PEDESTRIAN WIND ENVIRONMENT STATEMENT

SIRIUS SITE, 2-60 CUMBERLAND STREET, THE ROCKS

WF538-01F02(REV3)- WS REPORT

OCTOBER 27, 2020

Prepared for:

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DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
August 05, 2020	Initial.	0	MH	SR	RL
August 11, 2020	Minor Treatment Clarification.	1	MH	SR	RL
August 17, 2020	Further Treatment Clarification.	2	MH	SR	RL
September 16, 2020	Further Treatment Clarification.	3	MH	SR	RL
October 27, 2020	Further Treatment Clarification.	4	MH	SR	RL

EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the Sirius Building redevelopment located at, 2-60 Cumberland Street, Sydney on the local wind environment at the critical outdoor areas within and around the subject development. The effect of wind activity is examined for the three predominant wind directions for the Sydney region; namely the north-easterly, southerly and westerly winds. The analysis of the wind effects relating to the proposed development was 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 was 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. 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 subject development is relatively exposed to the three prevailing wind directions, affecting the site. As a result, there is a possible impact on the wind comfort within certain trafficable/occupant areas. It is expected that the majority of the wind effects are expected to be similar to the existing wind condition as the proposed building alterations retain the same form as the existing building. With the inclusion of the treatments listed below, the proposed design is expected to be equivalent or better in occupant comfort performance when compared to the existing design.

Ground Level Areas

- Provision of the proposed impermeable ground level private garden walls around the boundary of the gardens.
- Provision of the proposed impermeable ground level walls around the boundary of the northern café outdoor area.
- Maintaining the existing stepped/uneven façade tower design.
- Provision of the proposed densely foliating vegetation along Gloucester Walk and Cumberland Street.

Proposed Western Building Pool and Café areas.

- Provision of the proposed impermeable balustrades.
- Provision of the proposed roof canopy.
- Provision of the proposed full height screening on the eastern facade.

Extruded Balconies and Private Rooftop Gardens

- Provision of an impermeable balustrade around the boundary of the rooftop balconies at a height of 1.2m.
- Provision of proposed densely foliating vegetation along the balcony edges.

As the existing building façade and massing is primarily being retained and restored it is expected the majority of the wind conditions will be similar to the existing conditions and it is therefore expected that wind tunnel testing will not be required for this development.

CONTENTS

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 was 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 was 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 THE DEVELOPMENT AND SURROUNDINGS

The proposed development is for the restoration and refurbishment of the existing Sirius building, including alterations and additions. The existing building is proposed to be substantially retained and restored with integrity. New residential additions are proposed to be added to the existing structure in appropriate locations to maintain the legibility of the original architectural form, and new structures for commercial uses are proposed to be added at the Cumberland Street and Gloucester Walk frontages of the site.

The existing Sirius building has a varied height profile due to its modular form and due to the fall across the site when observed from Cumberland Street and from Gloucester Walk. The existing building rises from the north and south towards a central tower with a maximum height of 34.6m above ground level at Cumberland Street (equivalent to an 11-storey building). Due to the existing split-level apartments, the building is conveyed as having a greater number of levels (25 storeys).

The proposed alterations and additions to the existing building will increase the overall building height by 5.4m to a maximum building height of 40.9m above ground level at Cumberland Street. On the Cumberland Street entry side of the site, the building presents as thirteen (13) levels at the highest occupied level. When observed from Gloucester Walk, and due to the fall across the site, the building presents as fourteen (14) occupied levels.

The development site is bounded by Cumberland Street to the west, Gloucester Walk to the east, and mid-rise residential buildings abutting the site on the southern boundary. Surrounding the site to the east, south and west are predominantly low to mid rise retail/residential buildings. Immediately across Cumberland Street to the west is the Cahill Expressway.

The proposed works include:

- Alterations and additions to the existing building for residential accommodation (a total of 76 apartments);
- Commercial premises, including retail floorspace; and
- Basement car parking.
- Provision of a through-site link between Cumberland Street and Gloucester Walk.
- Upgrades to Gloucester Walk including landscaping and pedestrian access.
- Improvements to Cumberland Street including landscaping and improved carpark entry.

A survey of the land topography indicates there is an incline, along Gloucester Walk and Cumberland Street towards the south. Similarly, there are incline changes observed across the site from east to west. An aerial image of the subject site and the local surroundings is shown in Figure 1.

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

- Ground level pedestrian accessible areas around and within the site boundary.
- Ground level private garden areas.
- Proposed western building pool and café areas.
- Extruded balconies and private rooftop teracces.

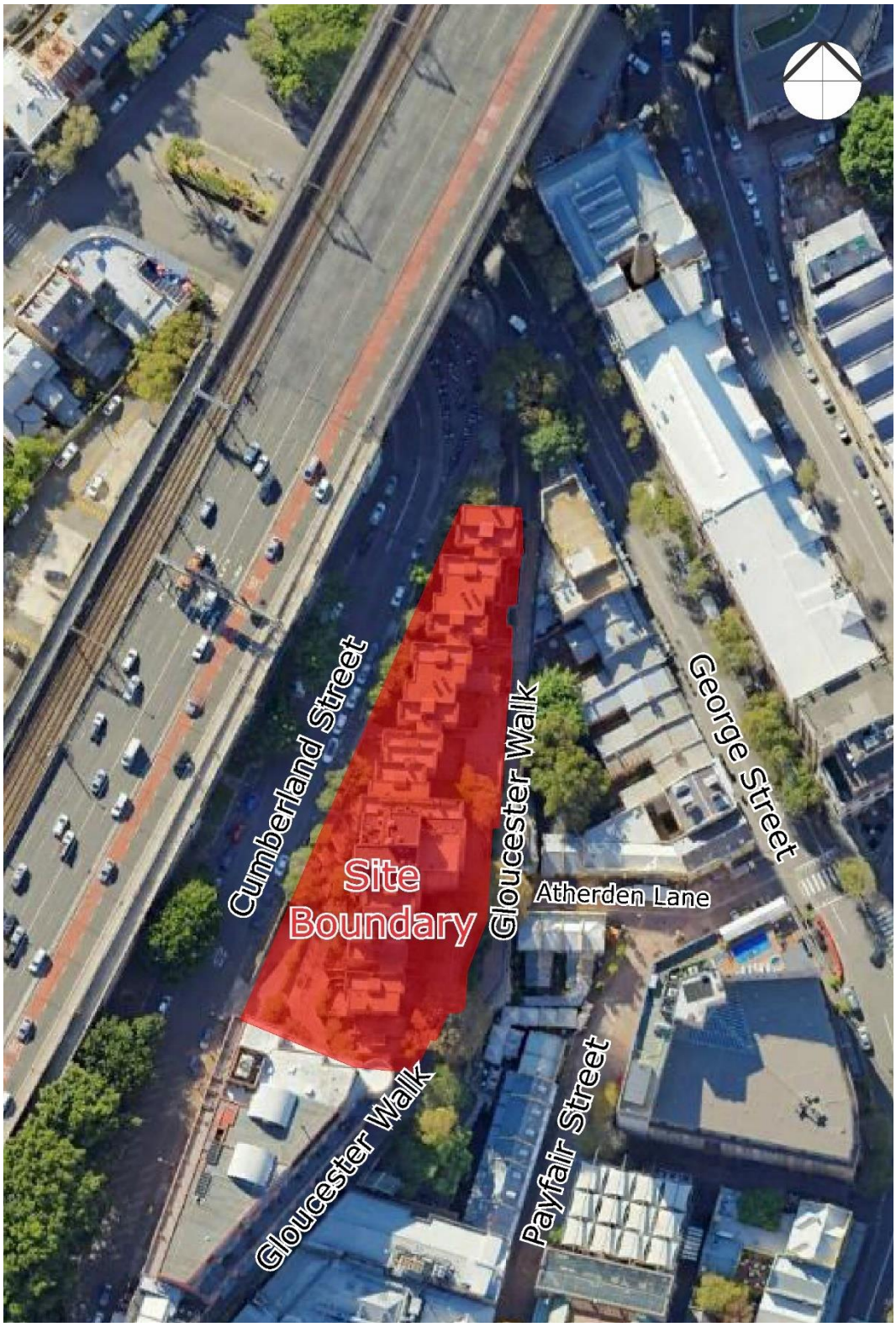

Figure 1: Aerial Image of the Site Location

Figure 2: Aerial Image of the Site Location

3 REGIONAL WIND

The Sydney region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary is based on a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1995 to 2016).

From this analysis, Figure 3a shows a summary of this analysis in the form of a directional plot of the annual and 5% exceedance mean winds for the Sydney region is also determined. The frequency of occurrence of these winds is also shown in Figure 3a. Figure 3b shows the 5% exceedance mean wind speeds for the Sydney region relative to the building form of the proposed development.

As shown in Figure 3a, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. The westerly winds occur most frequently during the winter season for the Sydney region, and although they are typically not as strong as the southerly winds, they are usually a cold wind since they occur during the winter and hence can be a cause for discomfort for outdoor areas. North-easterly winds occur most frequently during the warmer months of the year for the Sydney region, and hence are usually welcomed within outdoor areas since they are typically not as strong as the southerly or westerly winds.

Table 1: Principal Time of Occurrence of Winds for the Sydney Region

Month	North-Easterly Winds	Southerly Winds	Westerly Winds
January	X	X	
February	X	X	
March	X	X	
April		X	X
May			X
June			X
July			X
August			X
September		X	X
October	X	X	
November	X	X	
December	X	X	

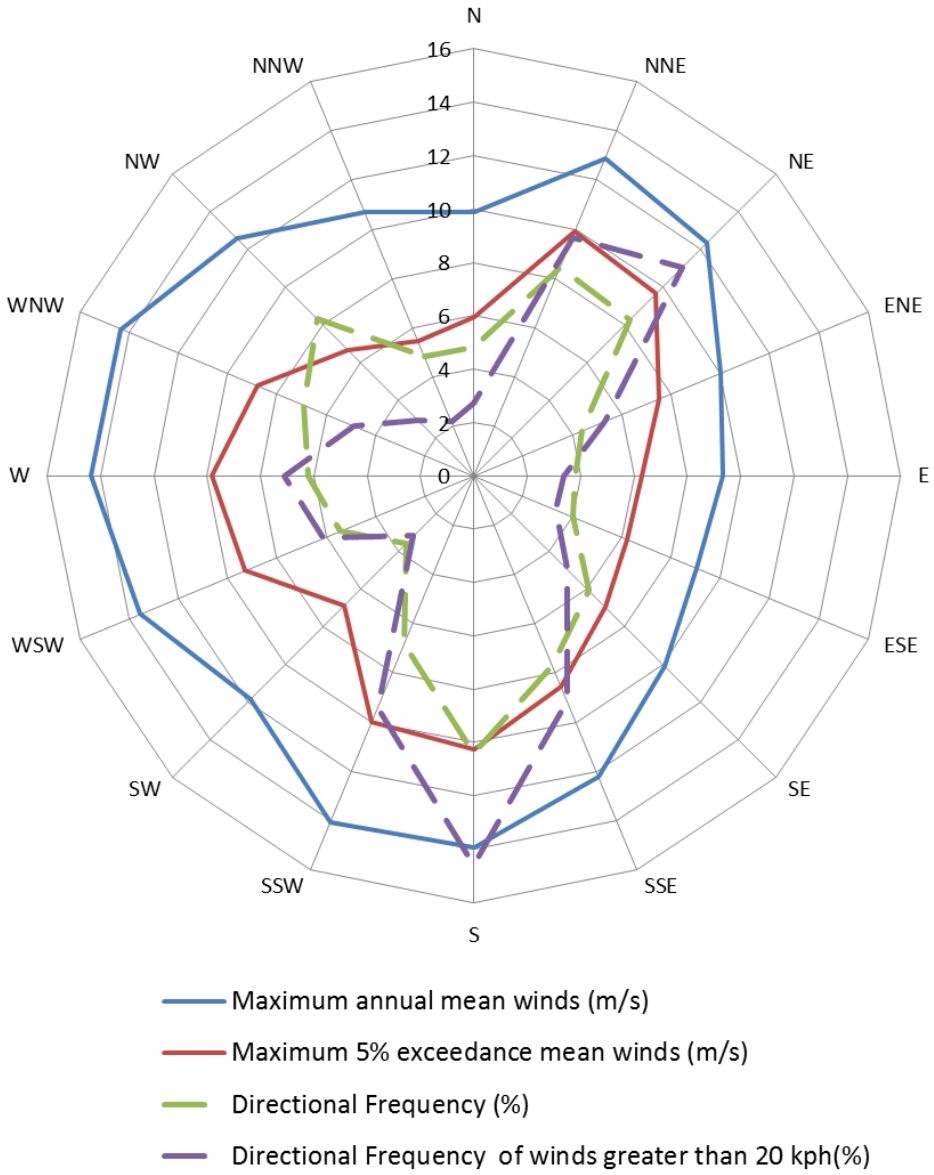

Figure 3a: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (referenced to 10m above ground in standard open terrain)

Legend

Line thickness represents the magnitude of the regional wind from that direction
Line length represents the frequency that the regional wind occurs for that direction

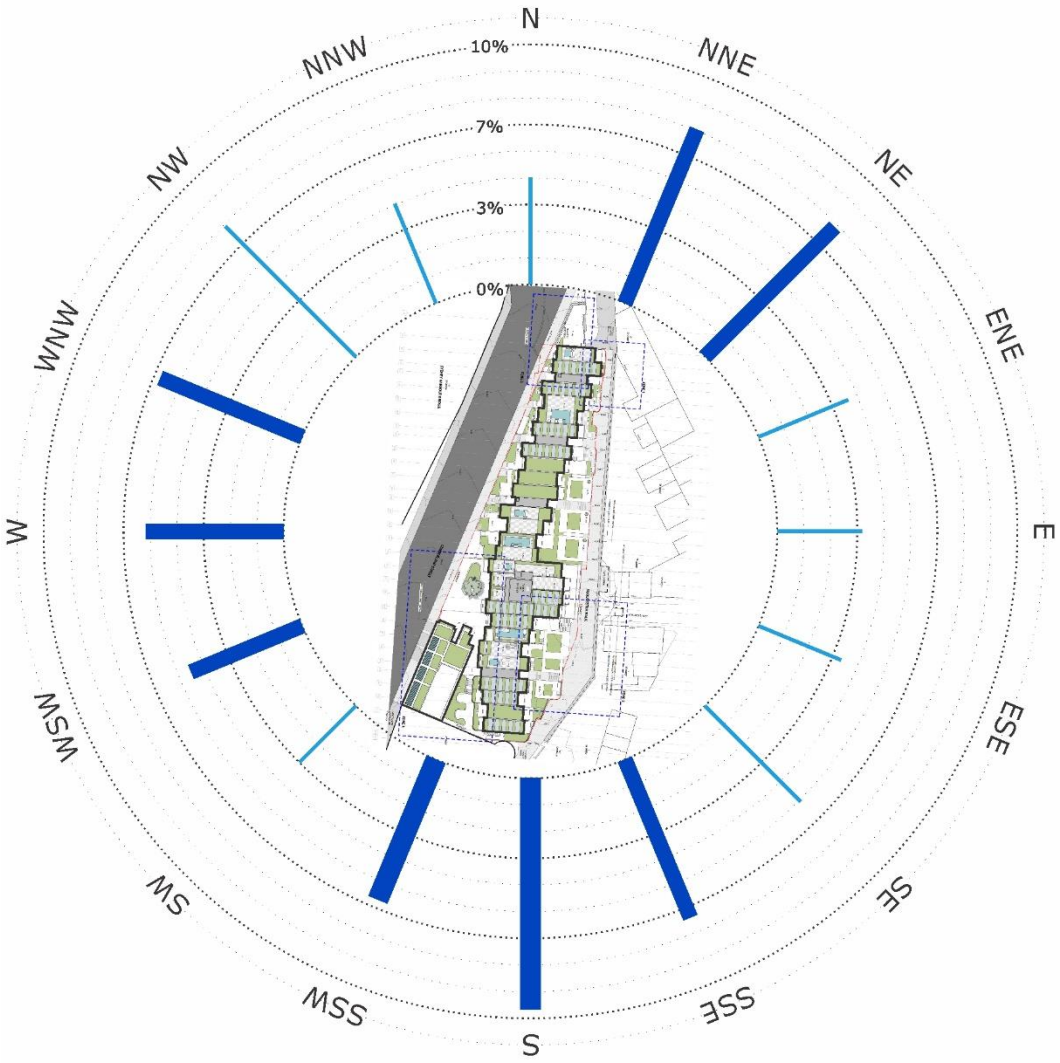

Figure 3b: Weekly Regional Wind Climate in relation to the Building Form

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 2 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 2: 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 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 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.

The ground plane will be used primarily for circulation. However, there are potential seating areas adjacent to the café located towards the north of the subject development and the forecourt along Cumberland Street. The recommended criterion for wind conditions for the circulation and private balcony areas is 8m/s with a 5% probability of exceedance, whereas the proposed seating areas and areas for short exposure activities (activities generally lasting less than 1 hour such as lobby entrance or retail areas) will need to satisfy a more stringent comfort criterion of 6m/s with a 5% probability of exceedance. Although this assessment is of a qualitative nature, the abovementioned criteria are considered when assessing the wind environment impacts.

5.1 Ground Level Areas

There is potential for the prevailing north-easterly winds being captured by the eastern façade of the tower to be redirected downward onto the pedestrian footpaths located on Gloucester Walk and the private garden areas on the east boundary, in the form of down wash. The setback of the tower form and the uneven façade line on the eastern elevation is expected to be effective in mitigating the potential down wash wind effects off the building on Gloucester Walk and the private ground garden areas.

The prevailing north-easterly winds may also experience side streaming effects along the eastern boundary impacting the café area to the north of the development, the private ground garden areas, the retail area adjacent to the through site link and Gloucester Walk. It is expected that that these conditions will be similar to the existing site conditions. Additionally, the setback of the building profile on the eastern side and uneven modulation of the facade are expected to be sufficient in reducing the side streaming winds impacting the café areas, the private garden areas at ground level, and Gloucester Walk.

The pedestrian footpaths located on Gloucester Walk and Cumberland Street are aligned to the prevailing southerly winds. These winds may funnel and side stream along the surrounding mid to high-rise levels of the building, before directly impacting pedestrian areas. It is expected that that these conditions are an existing site condition and will not be exacerbated by the additional height of the northern section of the building. The southerly winds are expected to funnel between the neighbouring buildings around the northern area of the development and create

adverse wind conditions for the northern most café area, the private garden areas at ground level, the retail area adjacent to the through site link and Gloucester Walk. The funnelling between the buildings is an existing site condition and will not be exacerbated by the additional height of the northern section of the building.

It is expected that the impact of westerly winds on the ground areas along the western boundary will be minimal due to the shielding provided by the existing structure under the Cahill Expressway to the west. Furthermore, the tower setback towards the west and uneven modulation of the facade should be sufficient in reducing the down washed winds impacting the Cumberland Street footpaths and private garden areas along the western boundary.

It should be noted that the direct wind effects along the pedestrian footpaths are expected to be similar to the existing wind condition for the site due to the minimal tower form changes in the proposed design.

The recessed entrance design and surrounding shielding from the prevailing winds, of the ground through site link is expected to be effective in mitigating the potential direct winds funnelling through the through site link and it is expected the wind conditions will be acceptable for the intended use.

It is expected that the majority of the wind effects are expected to be similar to the existing wind condition as the proposed building alterations retain the same form as the existing building. With the inclusion of the treatments listed below, the proposed design is expected to be equivalent or better in occupant comfort performance when compared to the existing design.

- Provision of the proposed impermeable ground level private garden walls around the boundary of the gardens.
- Provision of the proposed impermeable ground level walls around the boundary of the northern café outdoor area.
- Maintaining the existing stepped/uneven façade tower design.
- Provision of the proposed densely foliating vegetation along Gloucester Walk and Cumberland Street.

5.2 Proposed Western Building Pool and Café areas.

It is expected that the impact of prevailing winds on the Ground Level cafe area and the Level 1 pool area, of the proposed building will be minimal due to the shielding provided by the existing structure of the Cahill Expressway to the west, the Sirius building to the east and the neighbouring building to the south.

The western section of the Level 1 Pool Area may be exposed to the prevailing westerly winds being captured by the western tower façade before being recirculated onto the roof of the Pool area. Furthermore, the tower setback towards the east and uneven modulation of the façade, should be sufficient in reducing the down washed winds impacting the pool area.

The prevailing southerly winds may also experience side streaming effects along the western façade of the building to the south and along the proposed western building's western façade potentially impacting the open pool area of the building and the ground area of the Café.

It is expected that the majority of the wind effects are expected to be similar to the existing wind condition as the proposed building alterations retain the same form as the existing building. With the inclusion of the treatments listed below, the proposed design is expected to be equivalent or better in occupant comfort performance when compared to the existing design.

- Provision of the proposed impermeable balustrades.
- Provision of the proposed roof canopy.
- Provision of the proposed full height screening on the eastern façade on the pool area.
- Provision of the proposed ground level walls around the western boundary of the café area.

5.3 Extruded Balconies and Private Rooftop Terraces

The individual extruded private balconies enclosed on three aspects by full height screens/blade walls will be shielded from the prevailing winds side streaming or down washing off the façade of the development.

Furthermore, the rooftop gardens are exposed to the north easterly and westerly winds directly impacting the rooftop area and adversely impacting the local wind conditions within these areas.

It is expected that the majority of the wind effects are expected to be similar to the existing wind condition as the proposed building alterations retain the same form as the existing building. With the inclusion of the treatments listed below, the proposed design is expected to be equivalent or better in occupant comfort performance when compared to the existing design.

- Provision of an impermeable balustrade to the extruded balconies and around the boundary of the rooftop private terraces at a height of 1.2m.
- Provision of proposed densely foliating vegetation along the rooftop private terrace edges.

Landscaping can be an effective wind mitigation device to further mitigate the adverse wind conditions around the proposed site. The species should be of a densely foliating variety to ensure its effectiveness in wind mitigation. Evergreen trees should be considered for areas affected by the prevailing winds during winter. Trees should also be planted in clusters with interlocking canopies to more effectively absorb incident winds.

As a general note, the use of loose glass-tops and light-weight sheets or covers (including loose BBQ lids) is not appropriate on high-rise outdoor terraces and balconies. Furthermore, lightweight furniture is not recommended unless it is securely attached to the balcony or terrace floor slab.

The results of this assessment indicate that the subject development is relatively exposed to the three prevailing wind directions, affecting the site. As a result, there is a possible impact on the wind comfort within certain and surrounding several of the trafficable/occupant areas. It is expected that the majority of the wind effects identified are an existing wind condition which can be ameliorated with the consideration of the aforementioned treatment strategies and will be suitable for the intended use of the areas outlined.

As the existing building façade and massing is primarily being retained and restored it is expected the majority of the wind conditions will be similar to the existing conditions and it is therefore expected that wind tunnel testing will not be required for this development.

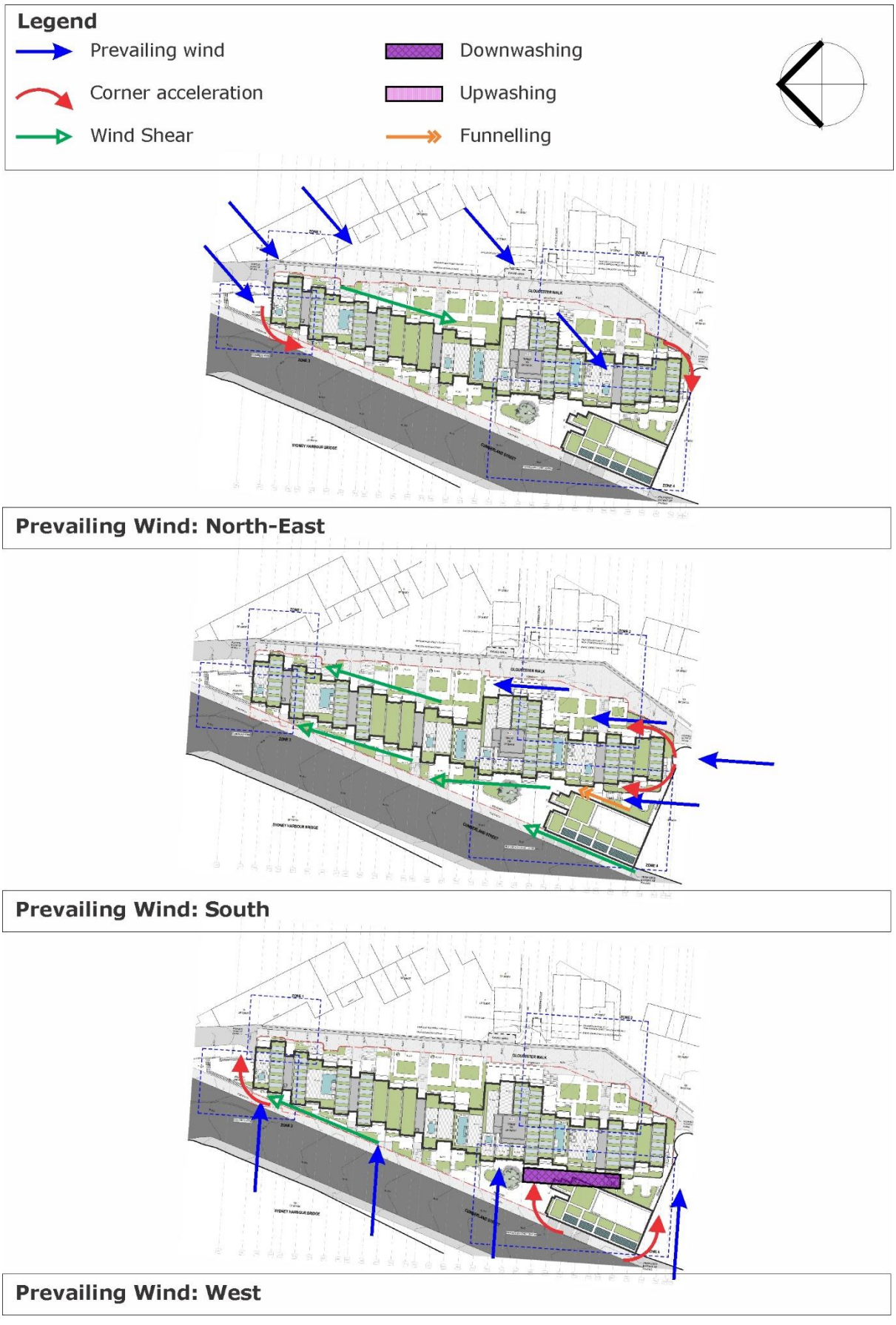

Figure 4: Wind Flow-Path Diagrams – Ground Level Plan

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