PEDESTRIAN WIND ENVIRONMENT STATEMENT

22 ST. QUENTIN AVENUE, CLAREMONT

WF755-01F02(REV1)- WS REPORT

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DOCUMENT CONTROL

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October 30, 2020	Initial.	0	TH	SWR	TH
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EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the proposed development located at 22 St. Quentin Avenue, Claremont, 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 Perth region; namely the easterly, south-westerly, 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 building benefits from shielding provided by the subject/neighbouring buildings, and the use of effective wind mitigating features in the building design such as the inclusion of planter areas, full-height privacy screens, impermeable balustrades and blade walls. There are however outdoor trafficable areas within and around the subject development site that are potentially exposed to a variety of adverse wind effects due to the interaction of the prevailing winds with the development built-form. It is expected that the wind effects identified in the report can be ameliorated and the local wind conditions further enhanced with the consideration of the following treatment strategies into the design of the development:

Ground Level

- The inclusion of densely foliating street trees along the Stirling Highway frontage of the site.
- The inclusion of densely foliating vegetation in form of trees or shrubs/hedge planting along the eastern perimeter edge of the library forecourt.

Level 3 Communal Outdoor Area

- The inclusion of densely foliating vegetation such as trees or shrubs/hedge planting within the proposed landscape areas along the perimeter edge of the communal space; in particular around the corner areas of the building and areas intended for short duration stationary activities such as the pool deck and alfresco etc.
- The inclusion of impermeable balustrades along the perimeter edge of the communal outdoor area.

- Consider an impermeable awning along the western tower façade to improve the pedestrian comfort and amenity on the pedestrian thoroughfare.

Private Balconies

- Retention of the proposed full-height privacy screens along the western perimeter edge of the north-western and south-western corner balconies as indicated in the architectural drawings.
- Retention of the proposed full-height privacy screens between the single aspect private balconies as indicated in the architectural drawings.
- The inclusion of full-height privacy screens along the eastern perimeter edge of the north-eastern and south-eastern corner balconies; similar to those along the western perimeter edge of the north-western and south-western corner balconies.
- The inclusion of the proposed impermeable balustrades along the remaining exposed perimeter edges of the various private balconies.
- The inclusion of densely foliating vegetation such as trees or shrubs/hedge planting within the proposed planter areas of the Level 18 penthouse terrace as indicated in the architectural drawings.
- The inclusion of 1.5m high impermeable balustrades along the exposed terrace perimeter edge of the Level 16 penthouse terrace.

With the consideration of the abovementioned treatment strategies 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 their applicable criteria.

Note the densely foliating vegetation is to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year and the vegetation should be spaced such that the foliage is able to interlock between plants (where possible).

Furthermore, 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 balconies or terraces. Lightweight furniture is not recommended unless it is securely attached to the balcony or terrace floor slab.

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 development site is bounded by St. Quentin Avenue to the north, Church Lane to the east, Stirling Highway to the south and a double storey retail building and open carparking abutting the site to the west. Surrounding the site predominantly low-rise commercial/retail buildings varying up to 4 storeys in height such as the Claremont Quarter Shopping Mall along the St. Quentin Avenue corridor. A survey of the land topography indicates there is a general rise in elevation towards the west of the site. An aerial image of the subject site and the local surroundings is shown in Figure 1.

The existing site consists of the Claremont Community Hub & Library, abutting an L-shaped retail building along the western and northern boundaries, with open carparking along the Church Lane frontage of the site. The Claremont Community Hub & Library is proposed to be retained with the remaining retail building to be redeveloped into a 17-storey high mixed-use building with retail/commercial tenancies proposed on the podium levels and private residential tenancies and associated amenities on the remaining levels.

The critical outdoor 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 footpaths and library forecourt.
- The Level 3 communal outdoor area.
- Private residential balconies and Level 16 penthouse terrace.

Figure 1: Aerial Image of the Site Location

3 REGIONAL WIND

The Perth region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the east, south-west 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 an analysis of wind rose data obtained by the Bureau of Meteorology from Perth Airport, from 1944 to 2006. From this analysis, directional probabilities of exceedance and directional wind speeds for the Perth region are determined. The directional wind speeds and corresponding directional frequencies of occurrence are presented in Figure 2.

As shown in Figure 2, the easterly winds are the most frequent for the Perth region, and are also the strongest. The south-westerly winds occur most frequently during the warmer months of the year for the Perth region, and hence are usually welcomed within outdoor areas. South-westerly winds are also similar strength to the westerly winds, but not as strong as the easterly events. The south-westerly and westerly winds typically occur during the afternoon periods

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

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

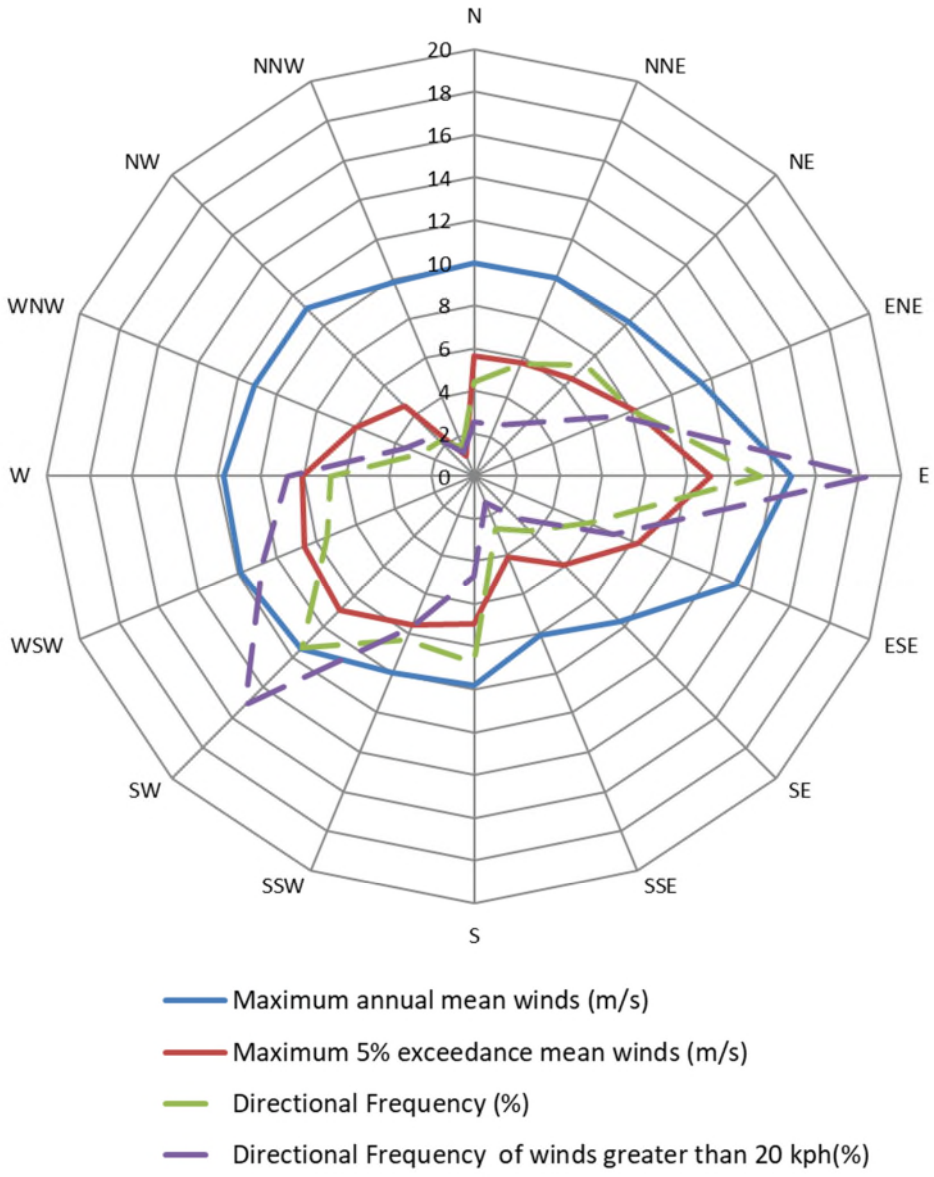

Figure 2: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Perth Region

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 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 (rather than referencing specific wind speeds). 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 desktop assessment of the local wind conditions is based on internationally recognised wind criteria for comfort; according to the intended use and typical activities of the trafficable area. The ground plane will be used primarily for circulation. The recommended criterion or wind conditions within circulation and private balcony areas is 5m/s with a 20% probability of exceedance, whereas the communal terrace areas are to satisfy a more stringent comfort criterion of 4m/s with a 20% 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

The pedestrian footpath along the St. Quentin Avenue benefits from the shielding provided by the subject and neighbouring buildings from the prevailing south-westerly winds. The staggered northern building façade is also expected to be effective in reducing the intensity of the prevailing easterly winds. Due to the east-west alignment of St. Quentin Avenue, the pedestrian footpath is potentially exposed to the direct wind effects travelling along the street. It should be noted that this is an existing wind condition for the site and the inclusion of the subject development is expected to have minimal impact upon the existing wind conditions when the prevailing winds are travelling along the street. The proposed awnings along the St. Quentin Avenue frontage of the site; as indicated in the architectural drawings, are expected to be effective in enhancing the wind conditions along the pedestrian footpath, hence they are recommended to be retained in the design of the development.

The pedestrian footpath along the Church Lane benefits from the shielding provided by the subject and neighbouring buildings from the prevailing easterly and westerly winds. Down-wash wind effects off the building façade are expected to be minimal due to setback of the tower from the podium edge. The existing densely foliating vegetation along the Stirling Highway frontage of the site are expected to be effective in mitigating the prevailing south-westerly winds travelling around the Claremont Community Hub & Library component of the development. Hence, they are recommended to be retained in the design of the development.

The library forecourt benefits from the shielding provided by the subject building and the existing densely foliating trees along the Stirling Highway frontage of the site from the

prevailing westerly and south-westerly winds. Furthermore, the forecourt is located within a recessed corner area of the development which is effective in stagnating the wind effects around the building entrance areas. The eastern perimeter edge of the library forecourt however is potentially exposed to the direct easterly winds as it travels along Stirling Highway and over the open carpark areas of the neighbouring Hungry Jack's development. It is expected the inclusion of densely foliating vegetation in form of trees or shrubs/hedge planting along the eastern perimeter edge of the library forecourt can mitigate these direct wind effects and enhance the local wind conditions within these areas.

The wind conditions on the pedestrian footpath along the Stirling Highway frontage of the site are expected to be similar to the existing wind conditions. This is due to the large setback distance of the proposed redevelopment from the pedestrian footpath. The existing densely foliating vegetation along the Stirling Highway frontage of the site are expected to be effective in enhancing the local wind conditions, hence they are recommended to be retained in the design of the development.

Note the densely foliating vegetation is to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year and the vegetation should be spaced such that the foliage is able to interlock between plants (where possible).

5.2 Level 3 Communal Outdoor Area

The Level 3 communal outdoor area is relatively exposed to direct wind effects from the three prevailing wind directions due to the lack of shielding provided by the surrounding low-rise buildings at this elevated position. The proposed build-form of the tower will afford some shielding to common areas located down-stream of the tower. The various corner outdoor areas are susceptible to accelerating flows around the tower build-form and the pedestrian thoroughfare along the western boundary may be exposed to the westerly winds captured off the relatively uniform and wide western tower façade and down-washed onto the thoroughfare.

The following treatment strategies are expected to be effective in mitigating the abovementioned potential wind effects and enhance the local wind conditions within the communal outdoor area, hence they are recommended to be considered in the design of the development:

Level 3 Communal Open Space

- The inclusion of densely foliating vegetation such as trees or shrubs/hedge planting within the proposed landscape areas along the perimeter edge of the communal space; in particular around the corner areas of the building and areas intended for short duration stationary activities such as the pool deck and alfresco etc.
- The inclusion of impermeable balustrades along the perimeter edge of the communal outdoor area.

- Consider an impermeable awning along the western tower façade to improve the pedestrian comfort and amenity on the pedestrian thoroughfare.

Note the densely foliating vegetation is to be of an evergreen species to ensure their effectiveness in wind mitigation throughout the year and the vegetation should be spaced such that the foliage is able to interlock between plants (where possible).

5.3 Private Balconies

Wind conditions within the north-western and south-western corner and single aspect balconies located near the centre of the tower build-form are expected to be acceptable for its intended uses. This is due to the shielding provided by the subject building, and the inclusion of effective wind mitigating elements in the design, such as the proposed impermeable balustrades and full-height privacy screens along the perimeter edges of the balconies as indicated in the architectural drawings.

The north-eastern and south-eastern corner balconies benefits from the wind amelioration afforded by the proposed impermeable full-height screen along the western perimeter edge. However, these corner balconies are exposed to direct wind and side-stream wind effects from the prevailing easterly direction, which is the strongest for the region. It is expected the inclusion of an impermeable full-height screen along the eastern perimeter edge; similar to the screen proposed along the western perimeter edge, would be effective in mitigating these adverse wind effects by creating a stagnation zone within the corner balconies.

Similarly, the Level 16 penthouse terrace; located along the eastern boundary benefits from the shielding provided by the tower build-form to direct wind effects from the prevailing south-westerly and westerly directions. However, it is exposed to direct wind effects from the prevailing easterly direction and accelerating flows around the corners of the tower build-form and reattaching onto the penthouse terrace. It is expected the inclusion of densely foliating vegetation such as trees or shrubs/hedge planting within the proposed planter areas and 1.5m high impermeable balustrades along the exposed terrace perimeter edge to be effective in mitigating the aforementioned adverse wind effects and enhance the local wind conditions to be suitable for its intended uses.

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 balconies or terraces. Lightweight furniture is not recommended unless it is securely attached to the balcony or terrace floor slab.

6 REFERENCES

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