CUNDALL

2 Hawthorne Place

Desktop Wind Comfort Report

SKS Group

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——	01 March 2022	DRAFT Issue for Development Application (DA)
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B	09 May 2022	Issued for Development Application (DA)
C	10 May 2022	Issued for DA – updated drawings
D	01 May 2025	Issued for DA – updated drawings
E	07 May 2025	Issued for Development Application (DA)

Document Validation (latest issue)

[redacted]

Executive Summary

Cundall have been engaged by SKS Group to assess the impact of the proposed 2 Hawthorne Place design located in Perth, Burswood. This desktop assessment considers the impacts of the proposed design on the local wind environment. This report summarises the method, results and conclusions of the desktop wind impact assessment that has been conducted. The assessment looked at the local site, proposed building design and local wind climate. The key factors which influence the wind microclimate in the area were investigated qualitatively including:

- The proposed building form and height
- The nature and distribution of wind obstructions surrounding the site
- The proximity to nearby buildings, outdoor retail areas and pedestrian areas
- Permanent shade structure (combination of metal pergola and roofing) over BBQ al-fresco area on podium level 3
- Wind mitigation design features, such as awnings, extended balcony floors, increased foliage and balustrades.

The building design includes large balcony floors, balustrades, and other features to break up the facade, as well as a podium, which can mitigate some potential negative impacts from wind. The development is expected to not adversely affect the wind conditions around the site regarding current conditions. The public pedestrian space is expected to be appropriate for use at ground level. However, further mitigation can be taken to potentially improve the suitability for the activities which may take place on the podium level terrace, apartment balconies and promenade.

To quantify the advice provided in this qualitative report computer-based simulation could be carried out. And whilst this report has considered wind comfort, computer simulation modelling should also be considered to analyse possible thermal comfort and wind driven issues for a more complete understanding of the site environment.

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1.0 Introduction

1.1 Project Background

Cundall has been engaged by SKS Group to provide a desktop study wind analysis of the impact of the proposed 2 Hawthorne Place design on local pedestrian wind environment located in Perth, Burswood.

This proposal will deliver a 19-storey mixed use multi-residential development comprising of:

- Parking in ground level, level 1 and level 2
- A commercial space at ground level near the main entrance.
- A residential lobby at the main entrance to the building.
- Multiple private apartments with balconies from ground floor up to level 19.
- An office space on the ground floor
- A podium level terrace on level 3 including a garden and alfresco area
- A common amenities room on level 3

The main pedestrian access to the site is via Hawthorne Place on the western side of the development.

Vehicular access to all parking is located on Lane 59 through two tilt up doors. An up ramp within the car park allows cars to park on level 2.

1.2 Site Location

The project site is located within the Perth, Burswood. Figure 1.1 and Figure 1.2 below shows satellite images of the site, highlighted in blue. There are several one storey buildings located to the south, west, and east of the site, while several large trees are located to the north of the site on GO Edwards Park. An appreciation of the site context is important to the consideration of the local winds for the development.

Figure 1.1 – Aerial view of the proposed site location highlighted in blue

Figure 1.2 – Perspective view of the proposed site location highlighted in blue

Figure *1.3* below. These areas are:

1. Hawthorne Place ground floor pedestrian access
2. Promenade
3. Podium terrace
4. Forecourt
5. Private apartment balconies

Figure 1.3 – 3D render of proposed development showing key areas considered in this assessment

1.3 Reference Documents

The following resources were used throughout this verification exercise:

- Drawings and models; a list of which is contained in Appendix A

1.4 Disclaimer

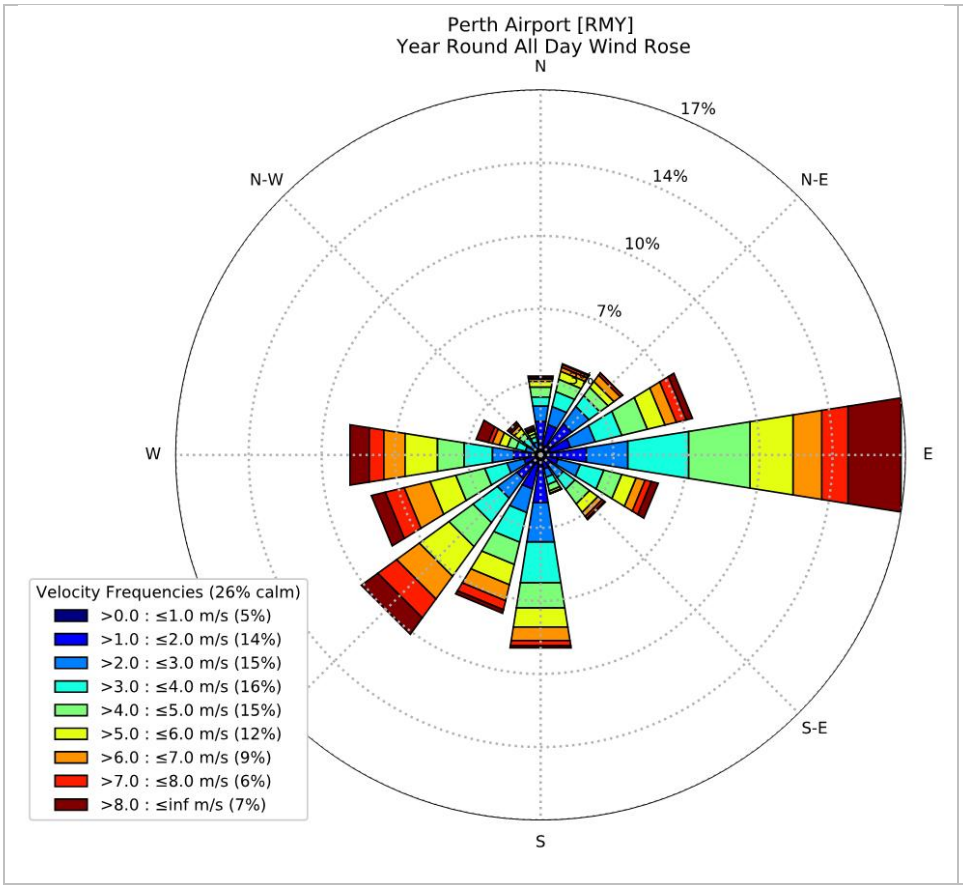
The following assessment is based on drawings provided by SKS Group and is a desktop study based on Cundall's prior experience.

No computer simulation modelling has been carried out as a part of this assessment. To quantify the advice provided in this qualitative report it is recommended that computer-based simulation be carried out at later design stages.

Whilst the report may focus on key areas of the building design, the results should be reviewed in whole, and the reader must consider all results shown within and around the building. Cundall will not take responsibility or accept liability for the use / interpretation of this report by any third party. This assessment does not use gust speeds and is not an assessment of pedestrian safety. It is also not an assessment of wind pressure, façade pressure or structural loading.

2.0 Perth wind climate

The wind conditions across the development site will be driven by the Perth climate prevailing winds. This report uses Perth Airport climate file AUS WA Reference Mean Year file to generate the wind environment. Figure 2.1 shows an annual wind rose for Perth Airport. This is a graphical representation of the wind conditions in Perth Airport, for a typical reference year. The wind roses for each season of the year are shown in Figure 2.2 these show the prevailing wind direction, speed and frequency for summer, autumn, winter and spring and are broken down into morning, afternoon, evening and night.



The wind rose diagram shows three key pieces of information

- Wind direction
- Wind strength
- Wind frequency

Colour shows wind strength i.e. yellow is 5.0-6.0 m/s

Length of each wedge indicates a fraction of time.

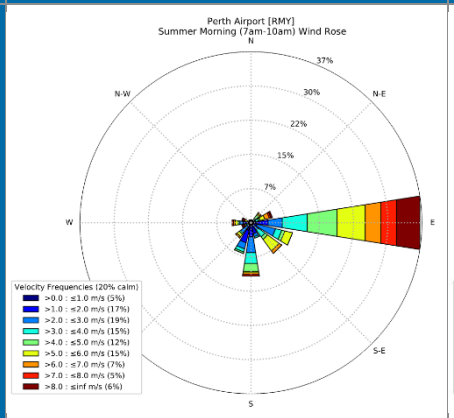
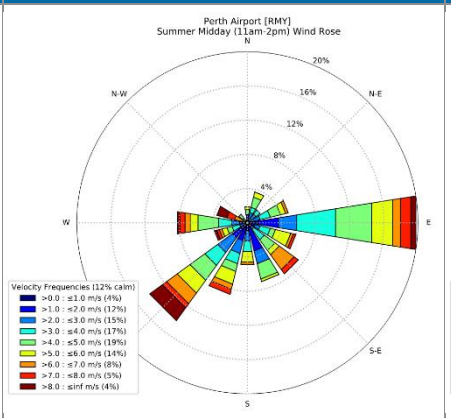
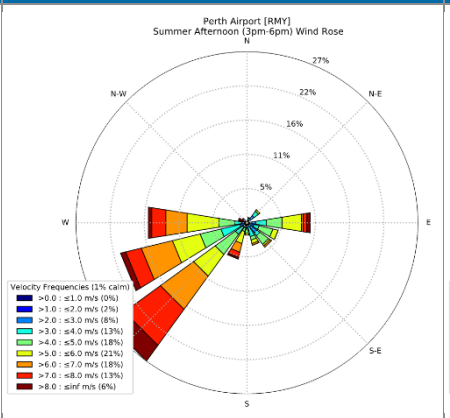
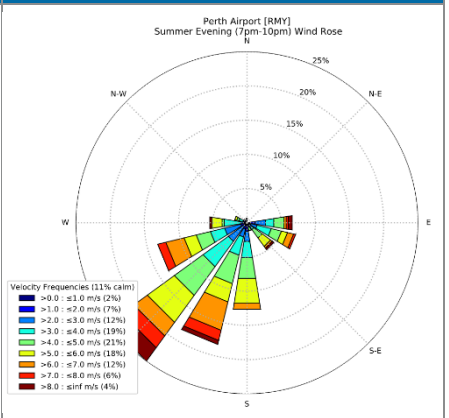
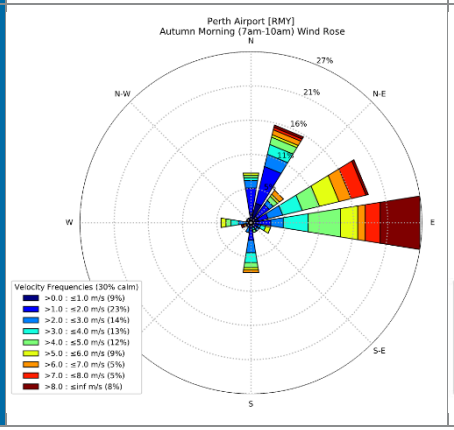
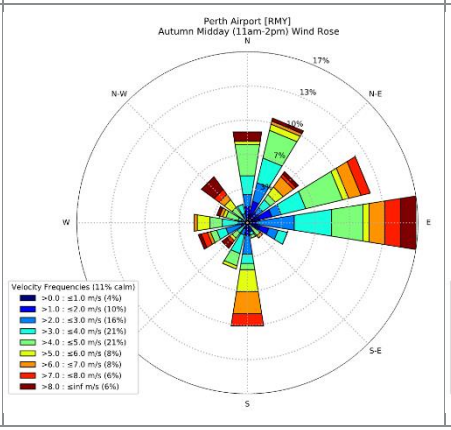
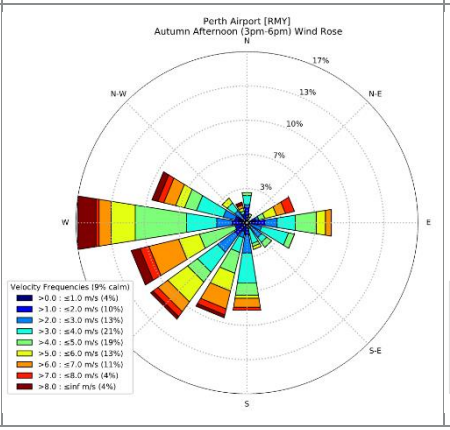
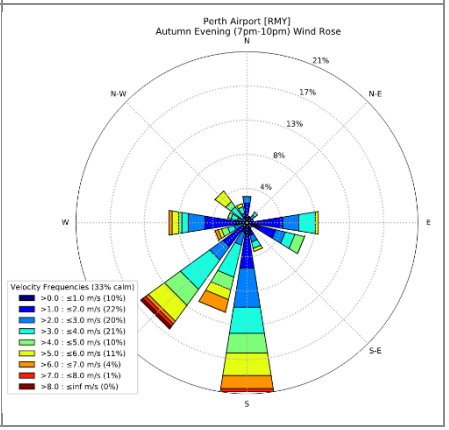
See Table 3.1 an 8 m/s wind is a Force 5, known as a fresh breeze and can cause small trees to sway.

Figure 2.1 – Wind rose – a full year wind profile

As illustrated in the wind roses below, Perth Airport has strong prevailing south-westerly winds throughout the spring and summer midday and afternoons with a very strong prevailing easterly wind in the mornings for a large part of the year.

Occasional northerly winds occur during autumn and winter seasons. It should be noted that these northerly winds, although not as common as easterly and south-westerly winds, generally occur as a result of storm activity and as such are very strong in intensity when they do occur.

The prevailing south-westerly and easterly winds are the focus of this report.

	Morning	Midday	Afternoon	Evening
Summer				
Autumn				

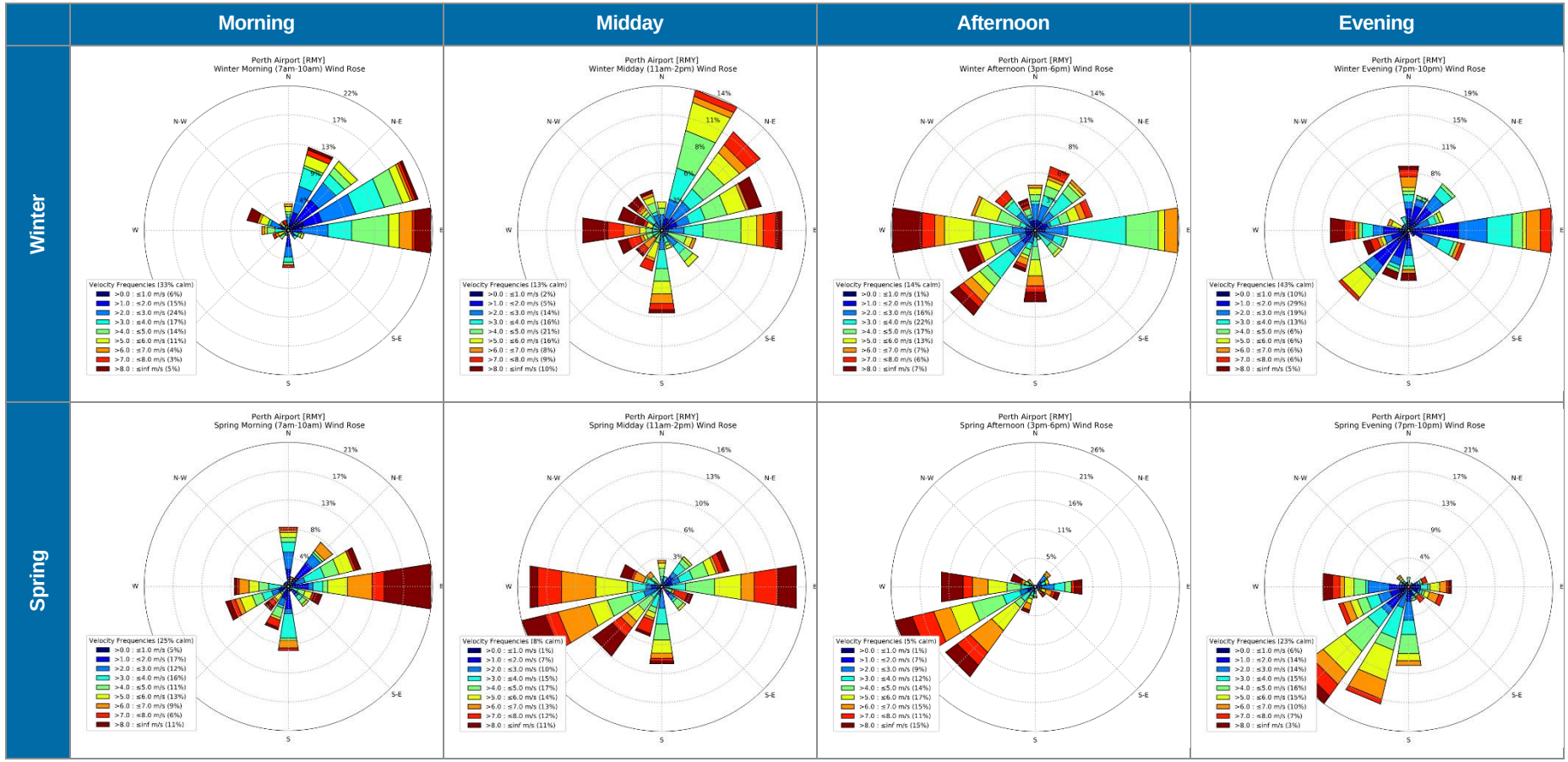


Figure 2.2 – Wind rose – for each time of the day and season.

3.0 Environmental wind speed criteria

Wind speed and frequency of wind occurrence are the primary parameters used in the assessment of pedestrian wind impact. Local wind effects can be assessed with respect to a number of environmental wind speed criteria established by various researchers. Despite the apparent differences in numerical values and assumptions made in their development, it has been found that when these are compared on a probabilistic basis, there is remarkably good agreement.

3.1 The Beaufort Scale

Wind criteria for pedestrian comfort are related to the Beaufort Wind Scale which is described in Table 3.1 along with relative conditions in order to aid in relating the scale to everyday occurrences.

Table 3.1 The Beaufort scale for wind strength and comparison with commonly sensed outcomes

Force	knots	Km/h	m/s	Name	Relative Conditions
0	<1	<2	0 - 0.5	Calm	Smoke rises vertically
1	1 - 3	1 - 5	0.5 - 1.5	Light air	Smoke drifts and leaves rustle
2	4 - 6	6 - 11	1.5 - 3	Light breeze	Wind felt on face
3	7 - 10	12 - 19	3 - 5.5	Gentle breeze	Flags extend, leaves move
4	11 - 16	20 - 29	5.5 - 8	Moderate breeze	Dust, leaves and loose paper lifted
5	17 - 21	30 - 39	8 - 11	Fresh breeze	Small trees sway
6	22 - 27	40 - 50	11 - 14	Strong breeze	Large tree branches move, wires whistle
7	28 - 33	51 - 61	14 - 17	Near gale	Whole trees in motion, inconvenience in walking.
8	34 - 40	62 - 74	17 - 21	Gale	Difficult to walk against wind, small branches blown off tree.
9	41 - 47	76 - 87	21 - 24	Strong gale	Minor structural damage may occur (shingles blown off roofs).

3.2 Lawson's Criteria

This report refers to the Lawson criteria developed over a period of some 30 years at the University of Bristol in the UK. These criteria are probably the most widely used in environmental impact assessments across the UK and are also specified as the urban comfort criteria to be adopted in the Perth City Link guidelines.

Six usage categories are defined by the criteria which are summarised in Table 3.2. The usage categories represent varying levels of activity as well as duration of that activity.

“Tolerable” conditions indicate a level at which pedestrians will be conscious of the wind but will put up with it. Conditions that are tolerable for a particular activity can be improved upon but don’t require remedial action if conflicting design constraints make this impossible or uneconomical.

“Unacceptable” conditions indicate that wind strength and potential duration will not be tolerated by pedestrians.

Conditions are “Unacceptable” or “Tolerable” based on the percentage of time that the points tested exceed the Beaufort force on a per usage basis. For example, if a sitting type area exceeds Beaufort 3 (3 m/s) for more than 1% of the time assessed, then this area may be considered uncomfortable for sitting type activities.

Table 3.2 Summary of Lawson’s Criteria for various space usage categories

Description	Letter	Unacceptable	Tolerable
Road and Car Parks	A	6% > Beaufort 5	2% > Beaufort 5
Business Walking	B	2% > Beaufort 5	2% > Beaufort 4
Pedestrian Walk-through	C	4% > Beaufort 4	6% > Beaufort 3
Pedestrian Standing	D	6% > Beaufort 3	6% > Beaufort 2
Entrance Doors	E	6% > Beaufort 3	4% > Beaufort 2
Sitting	F	1% > Beaufort 3	4% > Beaufort 2

4.0 Wind flow mechanisms

Fluid flows such as air/wind is driven from high pressure to low pressure regions much the same way as current flows from higher voltage to lower voltage and water flows in a river from a higher level to a lower level.

As the wind moves around a building it broadly tends to convert its kinetic energy (motion) into pressure. Upstream faces where the wind strikes the building may form a stagnation region where the pressure is the highest. Downstream faces experience lower pressure in the turbulent wake of the building. This pressure differential from the windward to the leeward sides of the building has the potential to drive high velocity air (wind) through or around the building.

After far field wind mitigation, building massing has the largest impact on the local wind environment of any development and is usually the most significant controllable variable. The building forms will typically depend focused on the architect's aesthetic aspirations, client's objectives and budget. Given these constraints, it may be difficult to reform the massing with a larger focus on wind impacts.

The wind will tend to follow the path of least resistance to get from the higher-pressure region to the lower pressure. Thus, if there is a narrow passageway or pedestrian arcade connecting the windward side of the building to the leeward side then a lot of air may be forced into this space potentially creating a wind tunnelling problem in this area. Wind effects may be reduced by either:

a) increasing the wind resistance through the passageway; or
b) providing an alternative, more favourable path for the wind to take.

Wind resistance can be increased by adopting 90-degree bends, wing-walls and podium levels or awnings above the entrance to reduce the potential for downwash to create high pressures on the windward side.

For an isolated building a large portion of the wind is accelerated down and around the windward corners. This is called downwash and causes the windiest conditions at ground level on the windward and sides of the building. Techniques to mitigate the effects of downwash winds on pedestrians include the provision of horizontal elements, the most effective being a podium to divert the flow away from pavements and building entrances. Awnings along street frontages perform a similar function and the deeper the horizontal element generally the more effective it will be in diverting the flow.

Winds at mid and upper levels on a building are accelerated substantially around the corners of the building. When balconies or external terraces are located on these corners they are likely to be breezy and will be used less by the owners due to the regularity of stronger winds. Owners quickly become familiar with when and how to use their balconies. If the corner balconies are deep enough, local calmer conditions can exist.

Below are some examples[1] of wind flow around buildings and the best practices to increase wind comfort:

Orientate the long axis parallel to the prevailing wind. Avoid large flanking walls facing the prevailing

Figure 4.1 – Illustration of the effect of orientation and massing

Use podiums to prevent downwash reaching ground level. Avoid large cubical buildings with plain façades.

[1] Wind Microclimate Around Buildings' p. 8, 2011 Digest DG 520, BRE Press and IHS

Figure 4.2 – Illustration of the podiums

Avoid potential issues with transverse wake flow using finger blocks on the rear face.

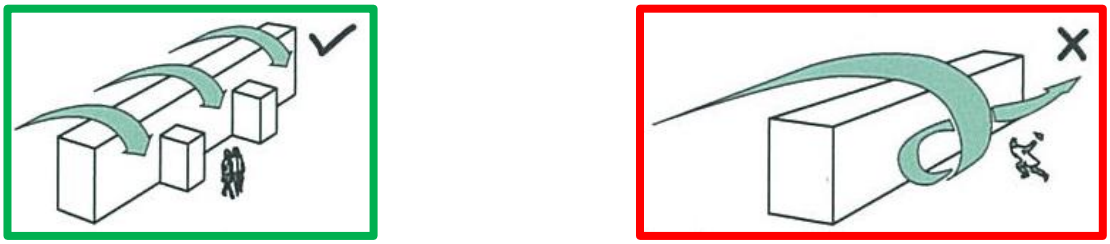


Figure 4.3 – Illustration of the effect of finger blocks

Use large canopies to mitigate downwash. However, be aware that this can trap and accelerate horizontal flows.

Figure 4.4 – Illustration of the effect of awnings

Avoid funnel-like gaps between buildings and passageways beneath buildings at ground level.

Figure 4.5 – Illustration of the effect of funnelling and tunnelling

Group buildings so that the height differential is minimised; ideally, the protruding building height should be less than twice the average height.

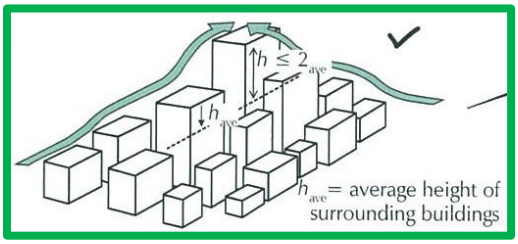


Figure 4.6 – Illustration of the effect of height differentials

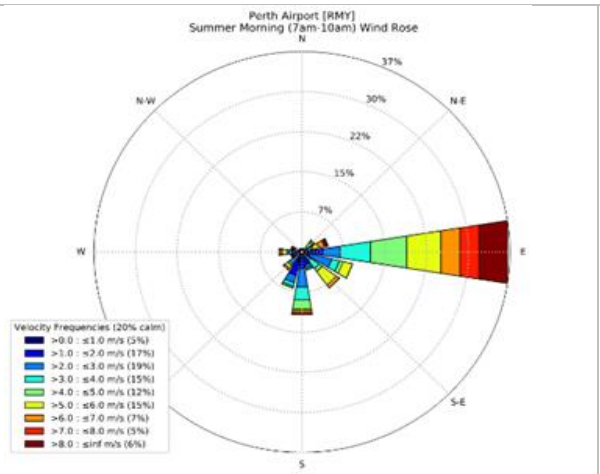
5.0 Environmental wind assessment

The following assessment considers the site factors, proposed redevelopment design and the prevailing winds in the Perth region.

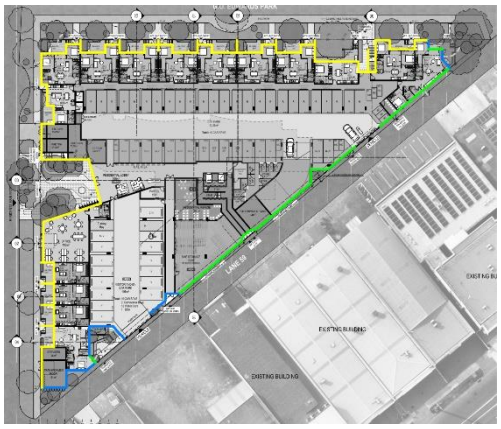
5.1 Site factors

The site of 2 Hawthorne Place is in an area surrounded by several other buildings. Several one storey buildings on 109-137 Lane 59 may offer some minor wind protection from easterly winds. However, the rear of buildings 111-113 is further away from the development in comparison as it has a large carpark/loading bay. Therefore, easterly winds will likely be at a greater velocity on impact with the development due to a reduction in protection. 28 Thorogood Street, a double storey building, is located to south-west of the site which may offer some minor wind protection against the south-westerly winds. Unfortunately, due to these buildings only being one to two stories tall, they will likely only offer some minor protection to the first two floors and the adjacent pedestrian walkways. Large trees are located to the northern side of the site on GO Edwards Park. These could offer some wind protection from less common northerly winds; however, this won't be considered in our evaluation. This is because the trees likely won't offer the same amount of protection all year round.

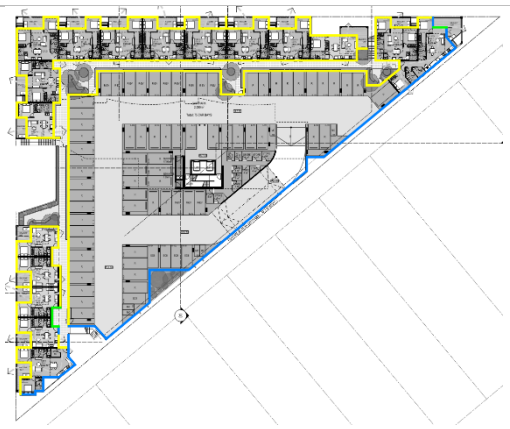
5.2 Easterly wind



Easterly Wind Rose

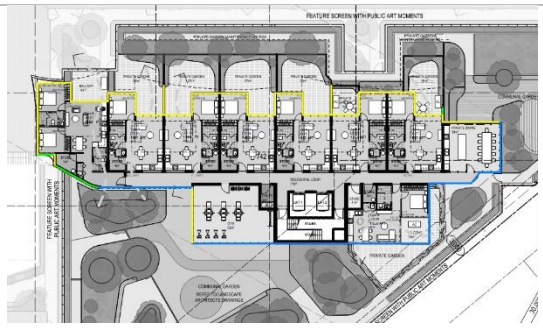


Ground Floor

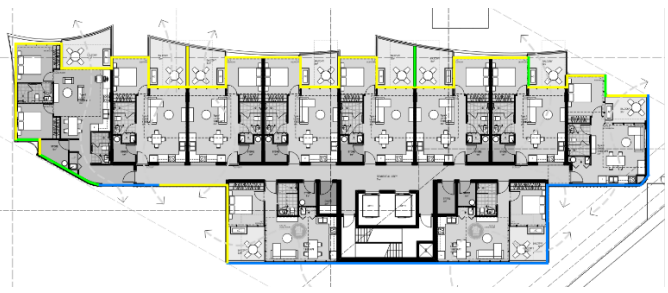


Level 1

Level 2



Level 3 Tower Podium



Level 4 – 10 Typical

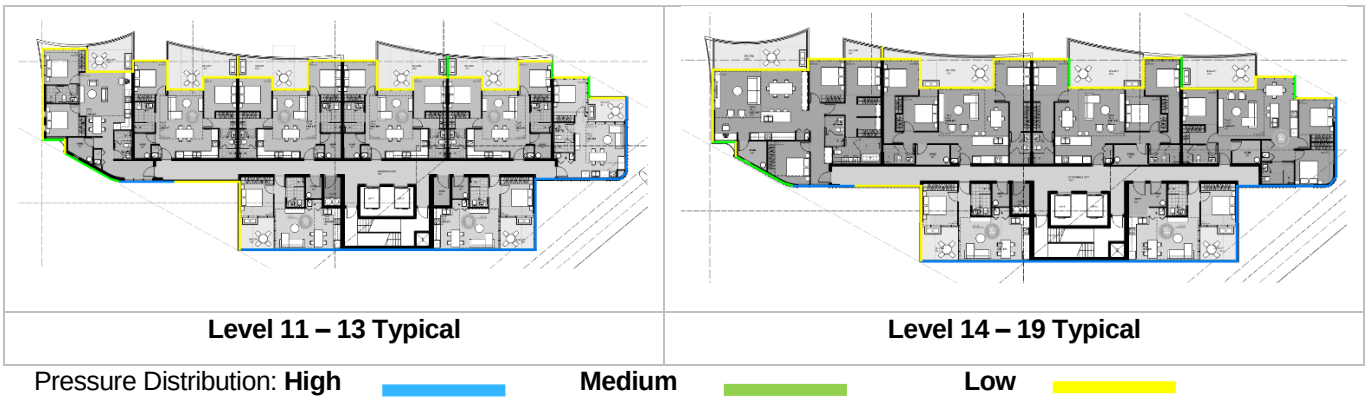


Figure 5.1 – Wind effects under easterly wind

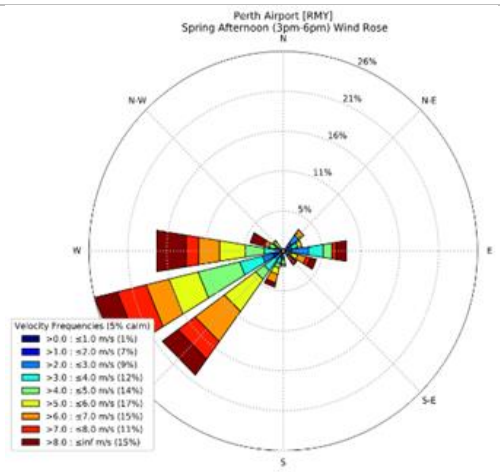
Figure 5.1 above illustrates the effect of an easterly wind on the building and the surrounding environment. The eastern wall is predominantly exposed, however the buildings on 109-137 Lane 59 may offer some protection to the ground floor. The exposed carpark/loading bay at the rear of buildings 111-113 Lane 59 could lead to higher winds reaching the development at ground level due to its greater exposure. This likely won't be a significant issue as Lane 59 is not a main pedestrian access way, instead is used predominantly for vehicular access. Easterly winds mostly occur during the morning in Perth and any easterly wind that reaches the building will likely affect any facilities open during this time. In particular, the podium level balcony on third floor is likely be subject to strong easterly winds in the morning hours. Increasing the volume of foliage around the perimeter could help to mitigate the strong morning winds from affecting the comfort of residents.

The pedestrian access and forecourt on the ground level, will likely be protected from Easterly winds throughout the year, whereas the northern and southern walls which shape the promenade, may assist in funnelling easterly winds through there in the morning. As a result of this potential wind tunnel, the comfort of the residents in this area may be negatively affected.

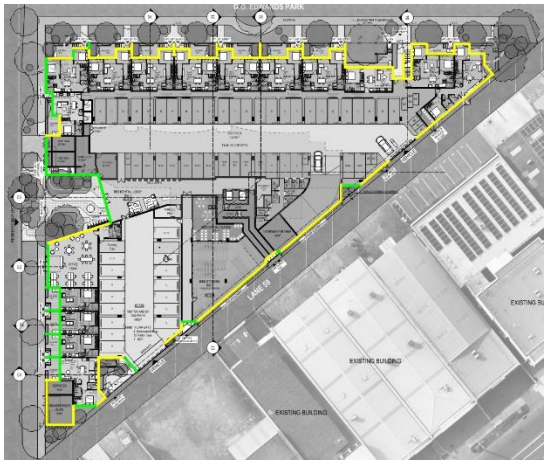
The terrace located to the far north-eastern end of the development could potentially be negatively affected by morning easterly winds. Ensuring there is a sufficiently tall balustrade should assist in improving the comfort of residents using these facilities. This would also assist in reducing the velocity of the winds which reach the wall next to the terrace.

All townhouses from the ground level to level 2 will likely be protected from easterly winds due to the orientation of the development, except for the one mentioned above. However, the private apartments from level 3 and above facing the east will likely be negatively affected by these winds. The recessed nature of the balcony doors in these wind conditions, may create a pressurised zone at the doorways, however, the extended floor plates and balustrades which have been designed will likely offer some protection and reduce the velocity and amount of wind which may ingress onto the balcony of each level. Further mitigation can be taken in the next stage of the design by increasing the height of balustrades and length of the floor plates, as these could potentially offer greater protection and comfort to those on their balcony.

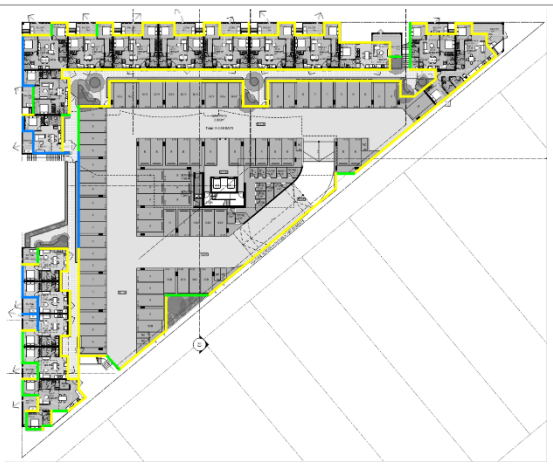
5.3 South-westerly wind



South Westerly Wind Rose

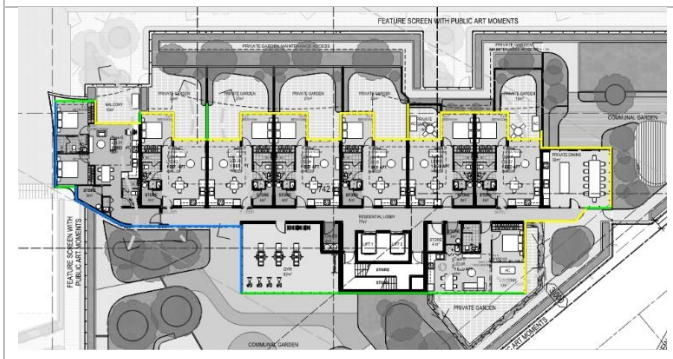


Ground Floor

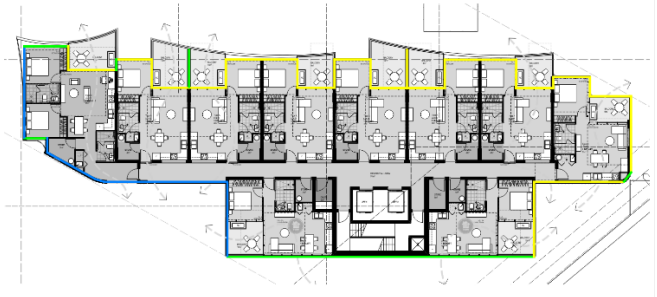


Level 1

Level 2



Level 3 Tower Podium



Level 4 – 10 Typical

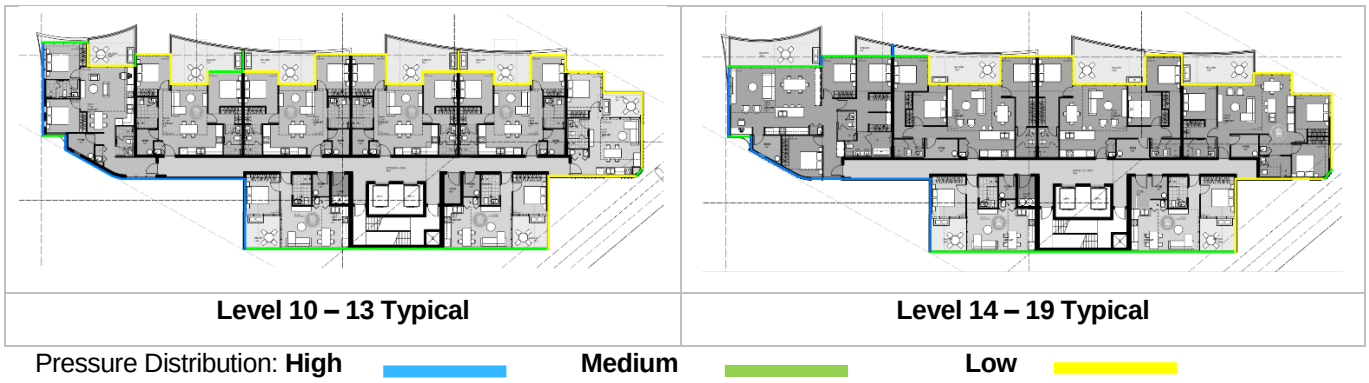


Figure 5.2 – Wind impacts under a south-westerly wind

Figure 5.2 above illustrates the effect of a south-westerly wind on the building and the local wind environment. The western and southern walls of the building are predominantly exposed; however, it may receive some minor wind protection at both ground level and level 1 at the southern corner of the development by 28 Thorogood Street. The main pedestrian access which runs along Hawthorne Place will likely be affected by these winds both by winds at ground level as well as downwash from floors above. While it may be difficult to reduce ground level winds, adding horizontal fins above both the walkway and forecourt could potentially reduce the negative impact of these winds on pedestrian comfort. Like the easterly winds, wind tunnelling may occur through the promenade on level 1 due to south-westerly winds in the afternoon hours. To mitigate this, extending the already existing vertical fins both in length and height, as well as adding new ones, may greatly assist in reducing this potential tunnelling effect. Increasing the volume of foliage will also help.

Due to no other tall buildings being present in the proximity of the development, it is likely that no major wind tunnels will be present increasing the effect of south-westerly winds on the building. However, all town houses from the ground floor to level 2, as well as the private apartments which face west are likely to be negatively affected by these winds. Specifically, the balconies for apartments type A.2 and B.5 will experience these winds greatly due to their exposure and floor height.

The recessed balconies from level 1 to 19 may also experience a greater pressurised region at the doorways like those that are subject to easterly winds. However, the use of the extended floor plates and balustrades represented in the design are likely to help to reduce these pressures. Further mitigation can again be taken in later design stages by increasing the length and height of the floor plates and balustrades respectively, as this could potentially reduce these pressures to a greater extent.

The south-westerly winds are Perth's most frequent wind direction and typically occur in the afternoon through to late evening, which could benefit the use of the podium level balcony on level 3 during hot periods throughout the year. However, use of these outdoor areas and facilities could be an issue during the cooler months, but this potential could be minimised through added foliage.

5.4 West – East Elevation view and perspective

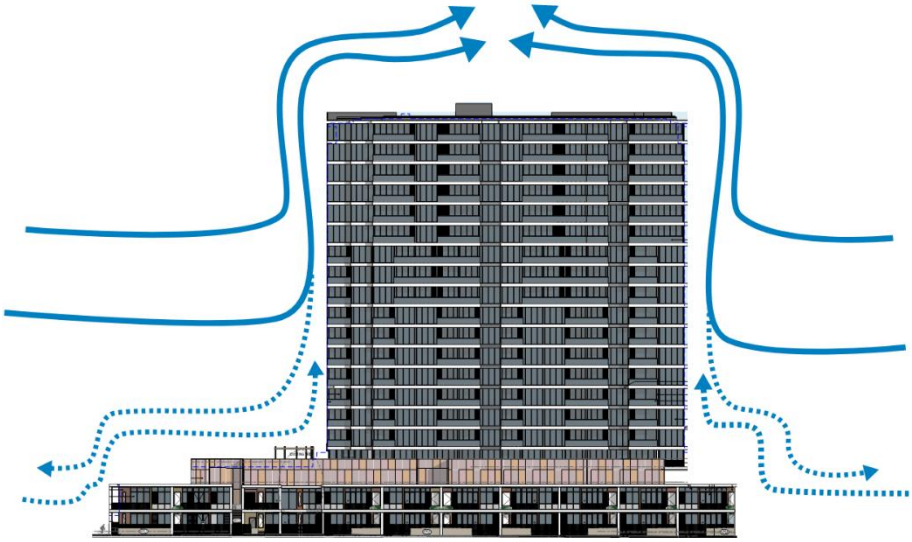


Figure 5.3 – Westerly and Easterly wind impacts on Northern elevation

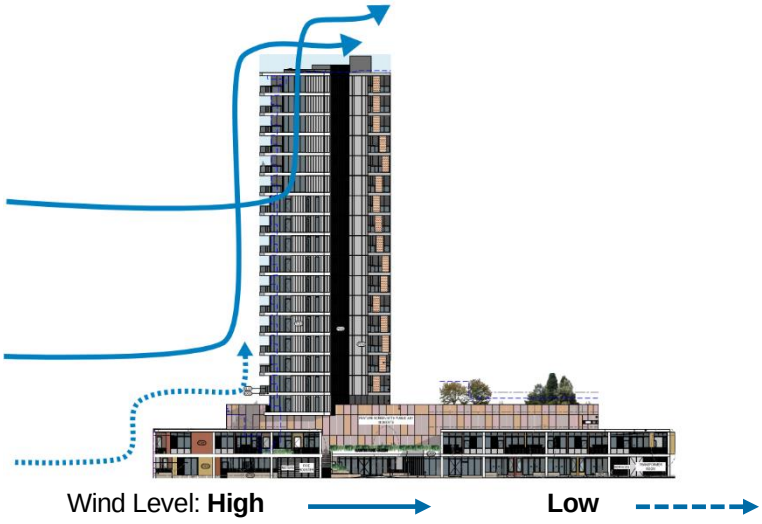


Figure 5.4 –Southerly wind impacts on section view

Figure 5.3 and Figure 5.4 above provide an approximation of the expected wind paths of two of the most common winds in Perth, south-westerly and easterly, around the development. Due to the podium level balcony on level 3, a lot of the high velocity winds which may pass down the façade of the development will likely be washed away prior to reaching the ground floor. Whilst some winds may pass down the façade of the development and over this podium level, causing downwash on the spaces below, these will likely be at a much lower velocity. It is likely that the easterly winds will not negatively impact nearby pedestrians due to the adjacent buildings offering protection from winds. Contrastingly, pedestrians may experience discomfort from south-westerly winds in the forecourt and promenade due to the lack of nearby westerly wind protection. Due to the orientation of the outdoor podium level area, it will likely be completely exposed to both easterly and south-westerly winds, which may cause some wind discomfort for some residents. The 1.2m balustrade surrounding the perimeter of the podium level will offer some minor protection from these winds, however, due to the size of the outdoor area, it is likely it will not greatly reduce the effect of these winds. Increasing the volume of foliage on the podium level is a wind mitigation strategy which can be pursued to improve the comfort of residents as it would likely help to diffuse the high winds which pass over this area.

5.5 Mitigation measures

The below summarises the key wind mitigation features that the planned development currently has incorporated into its proposed design:

- Extended balcony floors are provided to all balconies from level 1 to 19, thus reducing downwash
- All apartments with balconies from level 1 to 19 have recessed balcony doors
- A podium level balcony on level 3 reducing downwash onto the ground and lower levels
- A side wall is fitted to the western side of the stairs up to the promenade
- Balustrades are provided to all external terraces, and balconies, including the podium level outdoor space
- Permanent shade structure (combination of metal pergola and roofing) over BBQ al-fresco area on podium level 3
- Vegetation is provided to the ground floor, promenade, and podium level terrace to assist in diffusing winds.

Further measures that may be incorporated include:

- Higher private walls for the ground level dwellings, particularly on the west and southwest of the building
- Roofing above the BBQ areas on the terrace on level 3
- Glass doors in the lobby to be positioned away from the seating areas
- Additional vegetation and / or higher balustrades for the residents' workspace outside terrace on level 2
- Higher Balustrades, longer horizontal balcony floors for apartment exteriors
- Additional features on the southwest facing façade of the tower which overlooks the garden area, to reduce the effects of downwash onto the podium and garden
- Additional vegetation / landscaping to all outside areas (promenade, podium level terrace, and ground floor). All proposed vegetation should be of an evergreen species and be densely foliated to maximise the effect of mitigation.

6.0 Conclusion

The proposed development at 2 Hawthorne Place in Perth, WA, has been assessed for potential negative wind impacts on the local environment.

This desktop wind impact study assessed the development against the Lawson's Criteria and has highlighted that the proposed design has already incorporated design elements which may reduce the impacts that the wind may cause on the building users and the local environment. This includes the various mitigation measures noted in Section 5.5 which may assist in reducing potential negative wind impacts on the activities which may take place at ground level, on the podium level balcony, apartment balconies and podium levels.

In general, it will likely be difficult to completely mitigate the negative effects from predominant easterly and south-westerly winds due to only minimal protection being afforded by those buildings surrounding the proposed development. While wind conditions around the site are expected to be suitable for use as a transient space at ground level, further measures could be taken to potentially make it more suitable.

To quantify the advice provided in this qualitative report computer-based simulation could be carried out. And whilst this report has considered wind comfort, computer simulation modelling should also be able to analysis possible thermal comfort and wind driven issues.

Appendix A List of reference documents

Table 6.1 Drawings and models used for developing the analysis

Drawing Number / File name	Drawing Title	Revision	Date Issued
A0201	PARK CORNER	F	13/04/25
A0202	HAWTHORNE PLACE ENTRY	F	13/04/25
A0203	SOUTH - WEST CORNER	E	13/04/25
A0204	PARK VIEW	E	13/04/25
A0205	HAWTHORNE PLACE	B	13/04/25
A1001	VIEW CORRIDOR	E	13/04/25
A1002	STREET VIEW IMAGES	D	13/04/25
A1003	SITE PLAN	F	13/04/25
A2001	PLAN - GROUND FLOOR	J	13/04/25
A2002	PLAN - LEVEL 01	J	13/04/25
A2003	PLAN - LEVEL 02	J	13/04/25
A2004	PLAN - LEVEL 03 TOWER PODIUM	J	13/04/25
A2005	PLAN - LEVEL 04 - 10 (LOWER TOWER)	I	13/04/25
A2006	PLAN - LEVEL 11 - 13 (MID TOWER)	I	13/04/25
A2007	PLAN - LEVEL 14 - 19 (UPPER TOWER)	I	13/04/25
A2008	PLAN - ROOF	I	13/04/25
A3001	ELEVATION - WEST	H	13/04/25
A3002	ELEVATION - NORTH	H	13/04/25
A3003	ELEVATION - SOUTH - EAST	H	13/04/25
A3101	SECTION - SHEET 01	F	13/04/25
A3102	SECTION - SHEET 02	F	13/04/25
A3103	SECTION - SHEET 03	F	13/04/25
A3104	SECTION - SHEET 04	B	13/04/25
A3105	SECTION - SHEET 05	01	13/04/25

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