2, 66 Wentworth Ave, Surry Hills NSW 2010

AT THE LEADING EDGE

WINDTECH CONSULTANTS
www.windtechconsult.com
reception@windtechglobal.com

Sydney | Singapore | London | Melbourne | Mumbai | New York | Hong Kong | Dubai | Miami | Toronto

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EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the proposed development located at 46-52 Nicholson Street and 59-67 Christie Street on the local wind environment at the critical outdoor areas within and around the subject site. The effect of wind activity has been examined for the three predominant wind directions for the region, namely the north-easterly, southerly, and westerly winds. The analysis of the wind effects relating to the proposed development have been carried out in the context of the local wind climate, building morphology and land topography.

The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the latest architectural drawings. No wind tunnel testing has been undertaken for the subject development, and hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection of the architectural drawings provided (received 2 September 2025). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

The results of this assessment indicate that the development has incorporated several design features and wind mitigating strategies and is expected to be suitable for the intended use for the majority of the outdoor trafficable areas. However, there are some areas that are likely to be exposed to stronger winds. It is expected that the wind effects identified in the report can be ameliorated with the consideration of the following treatment strategies into the design of the development:

- Upper Ground:
    - Retention of planter boxes/landscaping, ensuring that the combined height of the planters and plantings is minimum 1.5m.
    - Retention of high back seating, ensuring backrest is impermeable and of at least 1.2m high above the seat.
    - Include impermeable screens with minimum height 1.2m within landscaping zones within and around the undercroft area.
    - Include impermeable screens with minimum height 1.5m within landscaping zones on the west side of the undercroft area.
    - Include porous full height screens, with minimum 50% porosity along the various mechanical room aspects on the Nicholson Street frontage of the development.
    - Include 2m high solid screens flush with the building wall on the Nicholson Street frontage of the development (within the southernmost landscaping zone and also the south-eastern building corner).

- Elevated Private Balconies:
    - Retention of recessed design and enclosure on three balcony aspects.
- Elevated Terraces:
    - Level 1 terrace:
        - Retention of the awnings just above the Level 2 walkways.
        - Retention of the recessed design of the terrace (i.e. fully enclosed on all aspects with open rooftop).
        - Retention of all planter boxes/landscaping.
    - Level 2 walkway:
        - Inclusion of standard height impermeable balustrades around walkway perimeter.
    - Level 33 terraces.
        - Retention of 2m high impermeable windscreens on the perimeter of both terraces.
        - Retention of the 2m high impermeable windscreen on the south-eastern corner of the south-eastern terrace.
        - Retention of all planter boxes/landscaping.
    - Level 34 terrace:
        - Retention of the wraparound canopy. If this canopy is porous, it should be at most 30% porous.
        - Retention of the 3m high impermeable windscreens on the perimeter of the terrace.
        - Retention of the operable umbrellas.
        - Retention of all planter boxes/landscaping.

With the inclusion of the abovementioned recommendations in the final design, it is expected that wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses, and that the wind speeds will satisfy the applicable criteria for pedestrian comfort and safety. Note that a wind tunnel program has commenced, which will allow for a quantitative assessment of the wind conditions, and thus the necessity/optimisation of any treatments as required (especially within the Upper Ground Level undercroft area).

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Appendix A Wind Effects Glossary

1 INTRODUCTION

An opinion on the likely impact of the proposed design on the local wind environment affecting pedestrians within the critical outdoor areas within and around the subject development is presented in this report. The analysis of wind effects relating to the proposed development has been carried out in the context of the predominant wind directions for the region, building morphology of the development and nearby buildings, and local land topography. The conclusions of this report are drawn from our extensive experience in the field of wind engineering and studies of wind environment effects.

No wind tunnel testing has been undertaken for this assessment. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made only in-principle.

2 DESCRIPTION OF DEVELOPMENT AND SURROUNDINGS

The site is located at 46-52 Nicholson Street and 59-67 Christie Street, St Leonards, and is bounded by Nicholson Street to the north and east, low-rise buildings to the south, and Christie Street to the west. The buildings immediately surrounding the subject development are mixed-use high-rise within the northern sector and low-to-mid-rise residential within the southern sector. As the following developments have been approved for construction, they have been accounted for in the analysis:

- 45-storey development at 524-542 Pacific Highway (north of the subject development).
- 14- and 10-storey buildings within a development at 29-57 Christie Street (south of the subject development)

A survey of the land topography indicates an increase in elevation towards the north-east; however, there are no sudden elevation changes in the area immediately surrounding the site.

An aerial image of the subject site and the local surroundings is shown in Figure 1, with the frequency and magnitude of the prevailing winds is superimposed for each wind direction.

The existing site consists of a 3-storey commercial building. The proposed development seeks approval for the rezoning of the site and construction of a BTR development. The SSDA specifically involves the following works:

- A single 36-storey tower including a 4-storey podium comprising approximately 500 units,
- Five levels of basement parking,
- BTR amenity provided in lower ground, upper ground, podium, tower and rooftop levels,
- Vehicular access from Christie Street and loading access from Nicholson Street,
- Site landscaping and public domain improvements, and
- Utility and services augmentation as required.

To accommodate the proposed SSDA, a concurrent rezoning is sought to increase the site's maximum building height and floor space ratio. Separate development approvals have been sought with Lane Cove Council. These relate to demolition of existing structures, tree removal, excavation, shoring wall and capping beam. The site has an existing concept State Significant Development Approval (SSD-56527976). The proposed development does not rely on this approval and will be surrendered upon consent being granted.

The critical outdoor trafficable areas associated with the proposed development, which are the focus of this assessment with regards to wind effects, are listed as follows:

- Upper Ground Level undercroft area and pedestrian footpaths on Nicholson Street and Christie Street.
- Elevated private balconies.
- Elevated terraces.

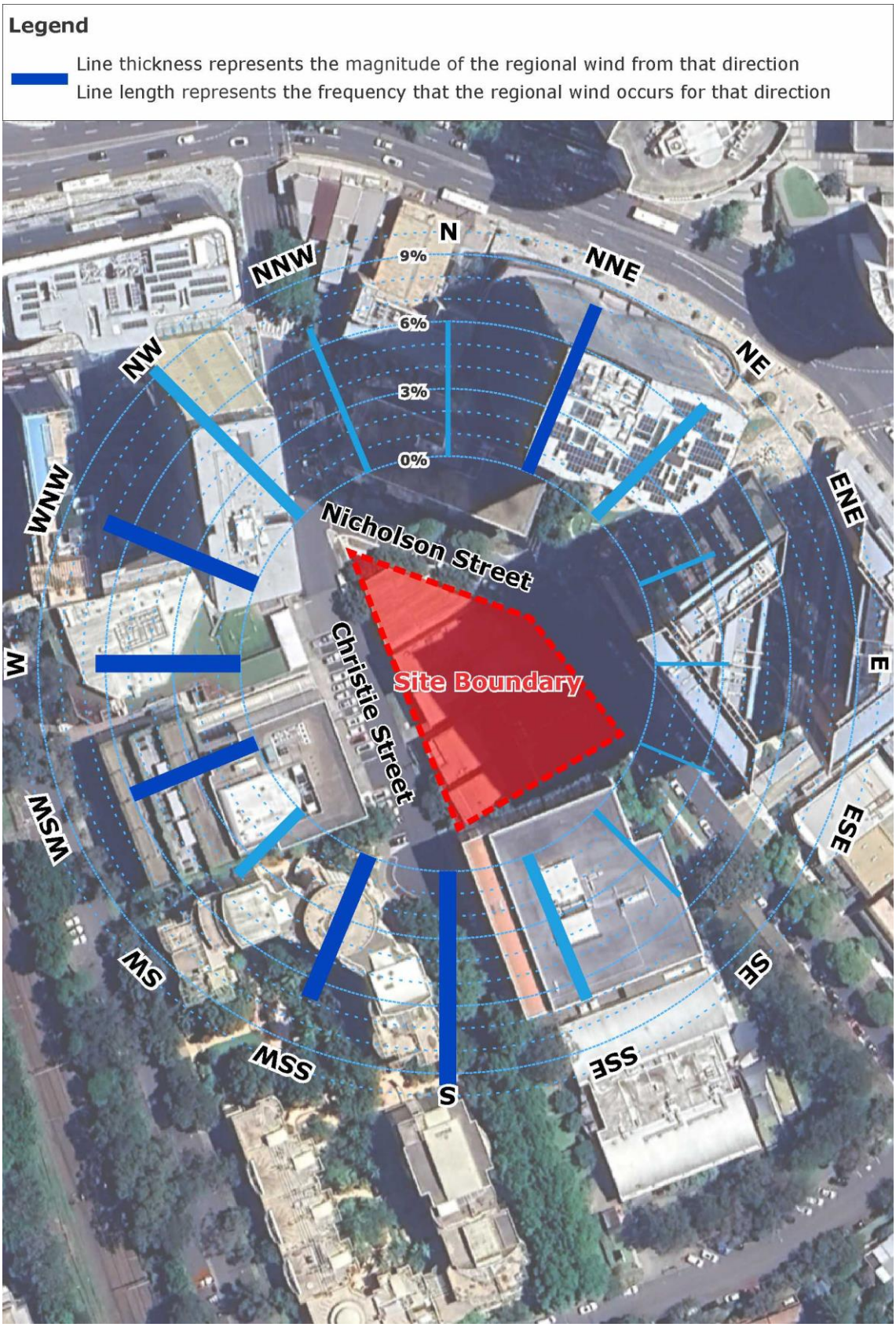

Figure 1: Aerial Image of the Site Location and Prevailing Wind Directions

3 REGIONAL WIND

The Sydney region is governed by three principal wind directions that can potentially affect the subject development. These winds prevail from the north-east, south, and west. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained from the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1995 to 2016). The data has been corrected to represent winds over standard open terrain at a height of 10m above ground level. The results of this analysis are presented in Figure 2 in the form of a directional plot of the annual and 5% exceedance mean winds for the region. The frequency of occurrence of these winds is also shown in Figure 2.

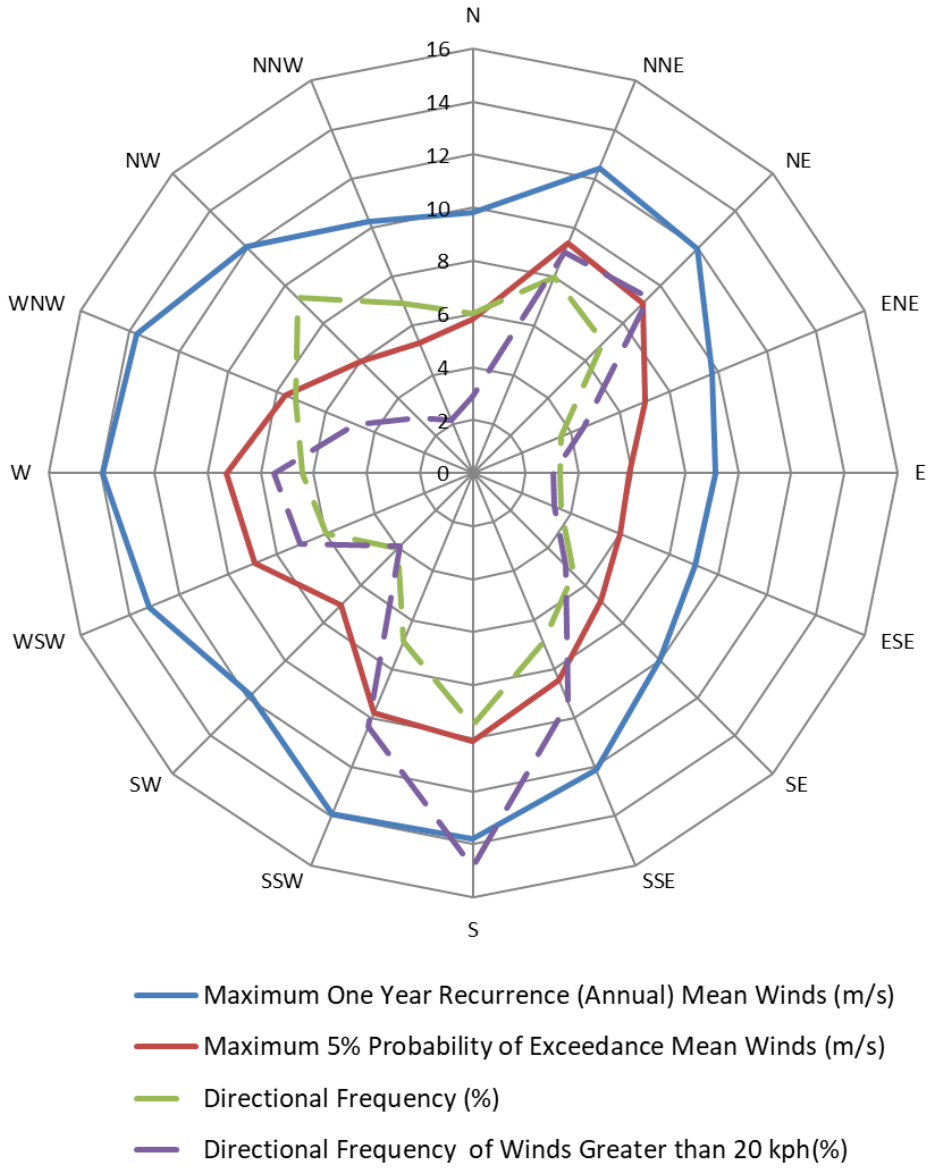

Figure 2: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for the Sydney Region

4 WIND EFFECTS ON PEOPLE

The acceptability of wind in any area is dependent upon its use. For example, people walking, or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 1 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 1: Summary of Wind Effects on People (A.D. Penwarden, 1973)

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm	0	Less than 0.3	Negligible.
Calm, light air	1	0.3 – 1.6	No noticeable wind.
Light breeze	2	1.6 – 3.4	Wind felt on face.
Gentle breeze	3	3.4 – 5.5	Hair is disturbed, clothing flaps, newspapers difficult to read.
Moderate breeze	4	5.5 – 8.0	Raises dust, dry soil and loose paper, hair disarranged.
Fresh breeze	5	8.0 – 10.8	Force of wind felt on body, danger of stumbling
Strong breeze	6	10.8 – 13.9	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant.
Near gale	7	13.9 – 17.2	Inconvenience felt when walking.
Gale	8	17.2 – 20.8	Generally impedes progress, difficulty balancing in gusts.
Strong gale	9	Greater than 20.8	People blown over.

It should be noted that wind speeds affecting this particular development can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection and the acceptability of the conditions for outdoor areas are determined based on their intended use. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

5 RESULTS AND DISCUSSION

The expected wind conditions affecting the development are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report. A glossary of the different wind effects described in this report included in Appendix A.

For this assessment, the wind speed criteria for pedestrian comfort that are considered are listed as follows:

- Walking Criterion (8m/s with a 5% probability of exceedance)
  for general circulation and pedestrian thoroughfares, e.g. footpaths, private balconies/terraces, through-site links etc.

- Standing (Short Exposure) Criterion (6m/s with a 5% probability of exceedance)
  for stationary activities generally less than an hour, e.g. waiting areas, communal terraces, main entries, café seating etc.

Note that the above wind comfort levels are derived from the Lawson (1975) criteria. Although this assessment is qualitative in nature, the abovementioned criteria for pedestrian comfort are considered when assessing the wind environment impacts. However, all areas are also assessed with consideration to a pedestrian safety criterion of 23m/s for the annual maximum gust.

5.1 Upper and Lower Ground Level Areas

5.1.1 Nicholson Street Frontage

The prevailing north-easterly winds are expected to funnel between the approved tower at 524 Pacific Highway, St Leonards (*Telstra Exchange*) and the tower at 500 Pacific Hwy, St Leonards (*The Landmark*), as well as between *The Landmark* and the tower at 472 Pacific Hwy, St Leonards (*St Leonards Square*), impacting the Nicholson Street frontage near the undercroft lobby entrance of the subject development, as well as the undercroft lobby area itself. There is also some potential for pressure-driven effects to adversely funnel these flows along Nicholson Street between the subject development and *St Leonards Square*.

The prevailing southerlies are expected to funnel between the subject development and *St Leonards Square,* impacting the entire Nicholson Street frontage (the funnelling between the two towers is expected to result in adverse sidestreaming and corner-acceleration closer to the Nicholson/Christie intersection).

The prevailing westerly winds are also likely to sidestream around the subject development, along the northernmost areas of Nicholson Street. Pressure-driven effects may force these winds to accelerate further south and funnel along Nicholson Street, i.e. between the subject development and *St Leonards Square*.

5.1.2 Christie Street Frontage

As mentioned earlier, the prevailing north-easterly winds are expected to funnel between the approved tower at *Telstra Exchange* and the tower at *The Landmark*, as well as *The Landmark* and *St Leonards Square*, contributing to adverse conditions within and around the undercroft lobby entrance as well as trafficable areas along Christie Street. In addition to the potential effects discussed along Nicholson Street, similar pressure-driven adverse sidestreaming flows may be observed along the entire Christie Street frontage.

The prevailing southerlies are expected to adversely sidestream along the Christie Street frontage, culminating in adverse corner-accelerated flows within and around the undercroft lobby entrance.

The Christie Street frontage is relatively exposed to the prevailing westerlies, some of which will funnel within the undercroft, or adversely sidestream along Christie Street in a southerly direction.

5.1.3 Treatments

To address these concerns on the Upper Ground, the following is recommended. Treatments are suggested with the aim of providing standing comfort for areas within the undercroft around the various lobby entrance and seating areas, and walking comfort everywhere else. Note that a wind tunnel program has commenced, which will allow for a quantitative assessment of the wind conditions, and thus the necessity/optimisation of any treatments as required. Refer to Figure 3 for locations.

- Retention of planter boxes/landscaping, ensuring that the combined height of the planters and plantings is minimum 1.5m.
- Retention of high back seating, ensuring backrest is impermeable and at least 1.2m high above the seat.
- Include impermeable screens with minimum height 1.2m within landscaping zones within and around the undercroft area.
- Include impermeable screens with minimum height 1.5m within landscaping zones on the west side of the undercroft area.
- Include porous full height screens, with minimum 50% porosity along the various mechanical room aspects on the Nicholson Street frontage of the development.
- Include 2m high solid screens flush with the building wall on the Nicholson Street frontage of the development (within the southernmost landscaping zone and also the south-eastern building corner).

5.2 Elevated Private Balconies

The majority of the private balconies on the development are enclosed or partially enclosed on three sides and recessed into the building form. This design, alongside the balconies' moderate size, is expected to lead to winds from all prevailing directions stagnating within the balcony. As such, these features are recommended to be retained.

5.3 Elevated Terraces

5.3.1 Level 1 Elevated Terrace and Level 2 Elevated Walkway

The terrace on Level 1 is expected to be shielded from the prevailing north-easterly and westerly winds due to the building form. The prevailing southerly winds are anticipated to downwash off the southern tower aspect, although these winds are expected to then stagnate within the recessed terrace (the adjacent existing 29-57 Christie Street building is expected to help with this). The following is recommended for the purpose of wind treatment, with the goal of achieving standing comfort within the terrace:

- Retention of the awnings just above the Level 2 walkways (see Figure 4).
- Retention of the recessed design of the terrace (i.e. fully enclosed on all aspects with open rooftop).
- Retention of all planter boxes/landscaping.

Similar mechanisms to those discussed above are expected on the Level 2 outdoor walkways. However, instead of stagnating, the prevailing downwashing southerly winds may affect the walkways. The following is recommended for reduction of wind flowing over the walkways (targeting the standing comfort crtierion):

- Inclusion of standard height impermeable balustrades around walkway perimeter.

5.3.2 Level 33 Terraces

The Level 33 terrace area is expected to be significantly exposed to all prevailing wind directions. The prevailing north-easterly and westerly winds are anticipated to directly impact the wind conditions on this terrace. The prevailing southerly winds are expected to sidestream along the building form and corner accelerate onto this northern terrace.

The south-eastern Level 33 terrace is expected to be directly exposed to the prevailing north-easterly and southerly winds. The southern aspect of this terrace may be exposed to the prevailing westerly winds accelerating around the south-western corner of the tower and sidestreaming along the tower southern aspect.

To ameliorate the expected negative impact of winds on the Level 33 terraces, the following is recommended (for the achievement of the standing comfort criterion). Treatments are provided with the aim of achieving standing comfort on both northern and south-eastern terraces. See Figure 5 for locations.

- Retention of 2m high impermeable windscreens on the perimeter of both terraces on Level 33.
- Retention of the 2m high impermeable windscreen on the south-eastern corner of the south-eastern terrace.
- Retention of all planter boxes/landscaping.

5.3.3 Level 34 Terrace

The Level 34 terrace area is expected to be shielded from the prevailing north-easterly winds by the building form but directly impacted by the prevailing westerly and southerly winds.

To ameliorate the expected negative impact of winds on these Level 34 terraces, the following is recommended. Refer to Figure 6 for recommended locations. Treatments are recommended with the aim of achieving standing comfort everywhere on the Level 34 terrace.

- Retention of the wraparound canopy. If this canopy is porous, it should be at most 30% porous.
- Retention of the 3m high impermeable windscreens on the perimeter of the terrace.
- Retention of the operable umbrellas.
- Retention of all planter boxes/landscaping.

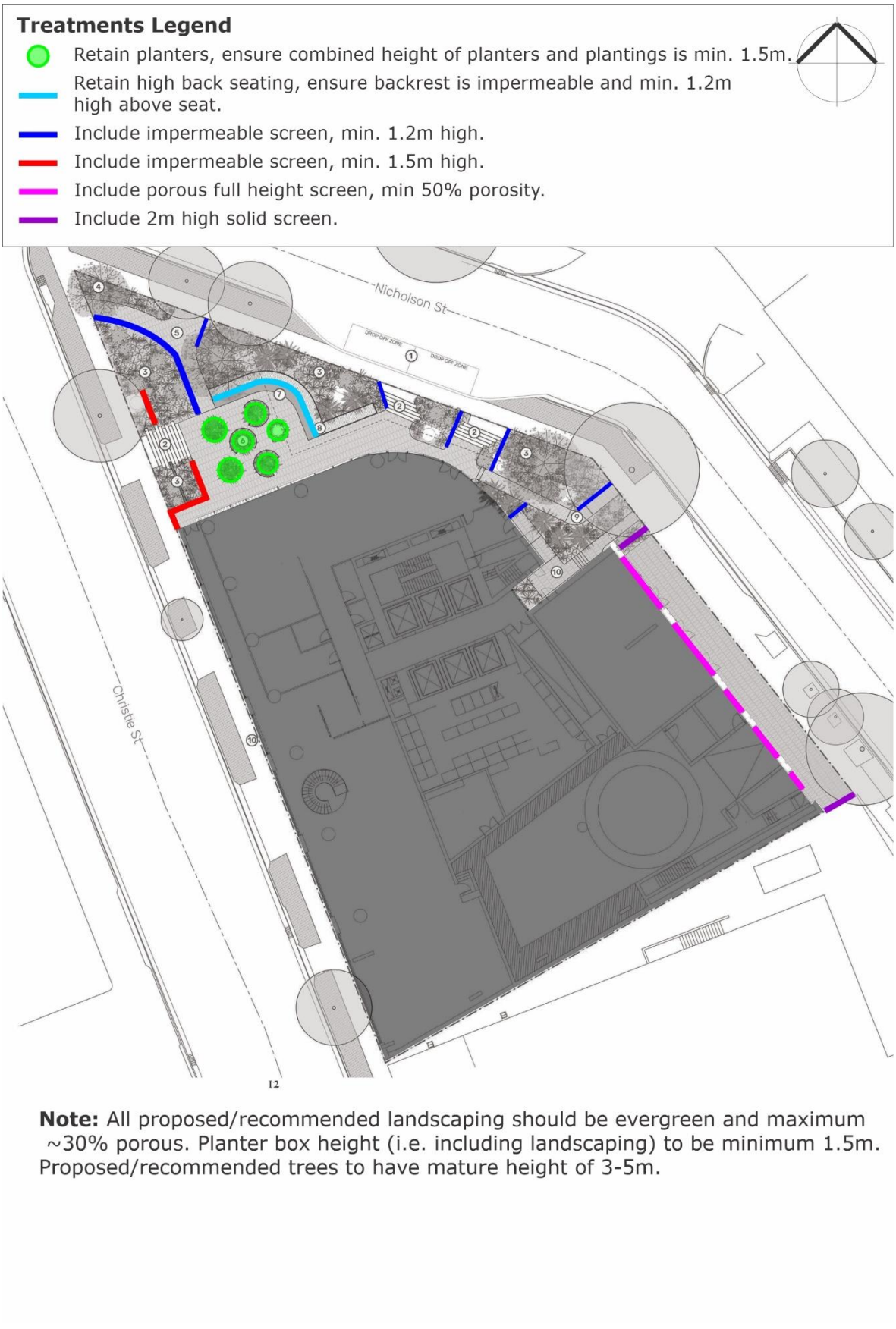

Figure 3: Upper ground recommended treatments

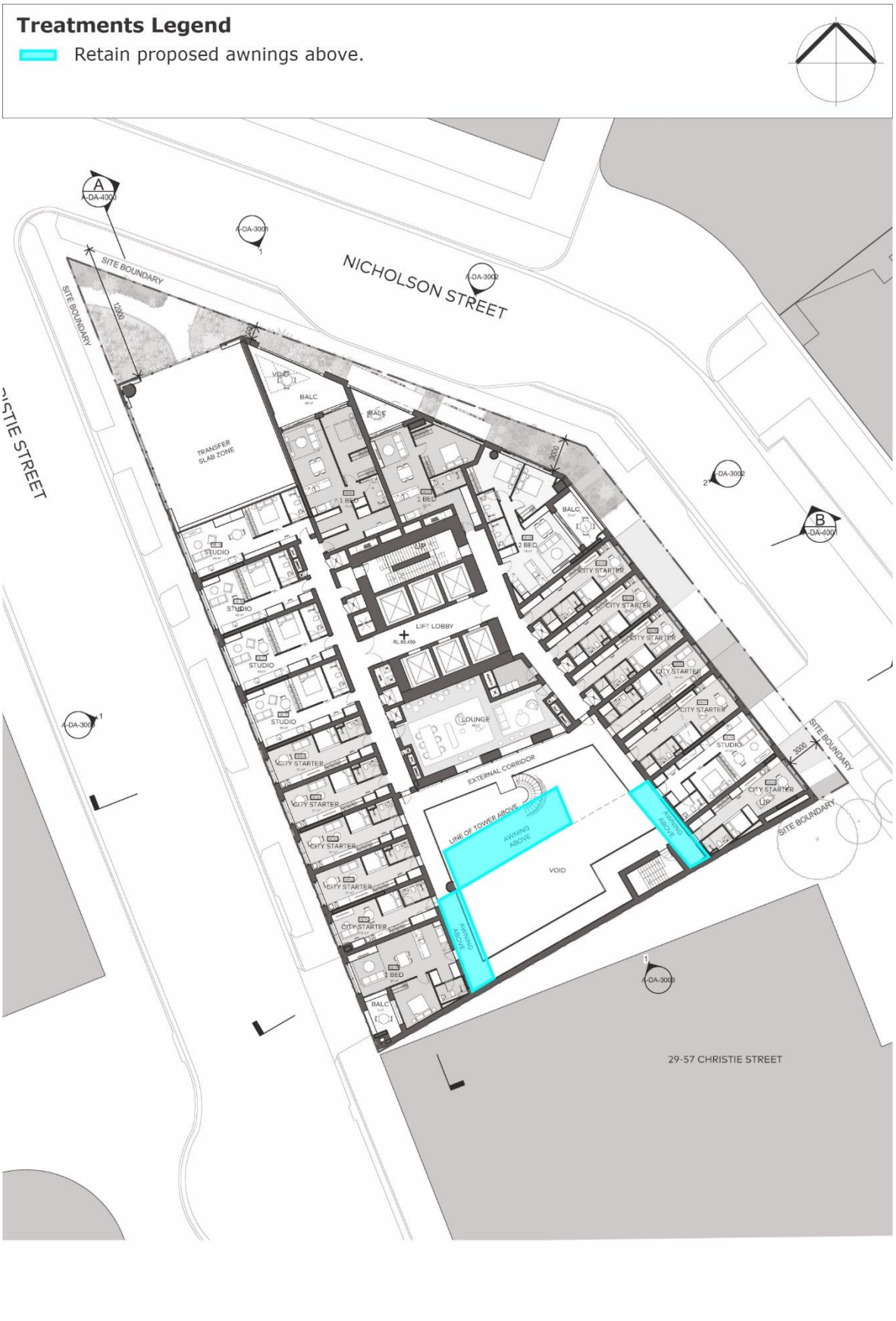

Figure 4: Level 2 recommended treatments

Note: All proposed/recommended landscaping should be evergreen and maximum ~30% porous. Planter box height (i.e. including landscaping) to be minimum 1.5m. Proposed/recommended trees to have mature height of 3-5m.

Figure 5: Level 33 recommended treatments

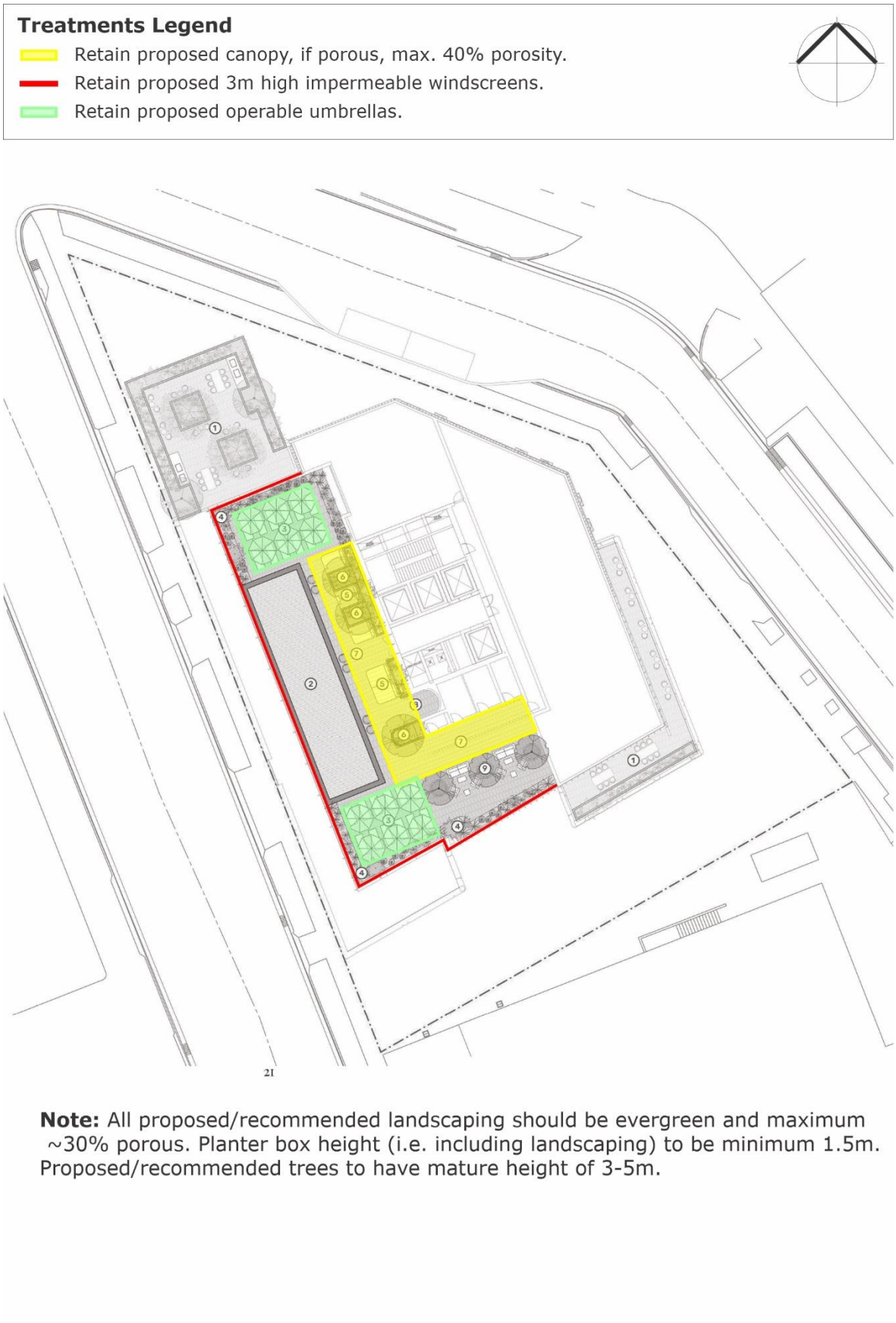

Figure 6: Level 34 recommended treatments

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APPENDIX A WIND EFFECTS GLOSSARY

A.1 Downwash and Upwash Effects

The downwash wind effect occurs when wind is deflected down the windward face of a building, causing accelerated winds at pedestrian level. This can lead to other adverse effects as corner acceleration as the wind attempts to flow around the building, as seen in Figure A.1.

This can also lead to recirculating flow in the presence of a shorter upstream building, causing local ground level winds to move back into the prevailing wind.

The upwash effect occurs near upper level edge of a building form as the wind flows over the top of the building. This has the potential to cause acceleration of winds near the leading edge, as well as potentially reattaching onto the roof area. This effect causes wind issues particularly near the leading edges of tall building and on the rooftop areas if there is sufficient depth along the wind direction. Upwash is more apparent in taller towers and podia.

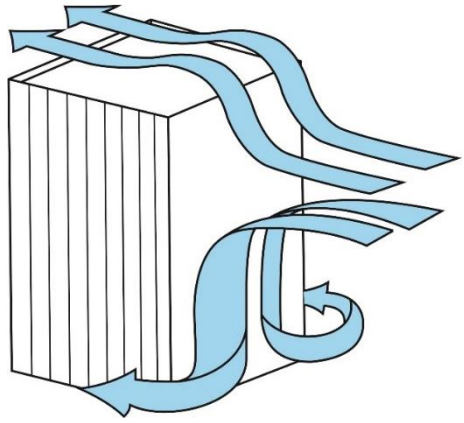

Figure A.1: Downwash Leading to Corner Wind Effect, and Upwash Effects

A.2 Funnelling/Venturi Effect

Funnelling occurs when the wind interacts with two or more buildings which are located adjacent to each other, which results in a bottleneck, as shown in Figure A.2. This causes the wind to be accelerated through the gap between the buildings, resulting in adverse wind conditions and pedestrian discomfort within the constricted space. Funnelling effects are common along pedestrian links and thoroughfares generally located between neighbouring buildings that have moderate gaps between them.

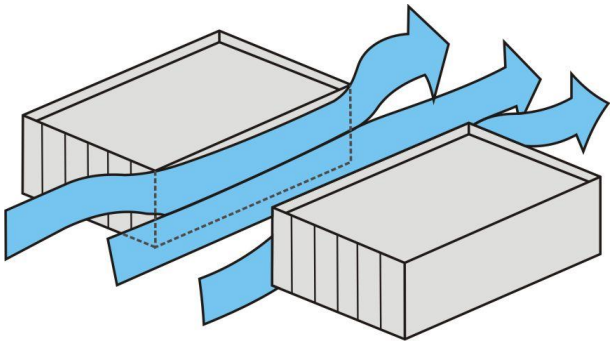

Figure A.2: Funnelling/Venturi Wind Effect

A.3 Gap Effect

The gap effect occurs in small openings in the façade that are open to wind on opposite faces, as seen in Figure A.3. This can involve a combination of funnelling and downwash effects. Presenting a small gap in the façade on the windward aspect as the easiest means through which the wind can flow through can result in wind acceleration through this gap. The pressure difference between the windward façade and the leeward façade also tends to exacerbate the wind flow through this gap.

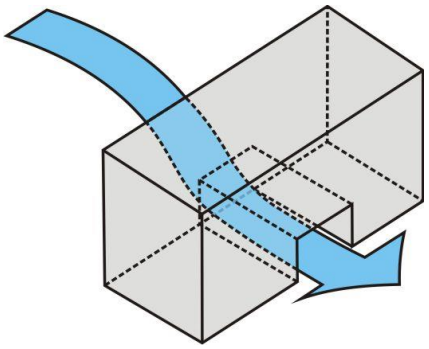

Figure A.3: Gap Wind Effect

A.4 Sidestream and Corner Effects

The sidestream effect is due to a gradual accumulation of wind shearing along the building façade that eventuates in an acceleration corner effect. The flow is parallel to the façade and can be exacerbated by downwash effects as well, or due to corner effect winds reattaching on the façade.

This is shown in Figure A.4. The corner refers to the acceleration of wind at the exterior vertical edge of a building, caused by the interaction of a large building massing with the incident wind, with the flow at the corner being accelerated due to high pressure differentials sets up between the windward façade and the orthogonal aspects. It can be further exacerbated by downwash effects that build up as the flow shears down the façade.

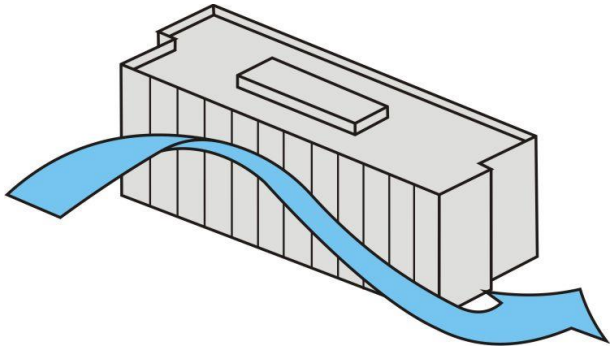

Figure A.4: Sidestream and Corner Wind Effect

A.5 Stagnation

Stagnation in a region refers to an area where the wind velocity is significantly reduced due to the effect of the flow being impeded by the bluff body. For a particular prevailing wind direction, this is typically located near the middle of the windward face of the building form or over a short distance in front of the windward face of a screen or fence. Concave building shapes tend to create an area of stagnation within the cavity, and wind speeds are generally low in these areas.