No.1 Castlefield

For

Kirindolam 8 Ltd

Wind Microclimate Report

4300788rep1v2

30 June 2026

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Issue History

	Previous Issue			Current Issue
Comment				
Issue			1	2
Date			29 June 2026	30 June 2026
Prepared by			K.S Chan	K.S Chan
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Signature				
Report Number			4300788rep1v1	4300788rep1v2

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Executive Summary

Background

A study has been carried out by Architectural Aerodynamics Ltd. (ArcAero) to assess the wind microclimate for the proposed No.1 Castlefield development in Manchester, UK.

The study has adopted wind tunnel testing to predict the strength of winds. Then using the industry standard Lawson criteria, it has established the suitability of wind conditions and the impact on the surrounding area, following the introduction of the proposed development.

Conclusions

The following conclusions have been drawn:

- Wind conditions within the existing site and surrounds are generally acceptable. A few exceedances of the comfort criteria are predicted to occur off-site.
- With the introduction of the proposed development within existing surrounds, exceedances of the safety and comfort criteria are predicted to occur within the site.
- With the introduction of cumulative surrounds, safety exceedances observed within the existing surrounds scenario further deteriorate at a few locations within the site.
- With the introduction of mitigation measures, the safety criteria are met throughout the site and surrounds for both the existing and cumulative surrounds scenarios. Comfort conditions within the site meet the criteria and are suitable for all uses. Off-site exceedances of the comfort criteria which are attributable to the introduction of the proposed development were also resolved.

1 Introduction

A microclimate is defined as the distinctive climate of a small-scale area. The weather variables in a microclimate, such as wind, may be different to the conditions prevailing over the area as a whole. Wind microclimate assessments consider the wind conditions that would result upon the introduction of a new development into an existing space.

Such assessments predict the proportion of time an area will experience wind speeds in excess of threshold values associated with safe and comfortable use by pedestrians and occupants once the development is introduced. It can therefore be shown within the various parts of a new proposal and neighbouring properties whether wind conditions are suitable or unsuitable, and whether design adjustment or mitigation measures are required. It is for this purpose that wind microclimate assessments are undertaken.

This report summarises the results wind tunnel studies commissioned by Kirindolam 8 Ltd, to assess the wind microclimate for the proposed No.1 Castlefield development in Manchester, UK.

2 The Proposed Development

2.1 Site Location and Surrounding Area

The No.1 Castlefield development is bounded by a railway to the north, the Castlefield Locks Apartment to the east, Ellesmere Street to the south, and the Vox Apartments to the west.

Further afield the area is typical of a Manchester suburb made up of mid to high-rise residential and commercial buildings, with the Manchester city centre located further south of the proposed site.

The proposed development will comprise of two buildings. Block A will rise to approximately 140 metres, with a podium terrace located on level 1. Block B will rise to approximately 31 metres, with a rooftop terrace located on level 7.

2.2 Drawing Information Describing the Proposed Development

Assessment models have been constructed on the basis of the following drawings received from Denton Corker Marshall LLP on 13th March 2026:

- N1C-DCM-ZZ-00-PL-A-50000.dwg
- N1C-DCM-ZZ-B1-PL-A-50008.dwg

The existing surrounding area was based upon information from Ordnance Survey details for the area. Cumulative surrounds were based upon information contained within the Manchester City Council planning portal.

2.3 Soft Landscaping

The wind microclimate has been assessed for the proposed development with the current soft landscaping proposals and surrounding landscaping on the basis of the following drawings received from Re-form on 4th June 2026:

- 1285-RFM-XX-00-M2-L-90001 Landscape Working Drawing.dwg
- 1285-RFM-XX-00-M2-L-90002-Podium Landscape Working Drawing.dwg

The proposed landscaping scheme as modelled within the wind tunnel is presented within Figure 2.1.

2.4 Surrounding Contexts

The proposed development was assessed in two surrounding contexts, namely existing surrounds and cumulative surrounds. Consented developments that have been considered within the cumulative surrounds scenario are listed in Table 2-1.

Table 2-1 – Cumulative Schemes

Development Name	Planning Reference
No. 1 Cornbrook	139133/FO/2024

2.5 Wind Mitigation Measures

The proposed development has been assessed with and without wind mitigation measures. Wind mitigation measures validated from the current wind tunnel test are presented in Figure 2.2 and Figure 2.3.

3 Assessment Methodology

3.1 Overview

Wind tunnel modelling was undertaken in the BRE atmospheric boundary layer wind tunnel. The effective blockage ratio was within the 5% level recommended by the ASCE SEI (1) and AWES QAM (2) guidelines. Full details of the wind tunnel testing conducted for the study are presented in Appendix A of this report.

Modelling via wind tunnel testing has derived mean and gust equivalent mean wind speeds, in accordance with best industry practice. In doing so 16 wind directions were assessed, in 22.5° increments.

The industry standard criteria for wind microclimate assessments, the LDDC variant of the Lawson criteria (3), has been employed for the study.

3.2 Wind Climate Analysis

Wind microclimate studies require that meteorological data is transposed from a nearby weather station with sufficient wind data to produce accurate wind frequency statistics. The current study uses data from Manchester Airport.

Full details of the wind climate relevant to the site, the wind properties approaching the site and the modelling of those wind properties in the wind tunnel models are provided in Appendix B of this report. All analysis of wind data and the atmospheric boundary layer has employed the methods of ESDU item 01008 (4), in accordance with best industry practice.

3.3 Assessment Scenarios

The wind tunnel model covered a radius of 435 metres from the site. All features which are likely to impact the wind flow within the study area have been replicated. The model was reviewed and approved by the design team prior to the study. The assessment considered a full range of directions in 22.5° intervals, and considered the following configurations:

1. Existing site, existing surrounding conditions
2. Proposed development, existing surrounding conditions
3. Proposed development, cumulative surrounding conditions
4. Proposed development, cumulative surrounding conditions with mitigation measures
5. Proposed development, existing surrounding conditions with mitigation measures

Details of the tunnel and model used for the wind tunnel study are presented in Appendix A of this report.

3.4 The LDDC Lawson Criteria

The industry standard criteria for wind microclimate assessments are commonly referred to in the UK as the Lawson criteria after one of their main authors. As with most other leading practitioners, ArcAero use the 'LDDC' variant of the Lawson Criteria (London Docklands Development Corporation (3).

The LDDC variant applies a single percentage probability of exceedance of a range of wind speeds and associates different wind speeds to different types of usage. This offers a relatively simple and practical manner for the assessment of wind comfort and safety.

3.4.1 Safety

A wind speed of 15 m/s occurring once per year is rated as unsuitable, in terms of safety, with the potential to de-stabilise the less able members of the public including the elderly, cyclists and children.

3.4.2 Comfort

The LDDC variant of the Lawson criteria (3) prescribes that wind conditions are suitable for a given activity when the threshold is exceeded no more than 5% of the time. The value of 5% has been established as giving a reasonable allowance for extreme and relatively infrequent winds that are tolerable within each category.

Where certain activities are year-round, such as walking, entrance use or for waiting areas, comfort ratings are required to be met in all seasons. For more seasonal activities, such as outdoor recreation or for sitting spaces, the assessment focuses on relevant seasons where the expectation will exist for conditions to be suitable. The LDDC comfort threshold wind speed values are presented in Table 3-1.

Table 3-1 – LDDC Wind Comfort Thresholds

Threshold Wind Speed [m/s]	Comfort Rating / Activity	
4	C4	Long-term sitting
6	C3	Short-term sitting / standing
8	C2	Strolling
10	C1	Walking
> 10	C0	Uncomfortable

3.5 Pedestrian / Occupant Uses

In using the Lawson criteria to consider the suitability of spaces, in terms of comfort, it is necessary to identify the anticipated usage of the various areas and assign that usage to an assessment receptor. Each measurement location is assigned a pedestrian / occupant use, for each assessment scenario. This is presented in Figure C.1 to Figure C.5 in Appendix C.

4 Results

4.1 Existing Site within Existing Surrounds

The results for the existing site conditions are presented graphically within Figure 4.1 and Figure 4.2 for worst-seasonal and summer conditions respectively.

4.1.1 Safety

All locations within the existing site and immediate surrounds satisfy the Lawson Criteria for safety.

4.1.2 Comfort

4.1.2.1 Surrounding Area

Within the existing site, wind conditions are substantially suitable for short-term sitting / standing or better, thus suitable for proposed usages. Exceptions were only found in off-site areas:

- Pedestrian thoroughfares along Dinton Street (location 9), the threshold wind speed for strolling is met approximately 94% of the time during the winter.
- Eastern entrance to the Vox apartment (location 81), the threshold wind speed for short-term sitting is met approximately 91% of the time during winter.
- Thoroughfares near the southwest corner of the Vox apartment (locations 89 and 91), the threshold wind speed for strolling is met approximately 91% and 93% of the time during winter.
- Entrance of the Insitu Manchester store (location 98), the threshold wind speed for short-term sitting is met approximately 93% of the time during winter.
- Entrance to the 301 Chester Road building (location 104), the threshold wind speed for short-term sitting is met approximately 91% of the time during winter.
- Entrance of the Pomona Wharf (location 118), the threshold wind speed for short-term sitting is met approximately 93% of the time during winter.

4.2 Proposed Development within Existing Surrounds

The results for the proposed development within existing surrounds are presented graphically within Figure 4.3 for worst-seasonal and Figure 4.4 and Figure 4.5 for summer conditions respectively.

4.2.1 Safety

The majority of the locations within the site and surrounding area satisfy the safety criteria, with a few exceptions occurring in:

- The pathway south of Block A leading into the courtyard (location 16).
- The parking space located east of the site (location 31).

- The southern corner of the Vox apartment (location 89).
- The northwest corner of the rooftop terrace of Block B (location 310).

4.2.2 Comfort

4.2.2.1 Thoroughfares

Wind conditions at thoroughfares within the site are generally expected to be suitable for strolling or better throughout the year, thus suitable for pedestrian usage. Exceptions occur:

- Near the Block A southwest entrance (location 12), where the threshold wind speed for strolling is met approximately 94% of the time during winter.
- The pathway south of Block A leading into the courtyard (location 16), where the threshold wind speed for strolling is met approximately 88% of the time during winter
- Eastern corner of Block A (location 29), where the threshold wind speed for strolling is met approximately 94% of the time during winter

4.2.2.2 Entrances

Wind conditions at entrances within the site are generally expected to be suitable for short-term sitting or better throughout the year, thus suitable for pedestrian ingress / egress. Exceptions occur:

- Block A southwest entrance (location 13), where the threshold wind speed for short-term sitting is met approximately 88% of the time during winter.
- Block B entrances facing southeast (locations 36 and 44), where the threshold wind speed for short-term sitting is met approximately 94% of the time for both locations during winter
- Block A courtyard entrance (location 58), where the threshold wind speed for short-term sitting is met approximately 94% of the time during winter.

4.2.2.3 Recreational Spaces

The wind conditions at the recreational spaces within the site are generally suitable for short-term sitting / standing in summer, thus making them suitable for general recreational purposes. Exceptions occur:

- The courtyard between Block A and B (locations 49, 54, 56), where the threshold wind speed for short-term sitting met 94%, 92%, and 91% of the time during summer respectively.
- Block A podium (locations 201), where the threshold wind speed for short-term sitting is met 94% of the time during summer.
- Block B terrace (locations 302, 309, 310, and 312), where the threshold wind speed for short-term sitting is met 90%, 94%, 89%, and 93% of the time during summer respectively.

4.2.2.4 Outdoor Seating

There are only three outdoor seating locations within the site, two of which exceed the conditions for long-term sitting / standing in summer. The locations with exceedance are:

- Outdoor seatings near the southeast façade of Block A (locations 57 and 61), where the threshold wind speed for long-term sitting is met approximately 76% and 94% of the time during summer respectively.

4.2.2.5 Surrounding Area

The wind conditions at the immediate surrounds are expected to be generally suitable for strolling or better throughout the year. Exceptions occur:

- Thoroughfares near the northeast façade of the Vox apartment building (locations 76 and 77), where the threshold wind speed for strolling is met approximately 94% and 91% of the time during winter.
- Several off-site exceedances present in the existing site and surrounds (location 81, 89, 91, 98, 104, and 118) remain within this scenario.

4.3 Proposed Development within Cumulative Surrounds

The results for the proposed development within cumulative surrounds are presented graphically within Figure 4.6 for worst-seasonal and Figure 4.7 and Figure 4.8 for summer conditions respectively.

4.3.1 Safety

A majority of the locations within the site and surrounding area satisfy the safety criteria, with a few exceptions occurring in:

- The pathway south of Block A leading into the courtyard (location 16).
- The parking space located east of the site (location 31).
- Along the thoroughfare between the proposed Block B and the Vox Apartment (location 77)
- Near the eastern corners of the No.1 Cornbrook development (locations 91 and 93).
- The northwest corner of the rooftop terrace of Block B (location 310).

4.3.2 Comfort

4.3.2.1 Thoroughfares

Wind conditions at thoroughfares within the site are generally expected to be generally suitable for strolling or better throughout the year, thus suitable for pedestrian usage. Exceptions occur:

- The pathway south of Block A leading into the courtyard (location 16), where the threshold wind speeds for strolling is met approximately 92% of the time during winter

- Eastern corner of Block A (location 29), where the threshold wind speed for strolling is met approximately 93% of the time during winter
- A thoroughfare leading into the courtyard (location 63), where the threshold wind speed for strolling is met 94.9% of the time during winter.

4.3.2.2 Entrances

Wind conditions at entrances within the site are generally expected to be suitable for short-term sitting or better throughout the year, thus suitable for pedestrian ingress / egress. Exceptions occur:

- Block A southwest entrance (location 13), where the threshold wind speed for short-term sitting is met approximately 91% of the time during winter.
- Block B entrances facing southeast (locations 36 and 44), where the threshold wind speed for short-term sitting is met approximately 93% and 94% of the time respectively during winter
- Block A courtyard entrance (location 58), where the threshold wind speed for short-term sitting is met approximately 94% of the time during winter.

4.3.2.3 Recreational Spaces

The wind conditions at the recreational spaces within the site are generally suitable for short-term sitting / standing in summer, thus making them suitable for general recreational purposes. Exceptions occur:

- At the courtyard between Block A and B (locations 54 and 56), where the threshold wind speed for short-term sitting is met 92% and 90% of the time respectively during summer.
- Block B terrace (locations 302, 309, 310, and 312), where the threshold wind speed for short-term sitting is met 91%, 93%, 88%, and 92% of the time respectively during summer.

4.3.2.4 Outdoor Seating

An outdoor seating area near the southeast façade of Block A (location 57), where the threshold wind speeds for long-term sitting are met approximately 75% of the time during summer. The remaining outdoor seating areas are otherwise suitable for their intended use.

4.3.2.5 Surrounding Area

The wind conditions at the immediate surrounds are expected to be generally suitable for strolling or better throughout the year. Exceptions occur:

- Several thoroughfares surrounding the No. 1 Cornbrook (locations 1, 92 and 93), where the threshold wind speed for strolling is met for 90%, 94% and 87% of the time respectively during the winter.

- Thoroughfares near the northeast façade of the Vox apartment building (locations 77, 84 and 85), where the threshold wind speed for strolling is met approximately 91%, 94% and 94% of the time respectively during the winter.
- Several off-site exceedances present in the existing site and surrounds scenario (location 81, 91, 98, 104 and 118) remains within this scenario.

It should be noted that comfort exceedances that emerged around No. 1 Cornbrook were detected during a preliminary CFD simulation. As a result, an existing site within cumulative surrounds CFD simulation was performed following that, which indicated that these exceedances were already present without the proposed development in place. Hence, these exceedances are determined to be pre-existing and not attributable to the proposed development.

Wind conditions within the site were determined to have deteriorated with the introduction of the cumulative surrounds. As such, the mitigation measures were developed with cumulative surrounds in place.

4.4 Proposed Development within Cumulative Surrounds with Mitigation Measures

The results for the proposed development within cumulative surrounds with mitigation measures in place are presented graphically within Figure 4.9 for worst-seasonal and Figure 4.10 and Figure 4.11 for summer conditions respectively.

4.4.1 Safety

With the mitigation measures in place, previously unsafe wind conditions have improved, and all locations within the site in the cumulative surrounds scenario now satisfy the Lawson Criteria for safety.

4.4.2 Comfort

Following the introduction of mitigation measures, wind conditions within the site have improved significantly and are now largely suitable for their intended uses. Residual exceedances are minor and considered to be acceptable for their intended uses, found at the following locations:

- Recreational spaces within the courtyard (locations 54 and 56), the threshold wind speed for short-term sitting / standing is met approximately 94% and 93% of the time respectively during summer.
- Outdoor seating near Block A (locations 57 and 59), the threshold wind speed for long-term sitting is both met approximately 94% of the time during summer.
- Block B entrances (locations 36 and 44), where the threshold wind speed for short-term sitting is met approximately 93% of the time during the winter.
- Block B terrace (locations 309 and 312), the threshold wind speed for short-term sitting is met approximately 94%, and 93% of the time respectively during summer.

- Thoroughfares near the Vox apartment (locations 84 and 85), the threshold wind speed for strolling at both locations is met approximately 94% of the time during the winter.
- Several off-site exceedances (locations 1, 81, 91, 92, 98, 104 and 118) which are determined to be pre-existing.

4.5 Proposed Development within Existing Surrounds with Mitigation Measures

The results for the proposed development within existing surrounds with mitigation measures in place are presented graphically within Figure 4.12 for worst-seasonal and Figure 4.13 and Figure 4.14 for summer conditions respectively.

Within the existing surrounds scenario, conditions remain similar to the cumulative surrounds scenario with mitigation measures in place, the conclusions of which are equally applicable to the existing surrounds scenario.

5 Conclusions

The following conclusions have been drawn:

- Wind conditions within the existing site and surrounds are generally acceptable. A few exceedances of the comfort criteria are predicted to occur off-site.
- With the introduction of the proposed development within existing surrounds, exceedances of the safety and comfort criteria are predicted to occur within the site.
- With the introduction of cumulative surrounds, safety exceedances observed within the existing surrounds scenario further deteriorate at a few locations within the site.
- With the introduction of mitigation measures, the safety criteria are met throughout the site and surrounds. Comfort conditions within the site meet the criteria and are suitable for all uses. Off-site exceedances of the comfort criteria which are attributable to the introduction of the proposed development were also resolved.

6 References

1. **Quality Assurance Manual - Wind Engineering Studies of Buildings. 2001. AWES-QAM-1-2001.**

2. The American Society of Civil Engineers (ASCE) Manual of Practice No.67 for Wind Tunnel Studies. ASCE SEI 49/12.

3. Lawson, T.V. ***The determination of the wind environment of a building complex before construction.*** **Bristol : University of Bristol, Department of Aeronautical Engineering, 1990.**

4. ESDU (Engineering Science Data Unit). ***Item 01008. Computer Program for wind speeds and turbulence properties: flat or hilly sites in terrain with roughness.*** **2001.**

7 Figures

Figure 2.1 – Proposed Landscaping Scheme, ground level and Block A Podium

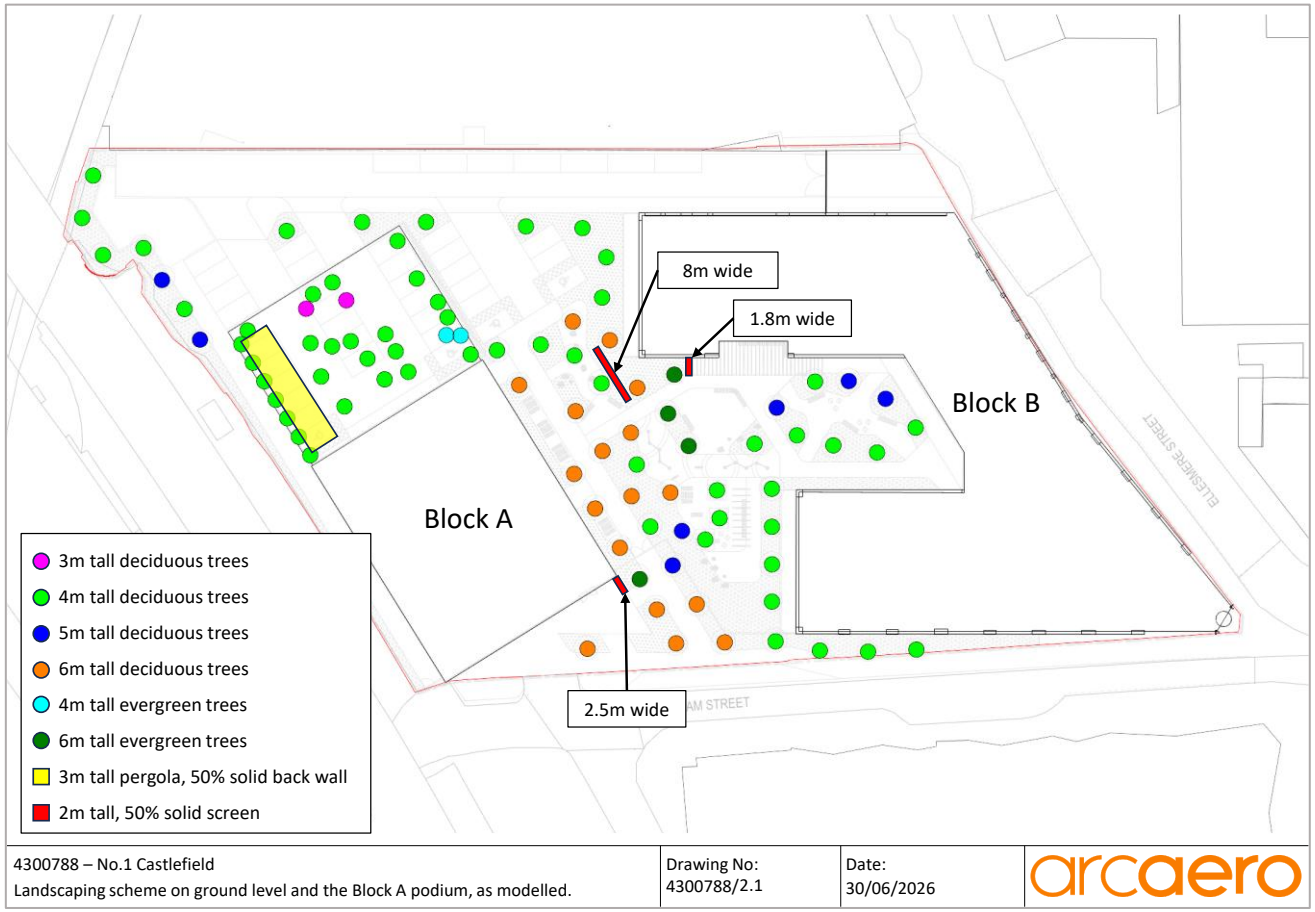


Figure 2.2 – Wind mitigation scheme, ground level and Block A Podium

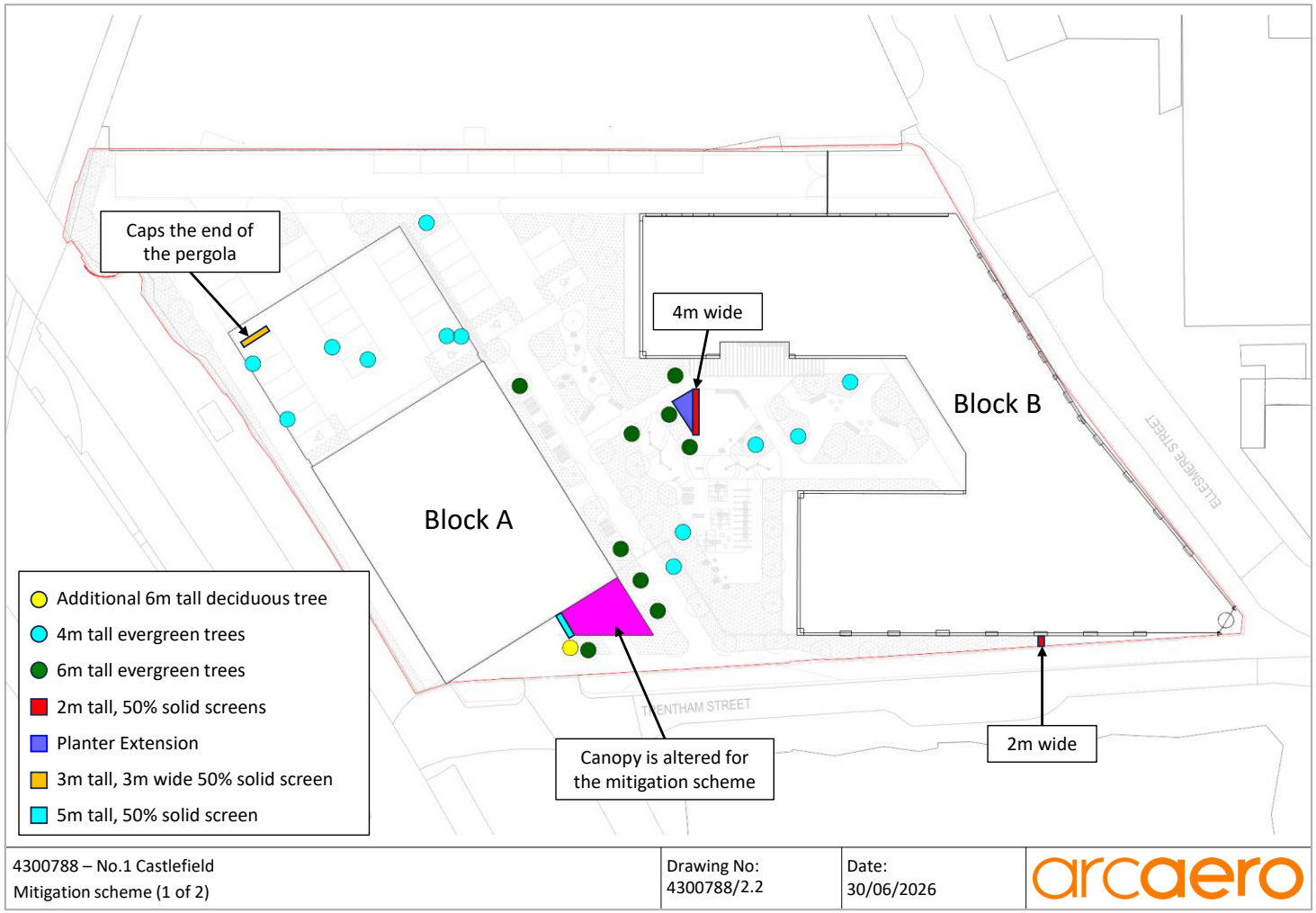


Figure 2.3 - *Wind mitigation scheme, Block B Terrace*

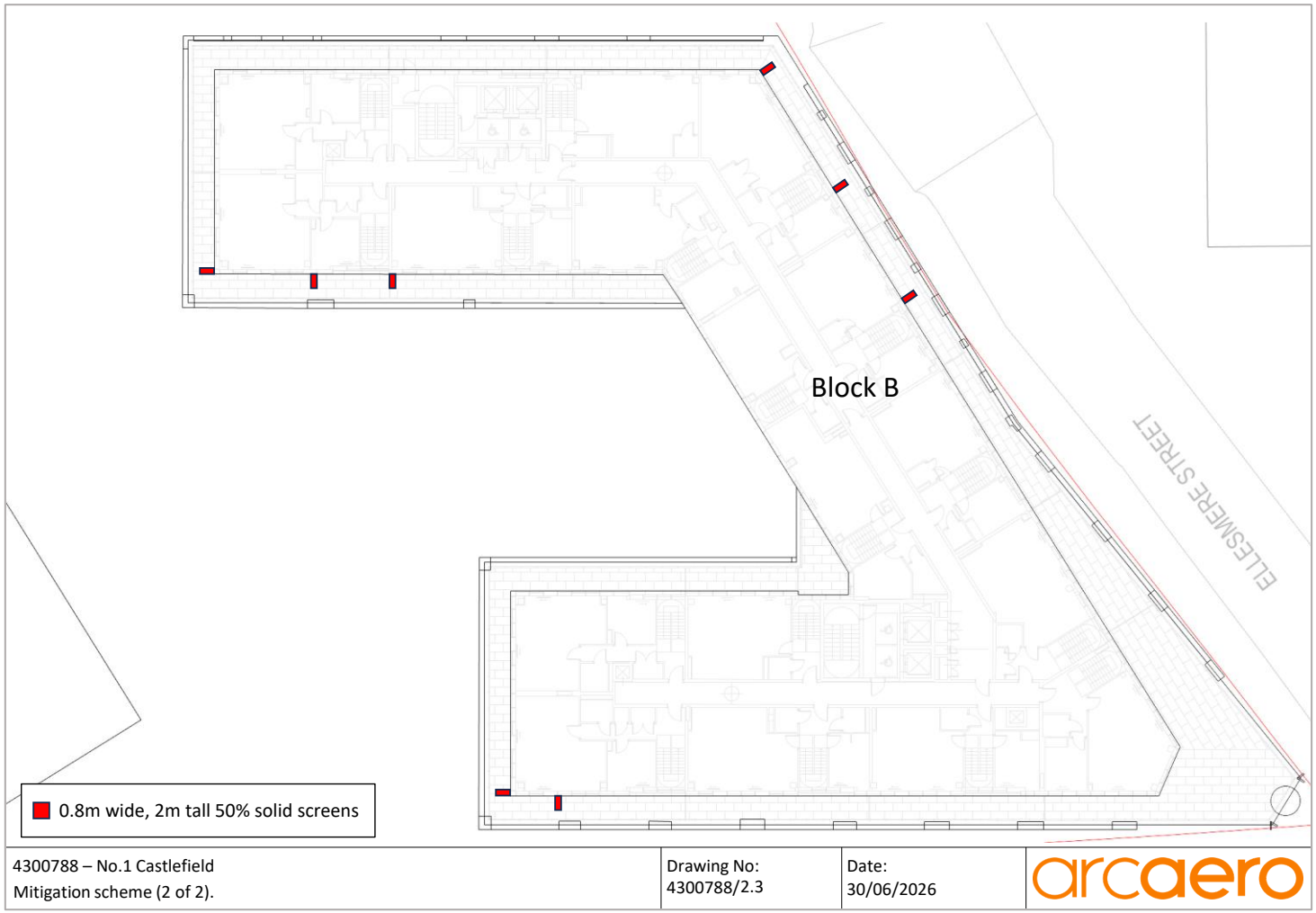


Figure 4.1- Pedestrian wind conditions, existing site within existing surrounds, 'worst' season

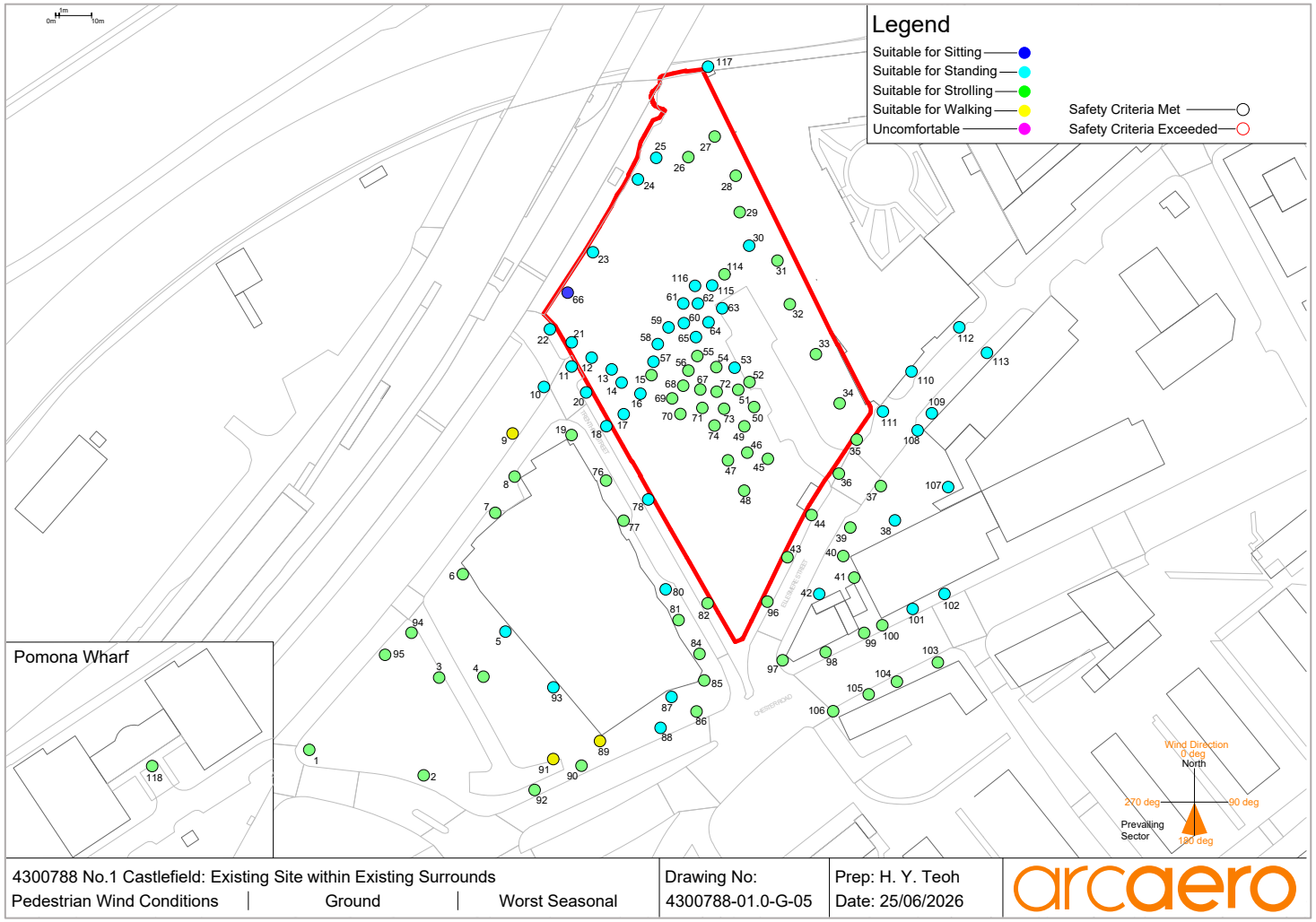


Figure 4.2 - Pedestrian wind conditions, existing site within existing surrounds, summer

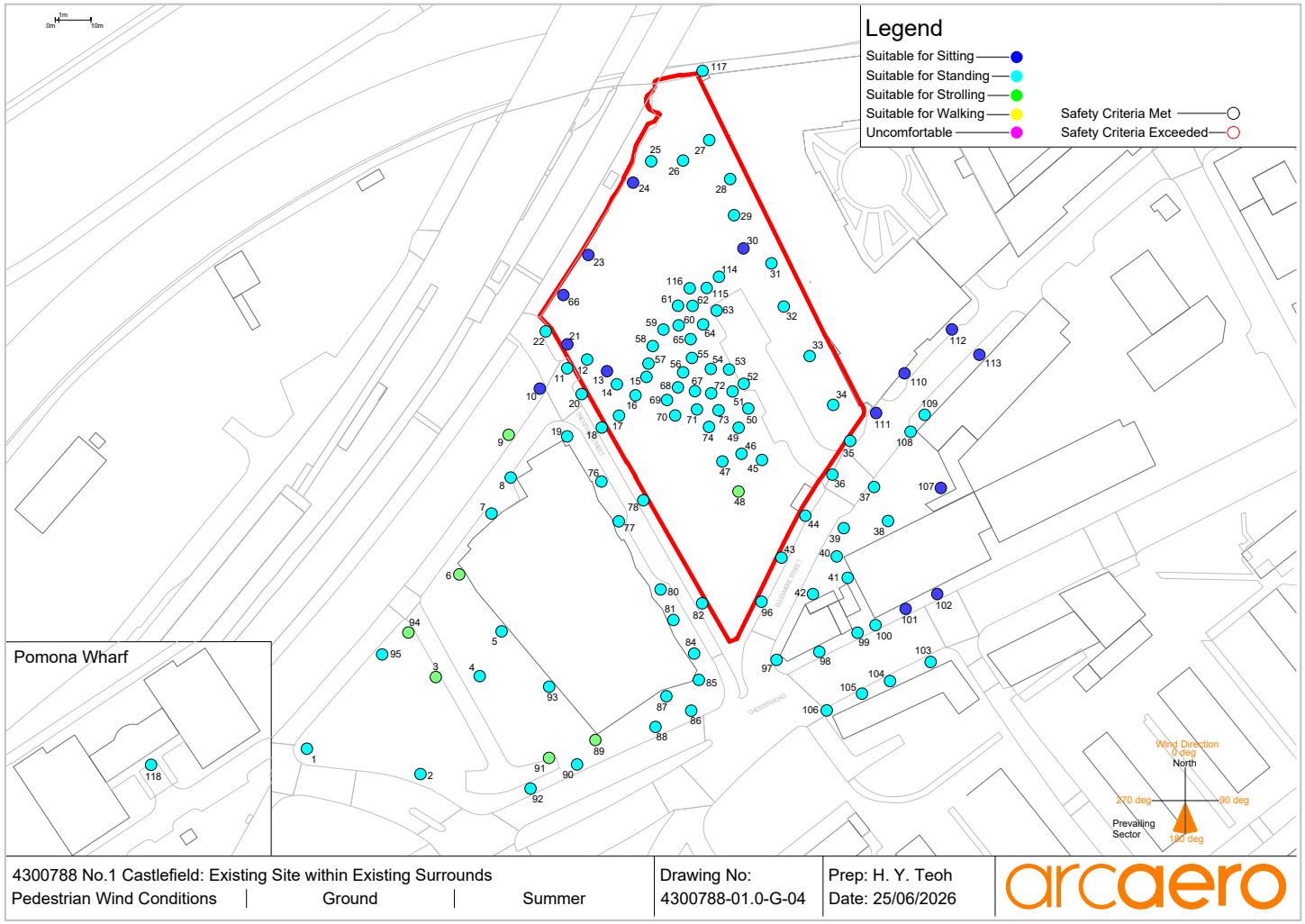


Figure 4.3 - Pedestrian wind conditions, proposed development within existing surrounds, 'worst' season – ground level

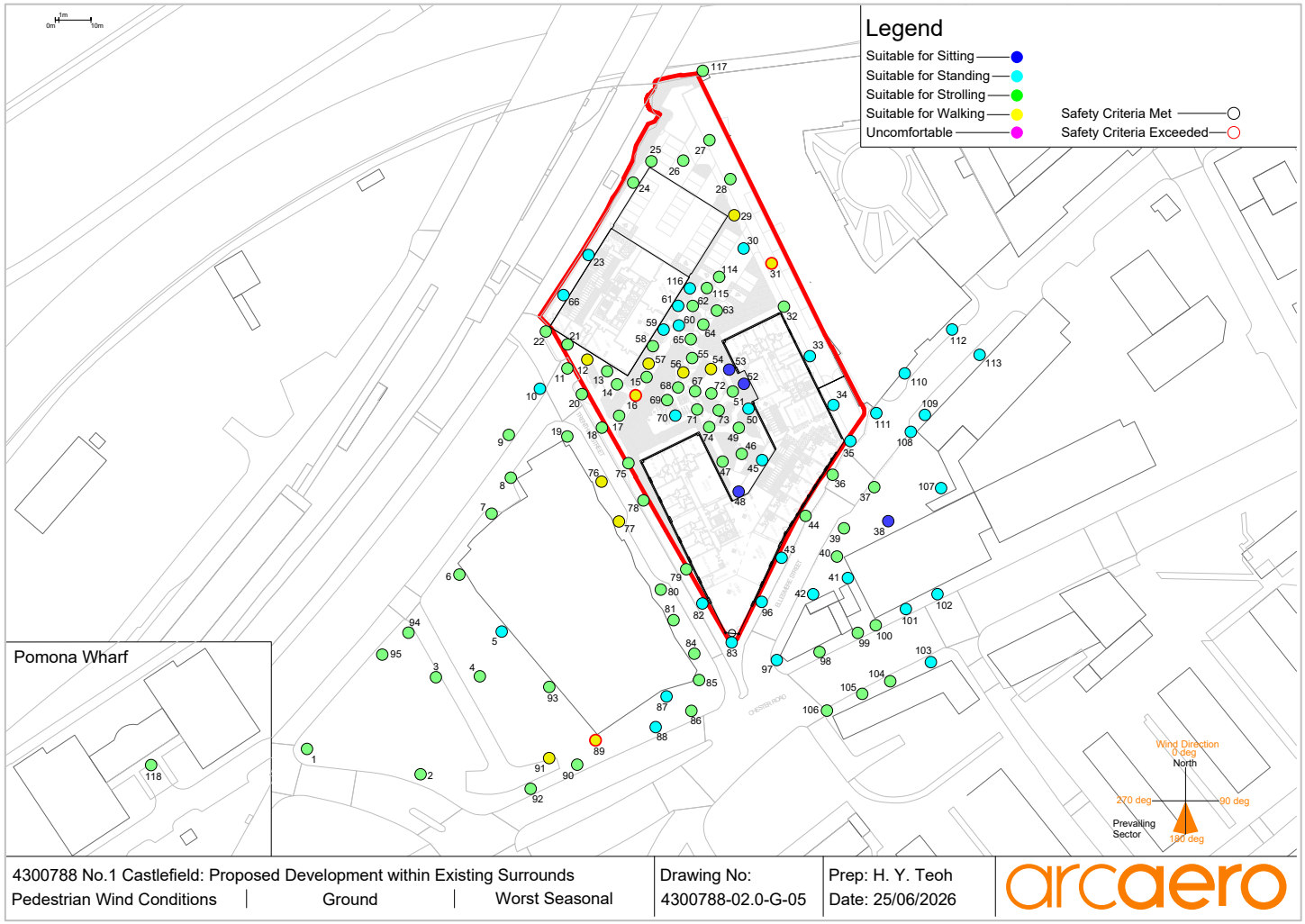


Figure 4.4 – Pedestrian wind conditions, proposed development within existing surrounds, summer – ground level

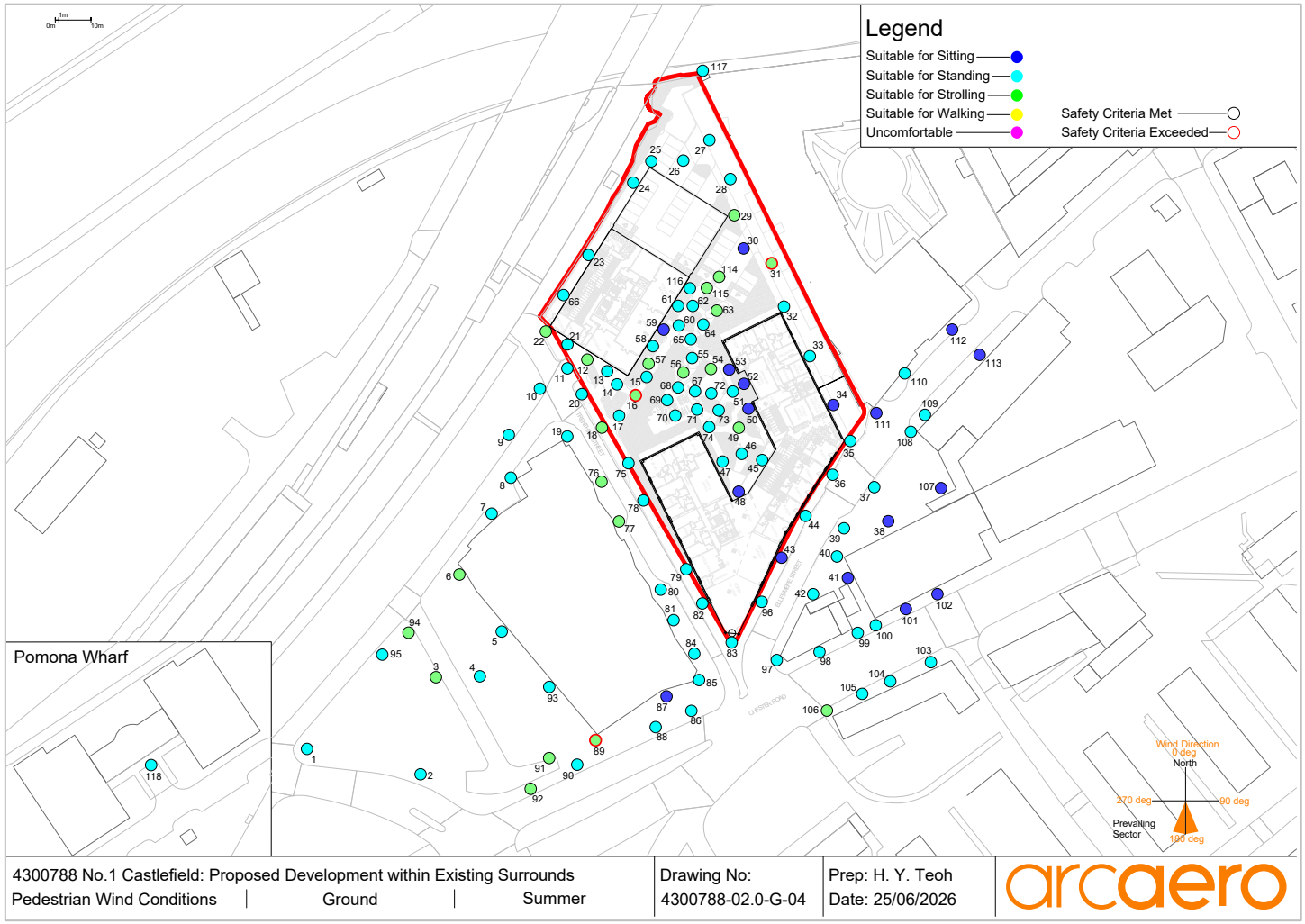


Figure 4.5 - Pedestrian wind conditions, proposed development within existing surrounds, summer – terrace / balcony level

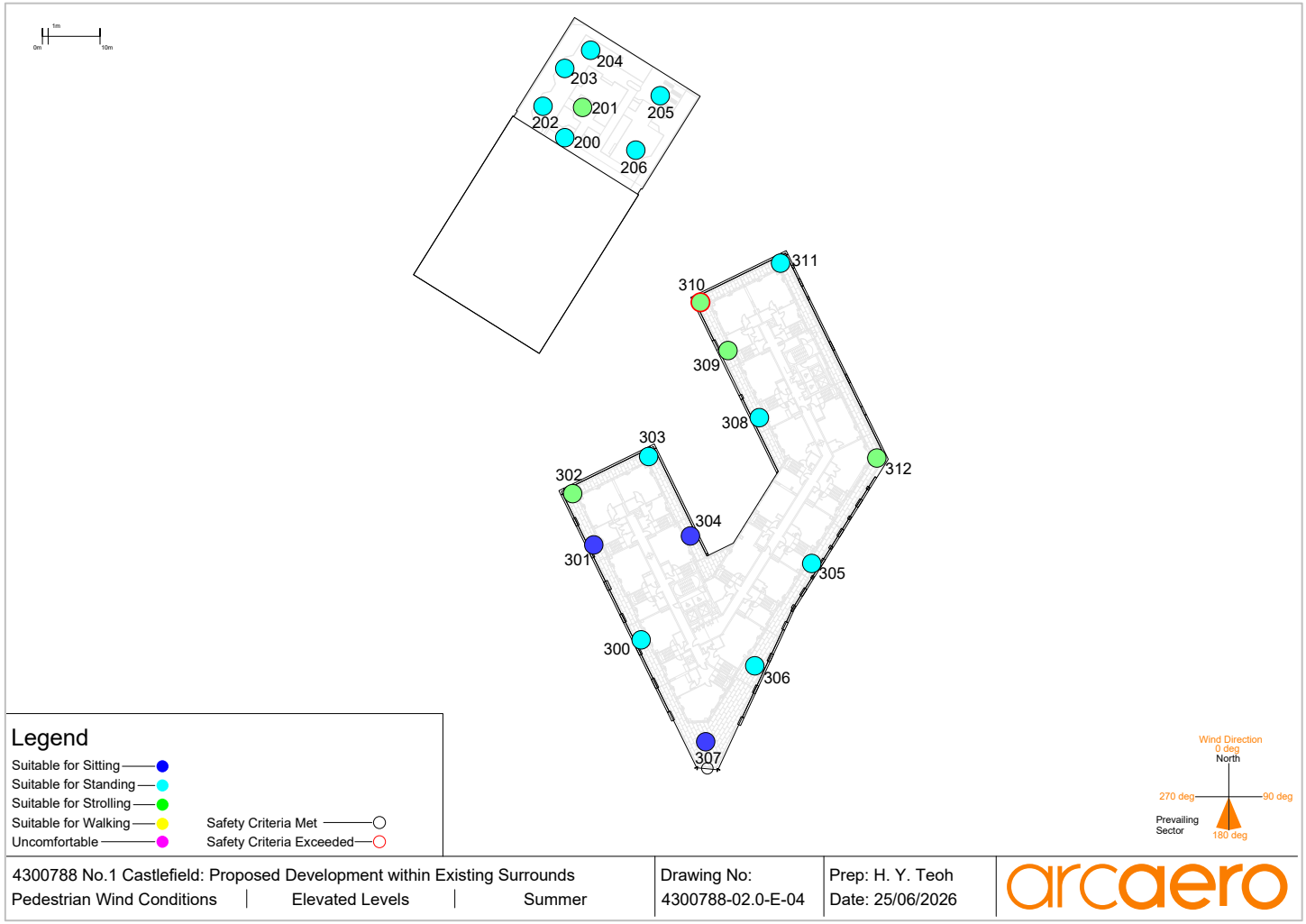


Figure 4.6 – Pedestrian wind conditions, proposed development within cumulative surrounds, 'worst' season – ground level

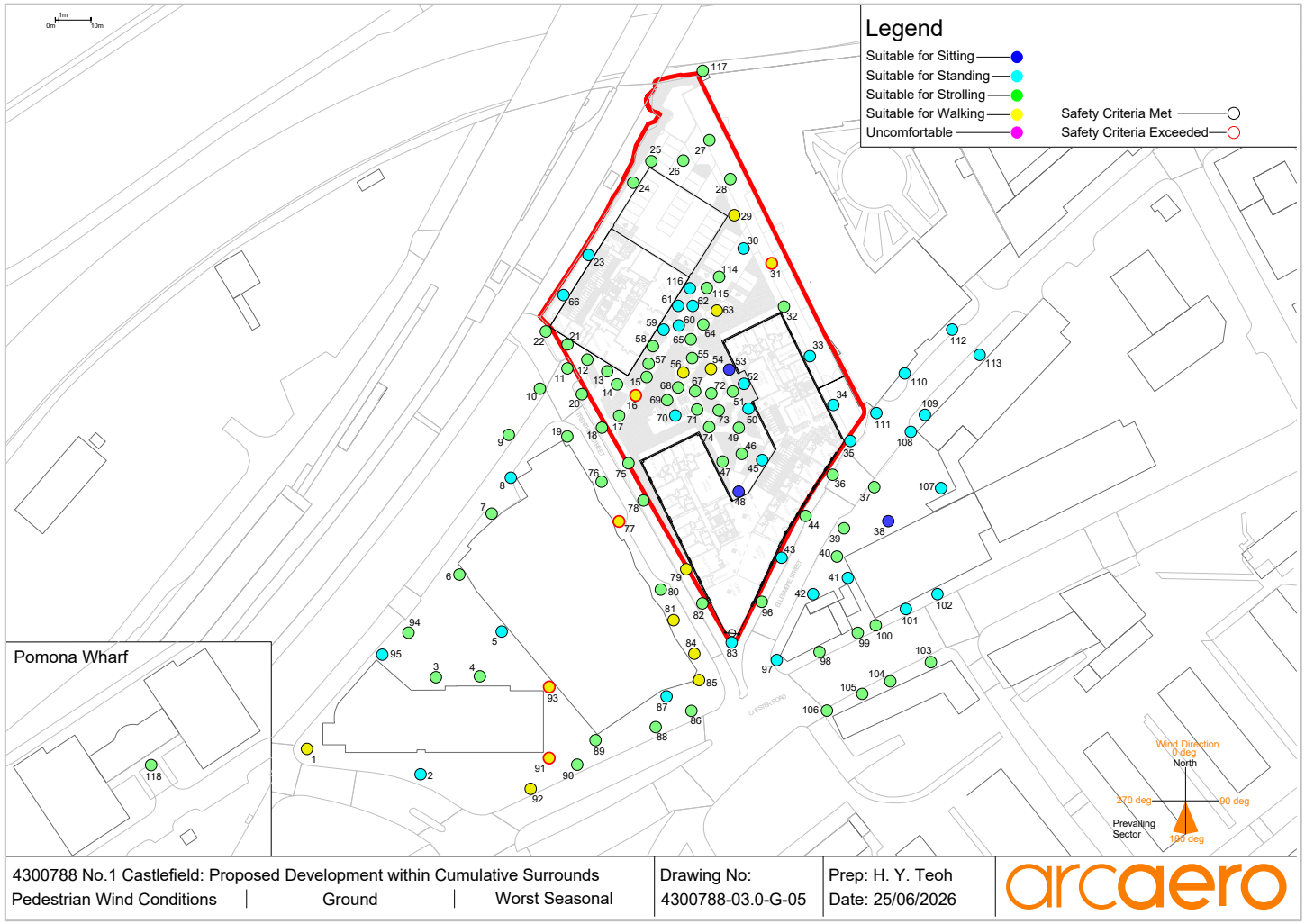


Figure 4.7 - Pedestrian wind conditions, proposed development within cumulative surrounds, summer – ground level

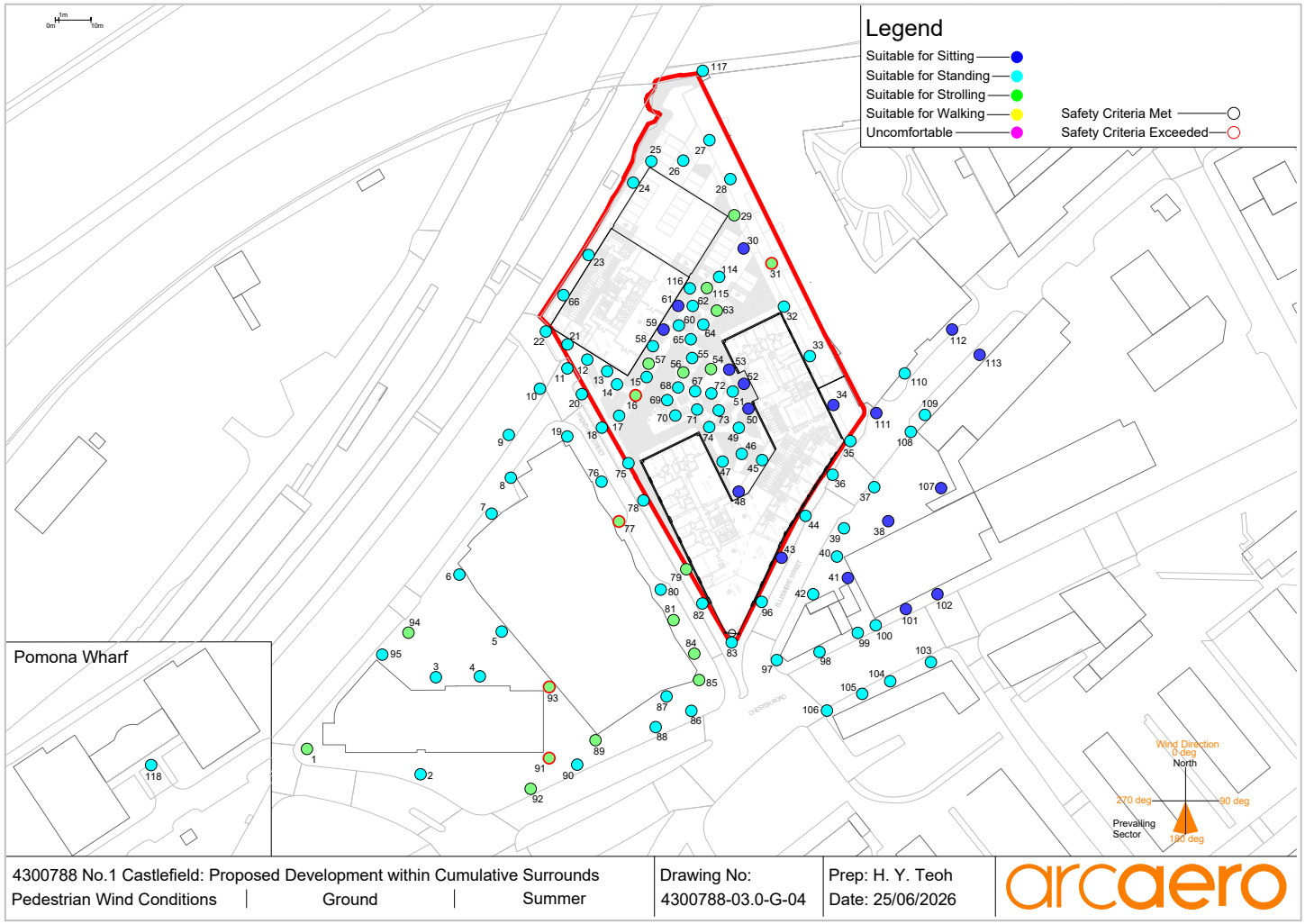


Figure 4.8 – Pedestrian wind conditions, proposed development within cumulative surrounds, summer – terrace / balcony level

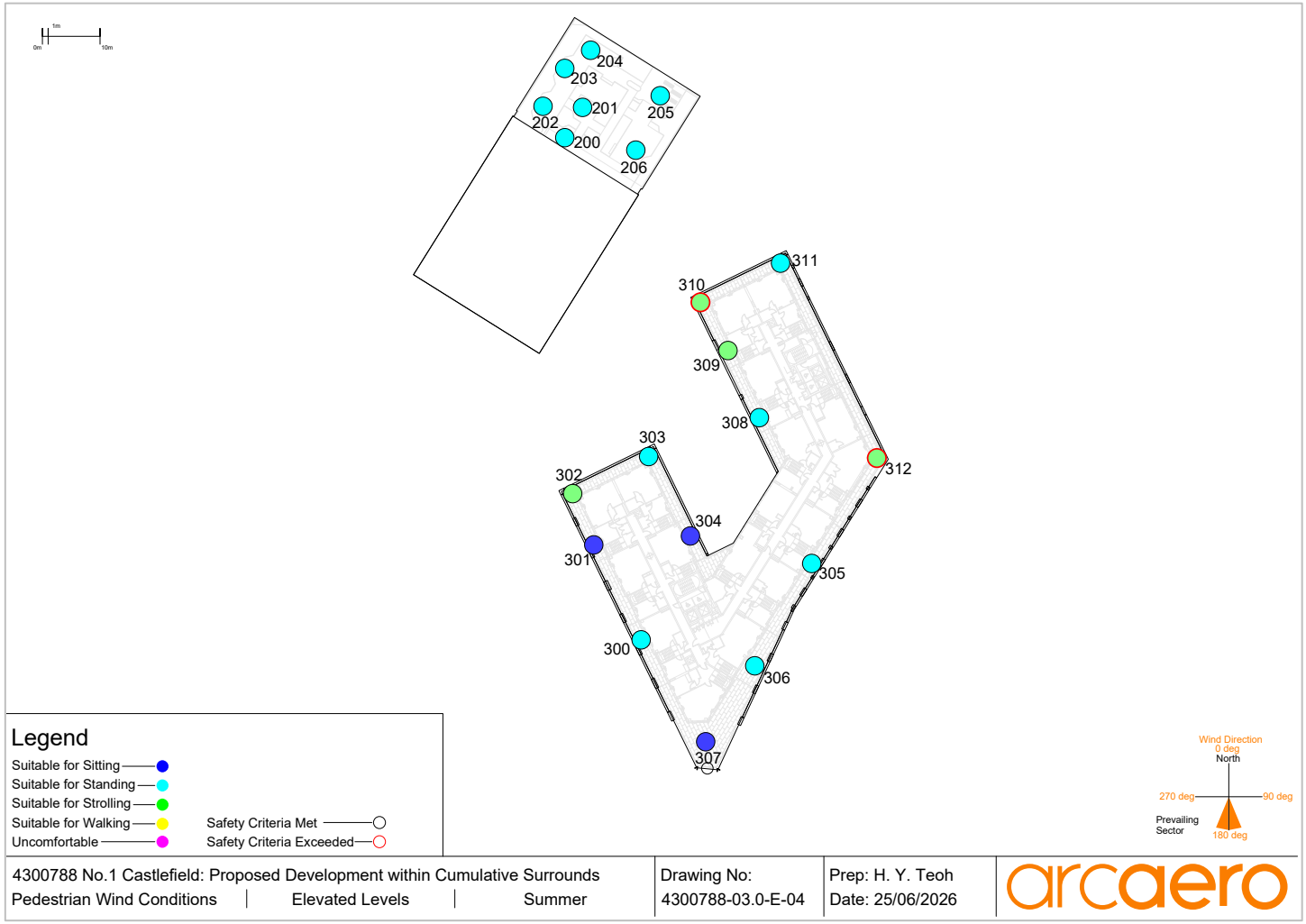


Figure 4.9 - Pedestrian wind conditions, proposed development within cumulative surrounds, with mitigation measures, 'worst' season – ground level

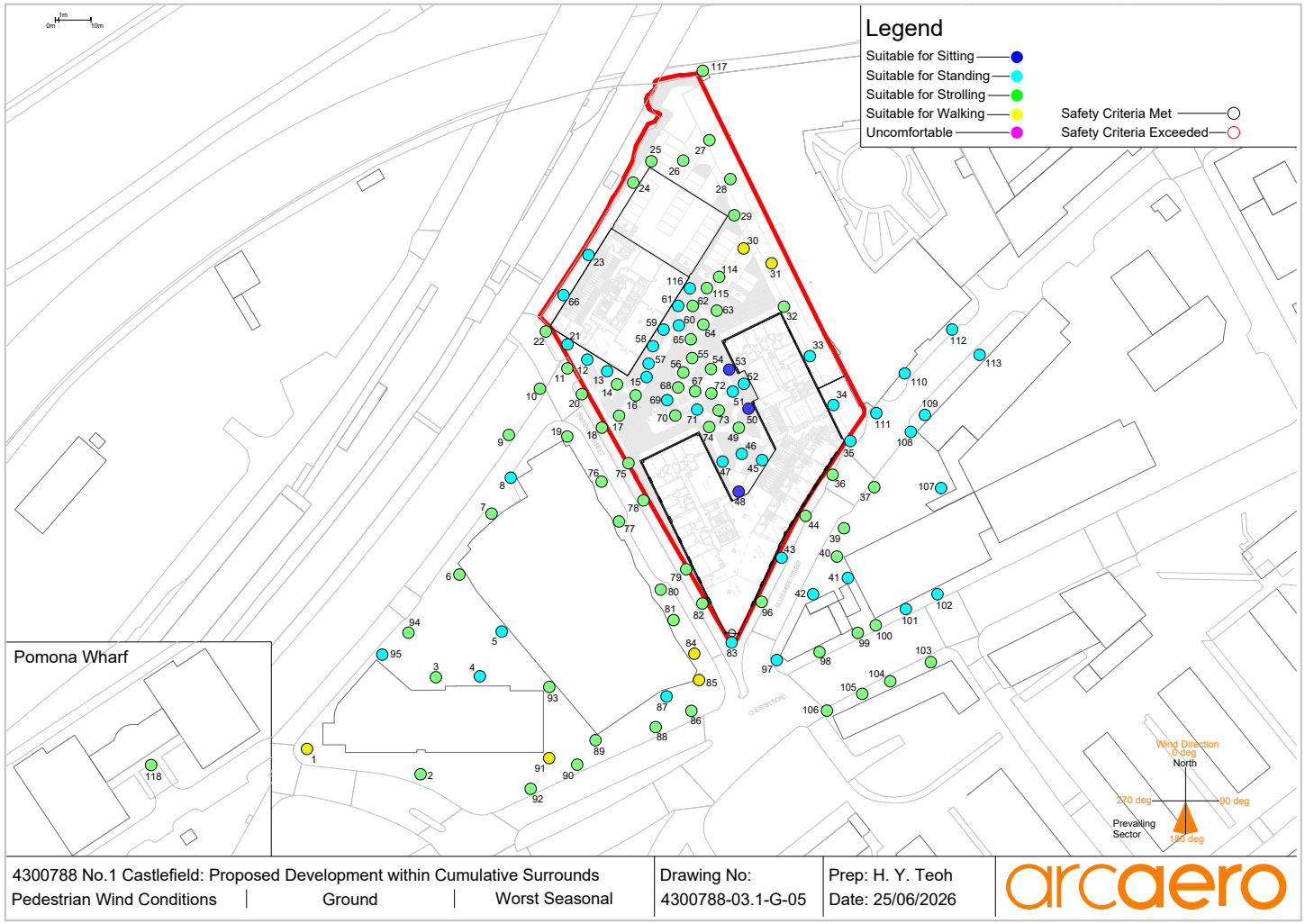


Figure 4.10 – Pedestrian wind conditions, proposed development within cumulative surrounds, with mitigation measures, summer – ground level

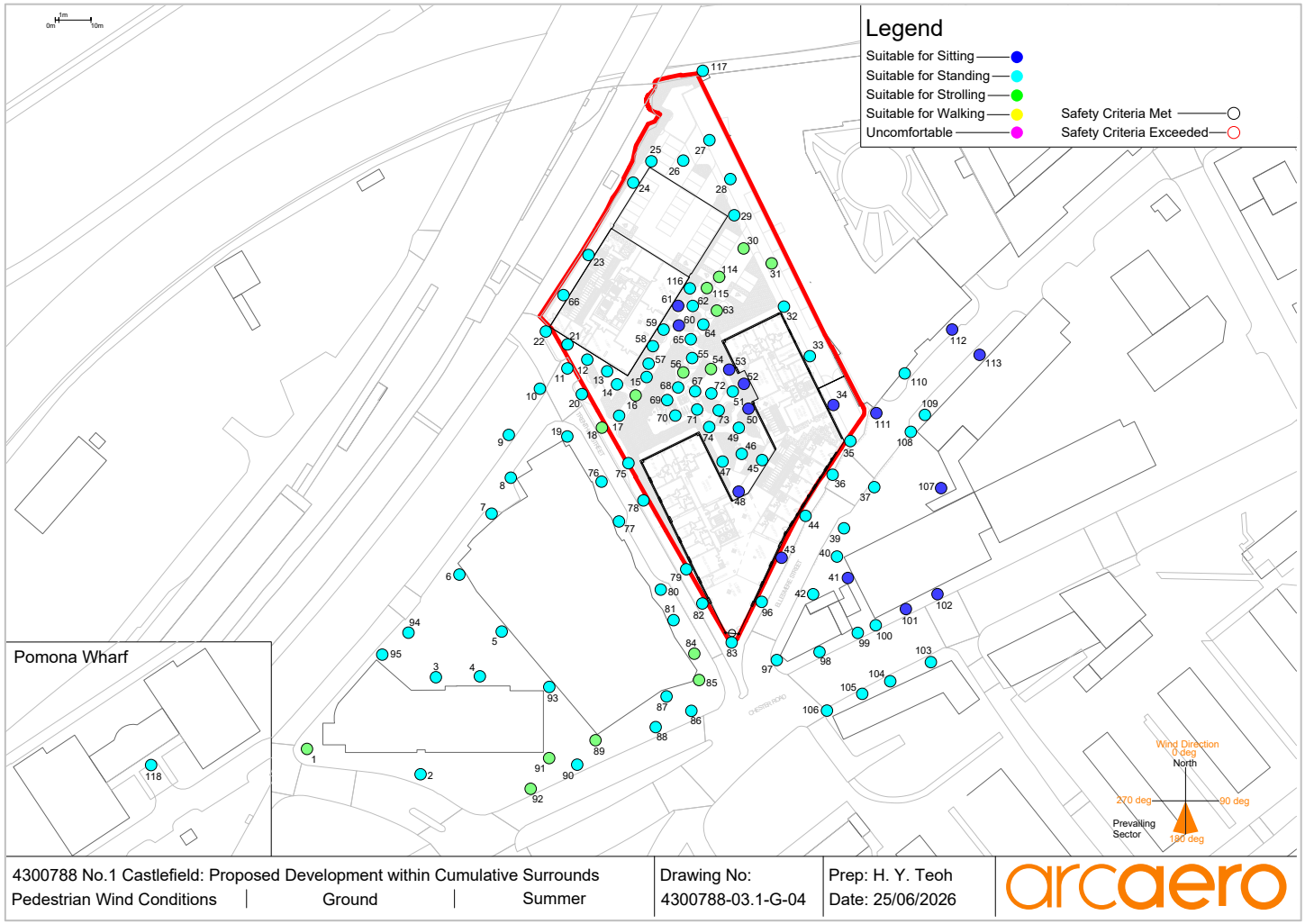


Figure 4.11 – Pedestrian wind conditions, proposed development within cumulative surrounds, with mitigation measures, summer – terrace / balcony level

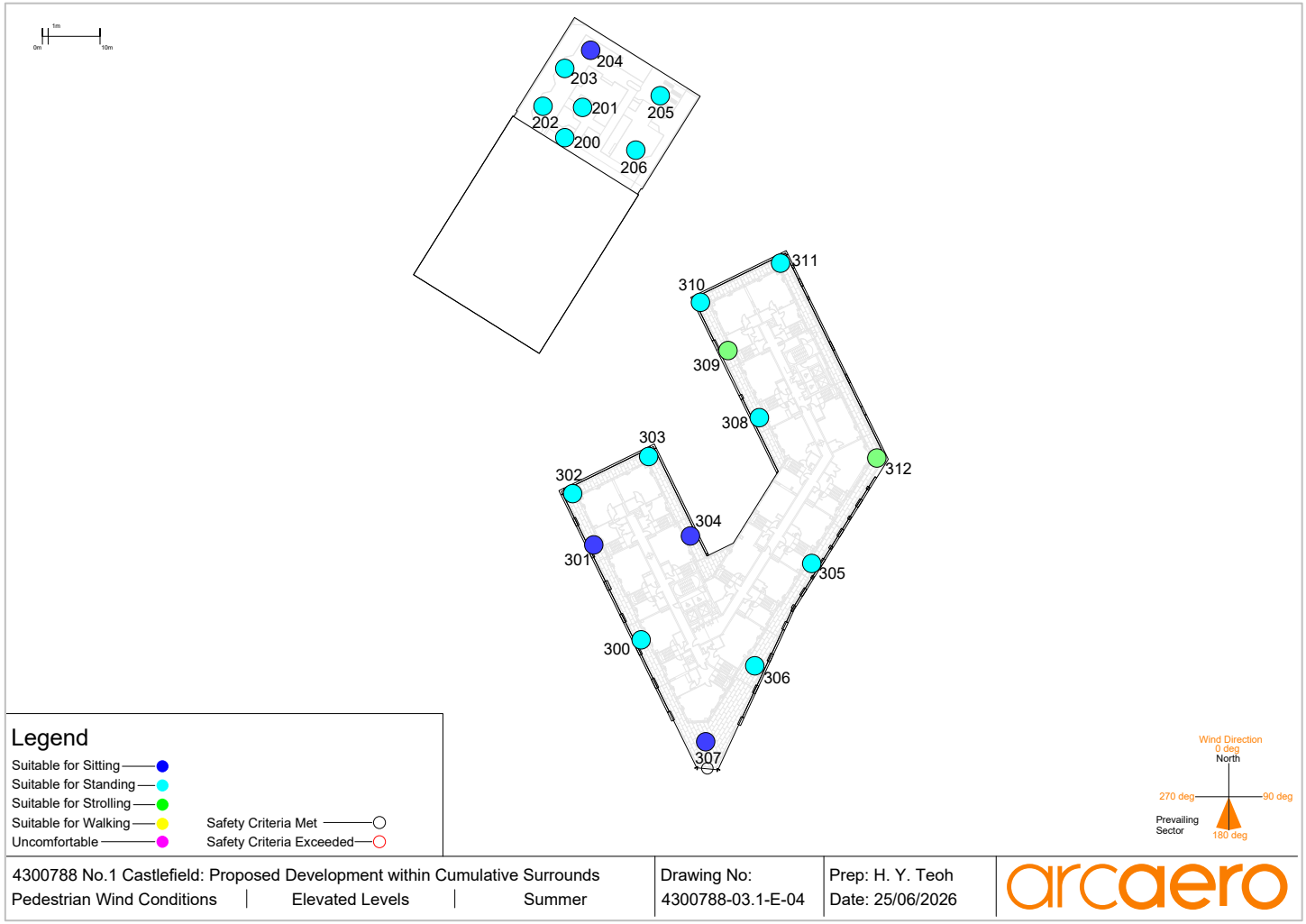


Figure 4.12 - Pedestrian wind conditions, proposed development within existing surrounds, with mitigation measures, 'worst' season – ground level

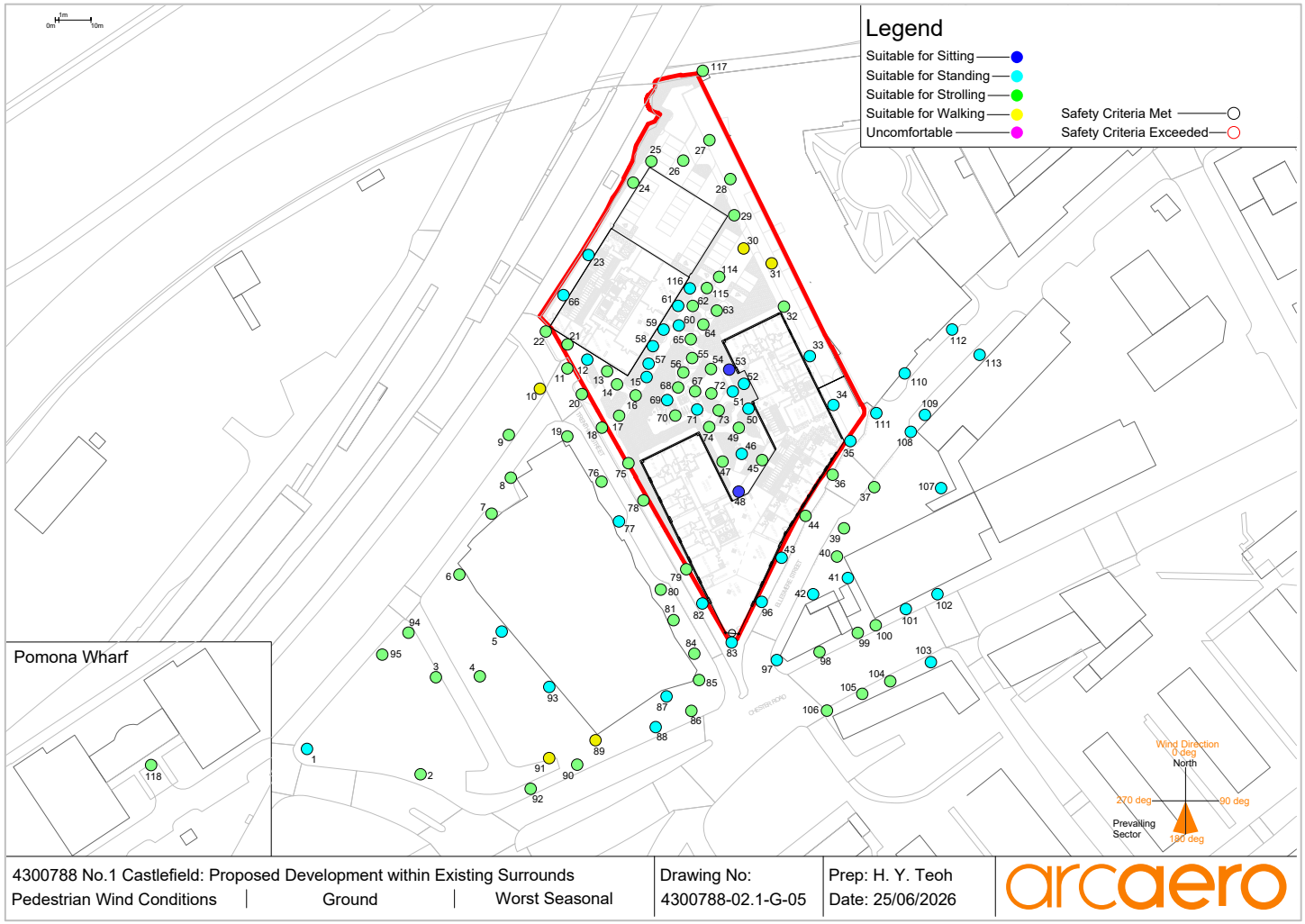


Figure 4.13 - Pedestrian wind conditions, proposed development within existing surrounds, with mitigation measures, summer – ground level

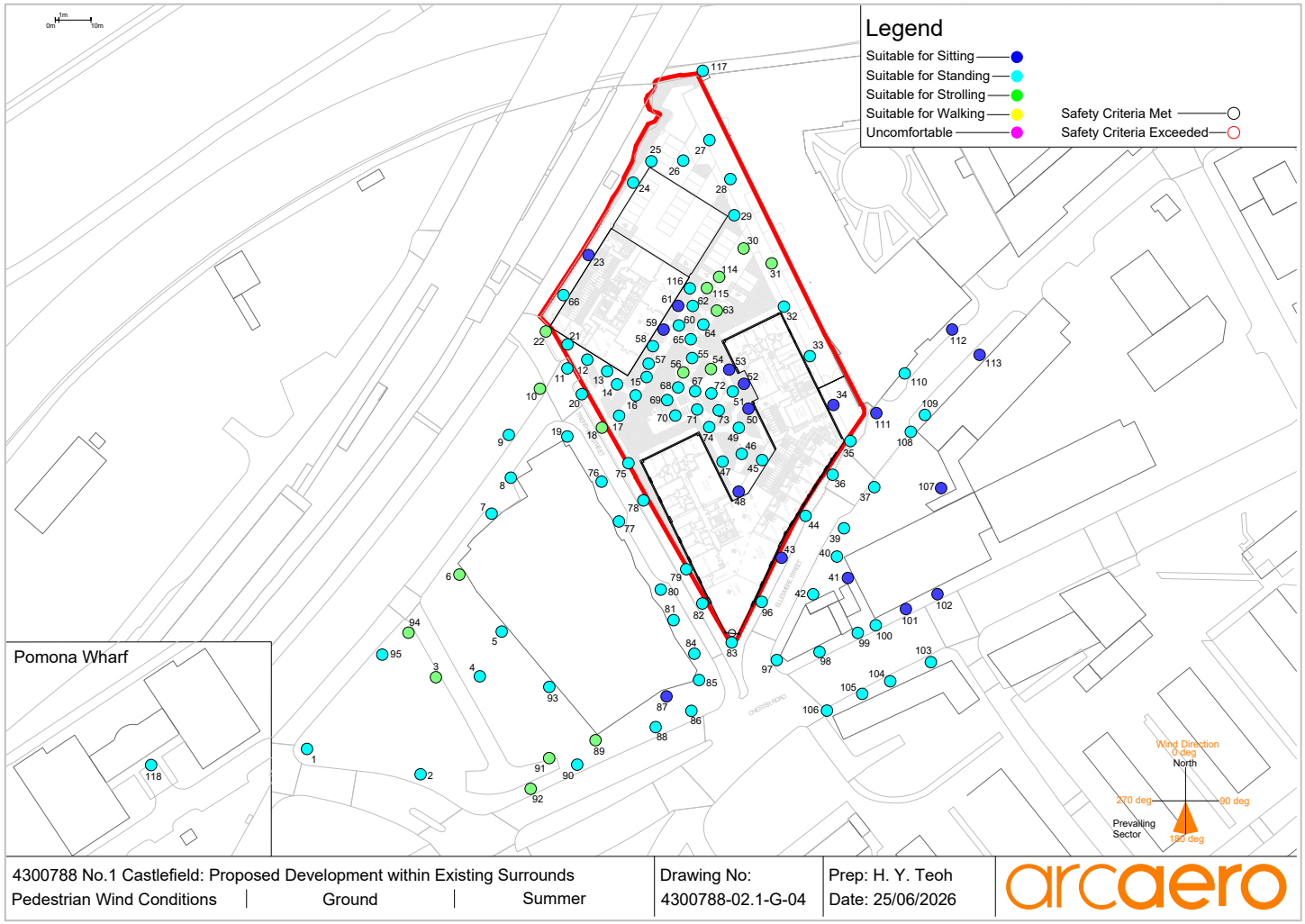
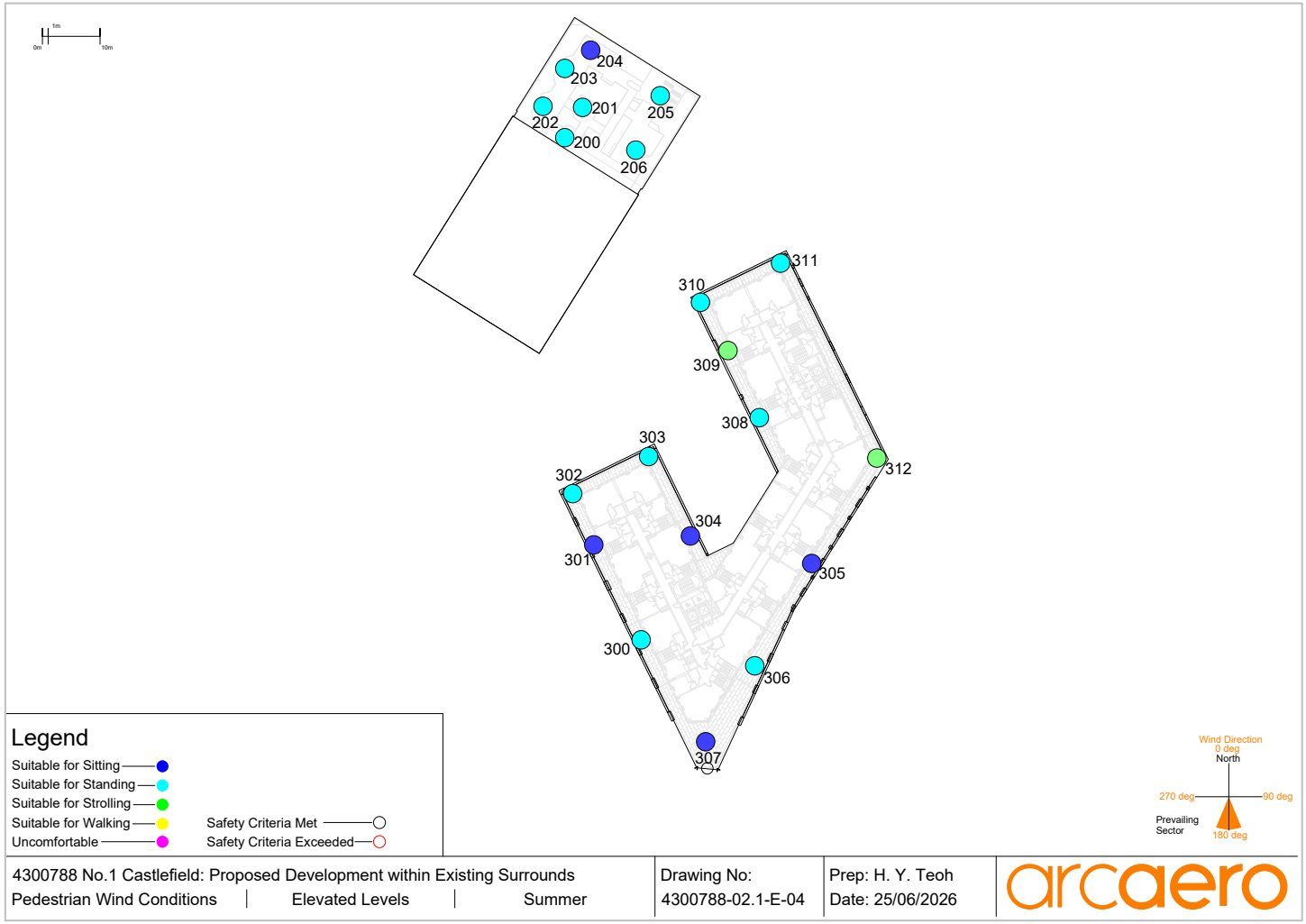


Figure 4.14 - Pedestrian wind conditions, proposed development within existing surrounds, with mitigation measures, summer – terrace / balcony level



Appendix A Wind Tunnel and Model

A.1 Atmospheric Boundary Layer Modelling

The study was conducted at the BRE wind tunnel in Hertfordshire. This open-loop facility provides a 14 metre long boundary layer test section and a 2.0 metre x 1.5 metre test section. The wind speed operating range is 0-50 m/s.

'Roughness blocks', a 2D fence and 3D posts were used to replicate the boundary layer. These elements are presented Figure A.1.

Figure B.1 - Boundary layer creation, BRE boundary layer wind tunnel, Hertfordshire



A.2 Wind Tunnel Models

A 1:400 scale wind tunnel was constructed from materials such as dense foam, wood and plastic. The wind microclimate was assessed at a total of 138 locations for the proposed development.

Photos of the wind tunnel model are presented as follows:

- Figure A.2 and Figure A.3: Existing site within existing surrounds
- Figure A.4 and Figure A.5: Proposed development within existing surrounds
- Figure A.6 and Figure A.7: Proposed development within cumulative surrounds
- Figure A.8 and Figure A.9: Close-ups of proposed development

Figure B.2 - Existing site conditions, viewed from north

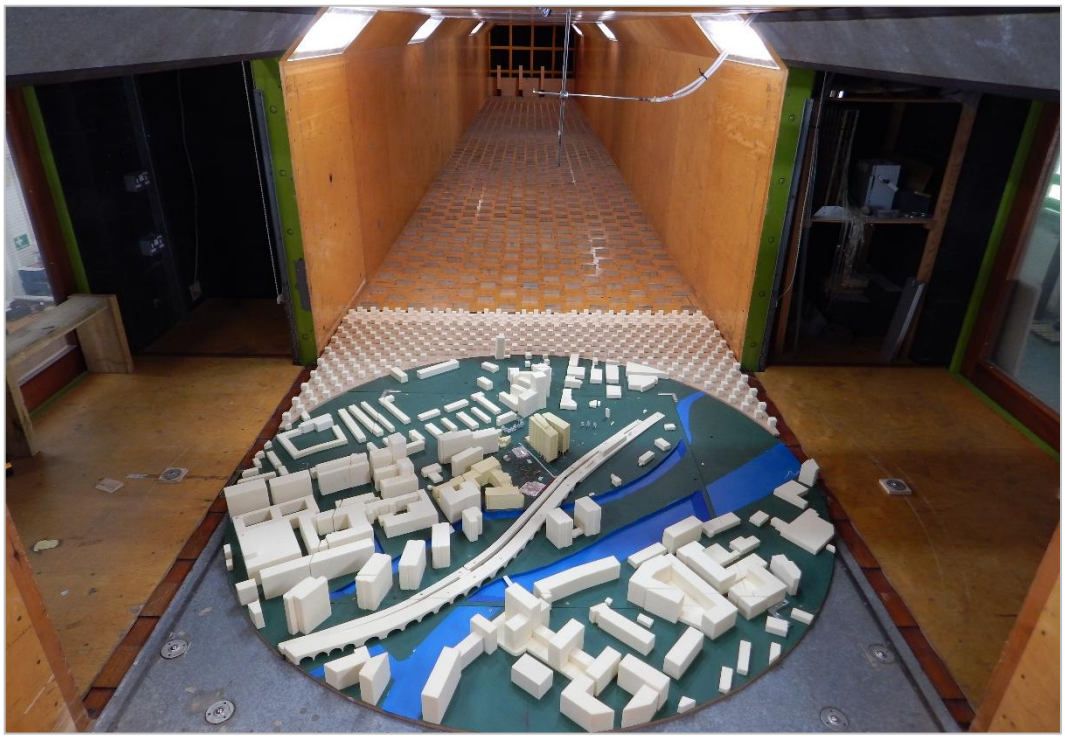


Figure B.3 - Existing site conditions, viewed from south

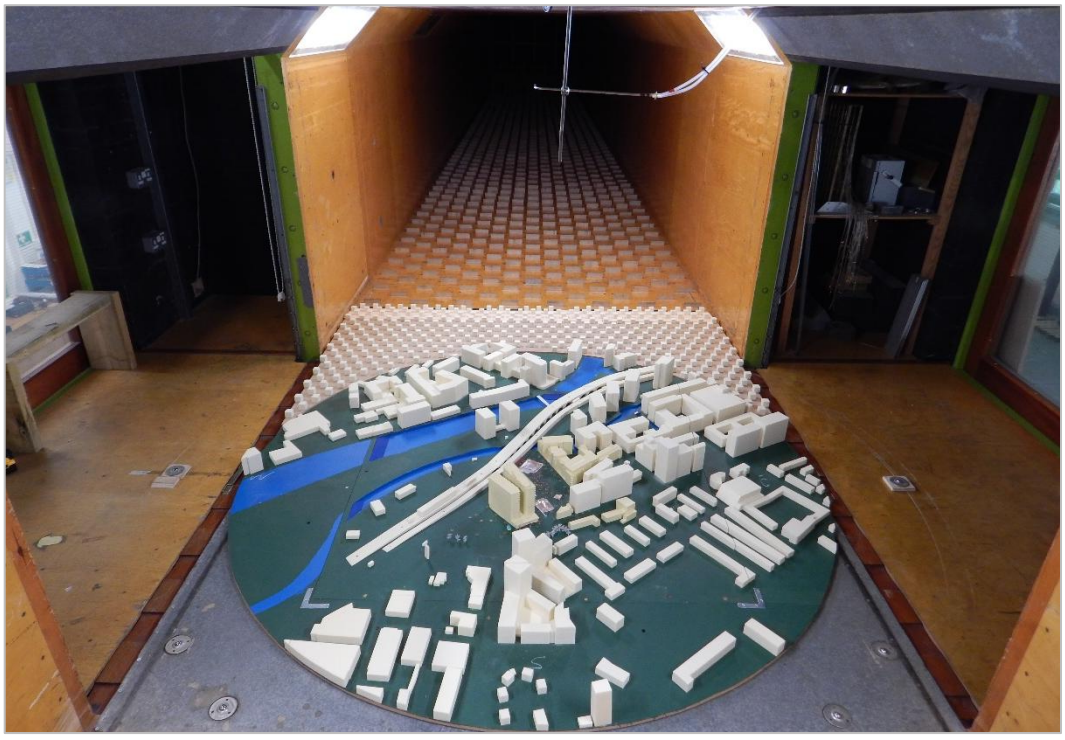


Figure B.4 - Proposed development within existing surrounds, viewed from north

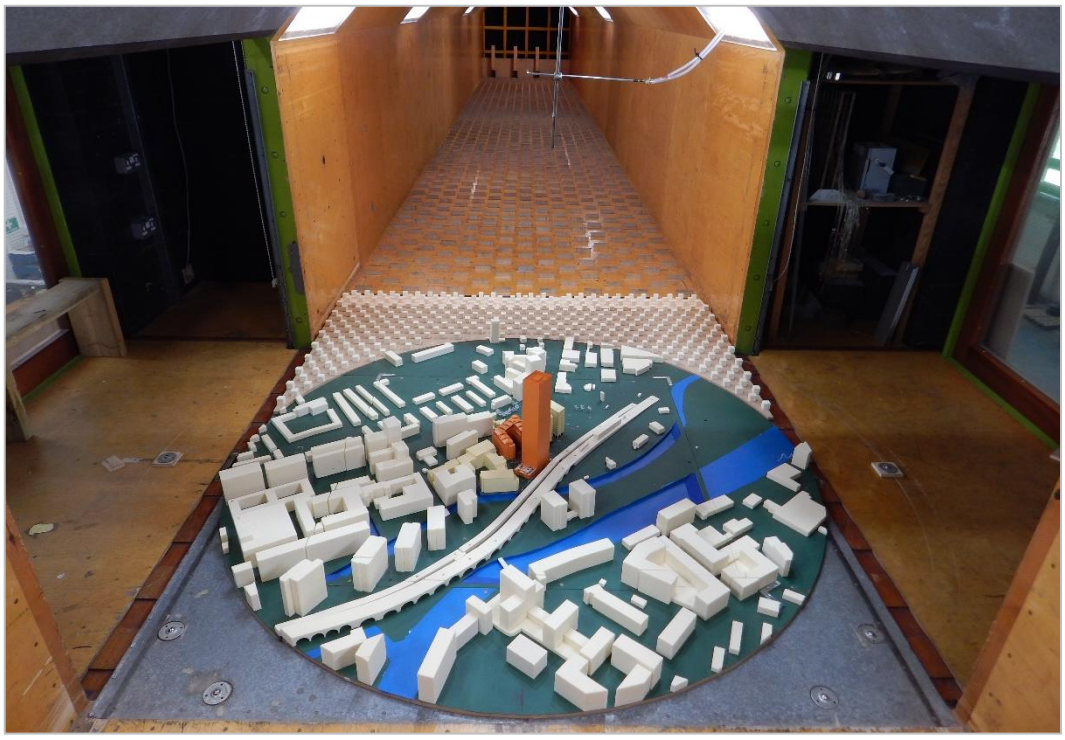


Figure B.5 - Proposed development within existing surrounds, viewed from south



Figure B.6 - Proposed development within cumulative surrounds, viewed from north



Figure B.7 - Proposed development within cumulative surrounds, viewed from south



Figure B.8– Close-up of the proposed development within cumulative surrounds, viewed from southeast



Figure B.9– Close-up of the proposed development within cumulative surrounds, viewed from northeast



A.3 Data Acquisition

Wind speed measurements were made using 'Irwin probes', capable of measuring fluctuating pressure differences that are calibrated against wind speed. A system of probes running simultaneously was used to obtain results from approximately 138 locations at a height corresponding to 1.5m at full scale.

Data was recorded for a sufficient length of time to determine the mean and 3-second gust wind speeds.

The gust wind speed is translated to an equivalent mean wind speed, the Gust Equivalent Mean or GEM, according to the following equation:

$$U_{GEM} = \frac{U_{GUST}}{1.85}$$

The results at each location were combined with wind statistics transposed to the site to assess the exceedance of threshold wind speeds that relate to comfort and safety in accordance with the Lawson criteria.

Appendix B Wind Climate Analysis

B.1 Wind Frequency Data, Manchester Airport

Wind microclimate studies require that wind speed data obtained from a measurement station be transposed to the site of interest. The current study employs wind data from Manchester airport.

The wind speed history has been reformatted into the number of observations of mean-hourly wind speeds within each of several wind speed ranges, for each wind direction and for each month of the year. To facilitate the transposition of the wind data, the months are grouped into the seasons and a Weibull distribution is fitted to the wind speed distribution for each wind direction, for each season.

From the Weibull cumulative distribution, the probability that, for a given wind direction, a wind speed, V, will be exceeded is given by:

$$P(>V) = e^{-(\frac{V}{c})^k}$$

where *c* is the dispersion parameter and *k* is the shape parameter.

To these parameters is further added the probability, p, of each wind direction occurring. Thus, for each month of the year the probability that a specified wind speed is exceeded for a specified wind direction may be calculated.

The resulting weather centre wind data is transposed to a standard reference terrain category, 'open country terrain', at sea-level, accounting for upwind terrain, topography and altitude for the weather centre. The open country wind data is then transposed to the reference height at the site of the proposed development, accounting for upwind terrain, topography and altitude for the target site.

For the transposition of wind speed data from the weather station to open country, and from open country to the site, the methods set out in ESDU item 01008 (4) (the industry standard) have been employed.

The resulting annual and seasonal directional and wind speed probability distributions at the reference height of 140m, at the proposed site, are given in Figures B.2 to B.6, respectively.

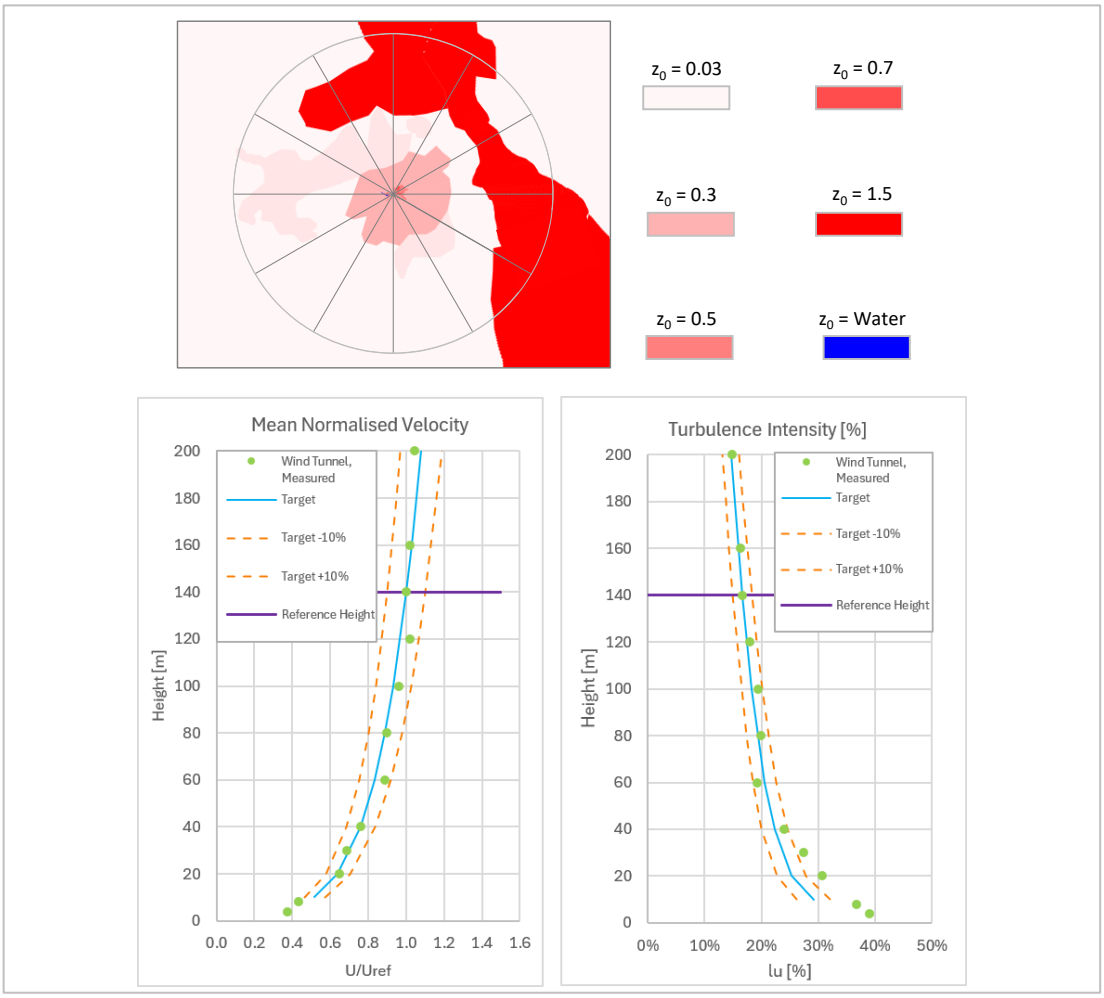
B.2 Wind Properties at the Site

A detailed analysis, based on the widely accepted Deaves and Harris model of the atmospheric boundary layer (ABL), as defined in ESDU Item 01008 (4), has been carried out to determine the wind properties at the site. From this analysis a representative profile was defined as a target for the ABL simulation in the wind tunnel.

Upon conducting the ESDU analysis, one wind profile was replicated in the wind tunnel to adequately account for wind blowing from all angles.

ArcAero's terrain analysis and resulting mean wind speed and turbulence intensity profiles are presented within Figure B.10.

Figure B.10 – Target mean wind speed and turbulence intensity profiles and wind tunnel profile



B.3 Wind Frequency Data

Wind microclimate studies require that meteorological data is transposed from a nearby weather station with sufficient wind data to produce accurate wind frequency statistics. The current study uses data from Manchester Airport. The cumulative wind speed probability distributions, transposed to building height at site are provided in Figure B.11 to Figure B.15.

Figure B.11 – Cumulative wind speed probability distribution at site, annual

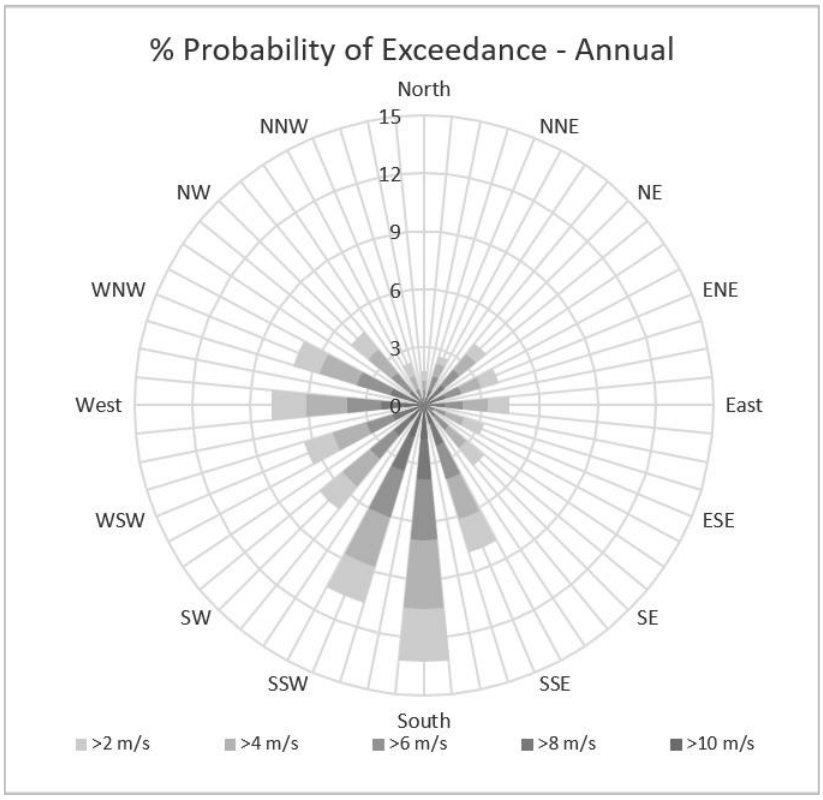


Figure B.12 – Cumulative wind speed probability distribution at site, spring

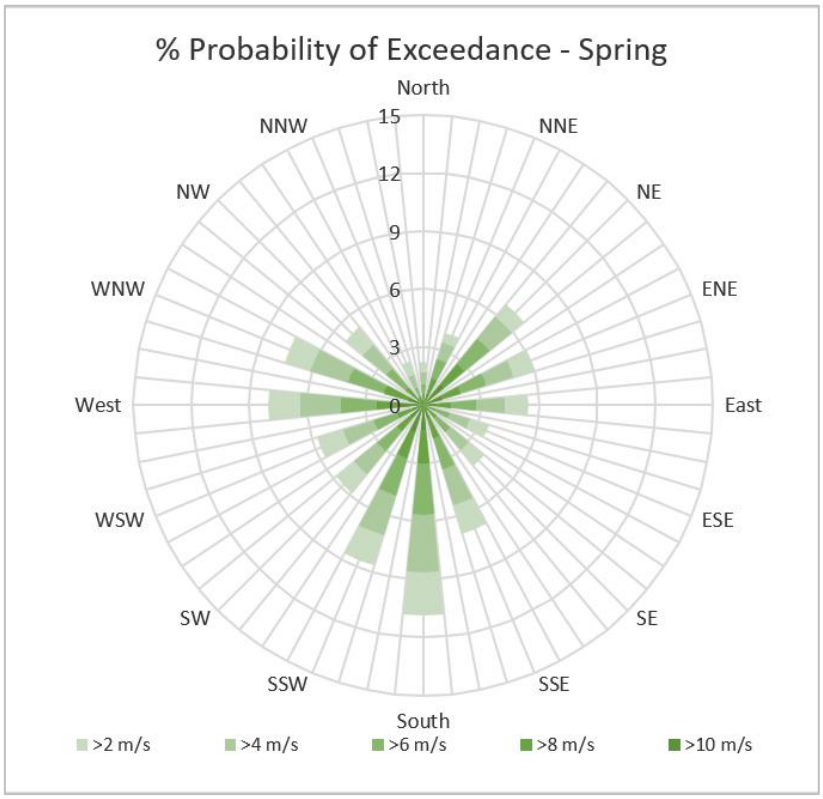


Figure B.13 – Cumulative wind speed probability distribution at site, summer

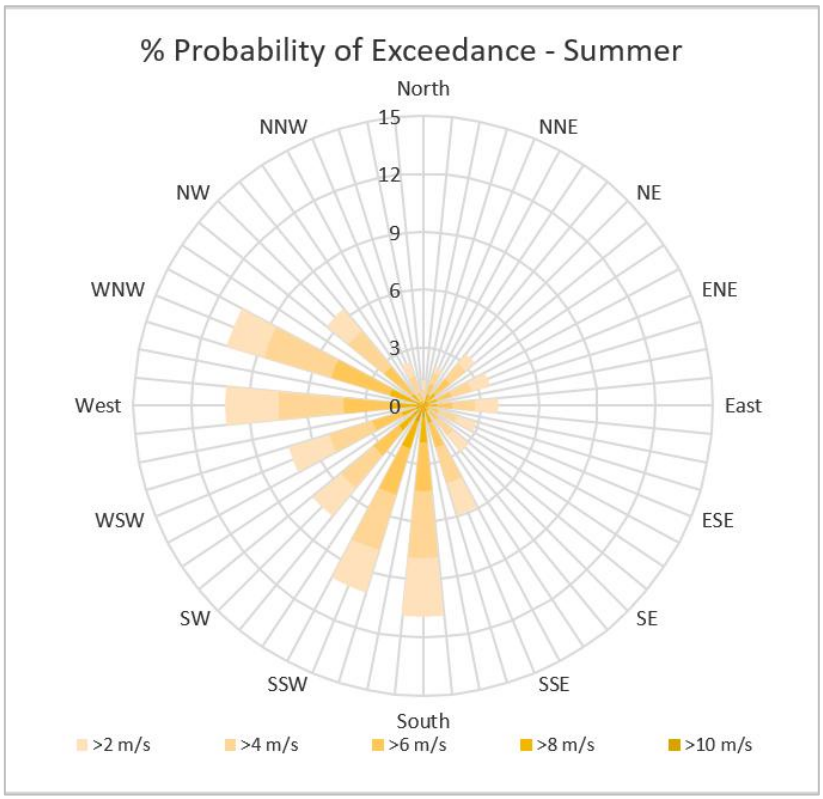


Figure B.14 – Cumulative wind speed probability distribution at site, autumn

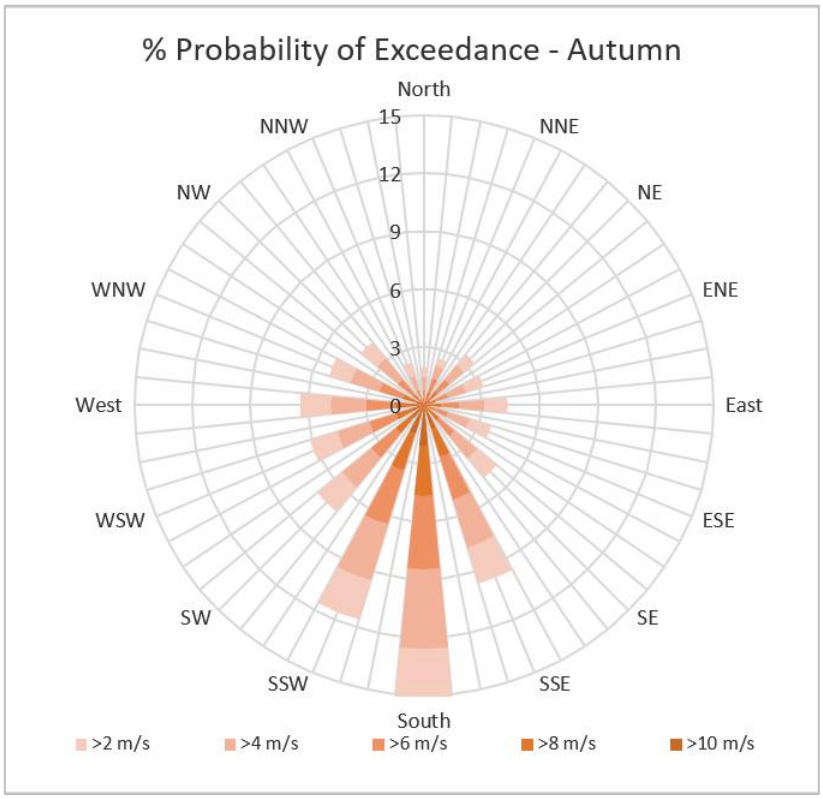
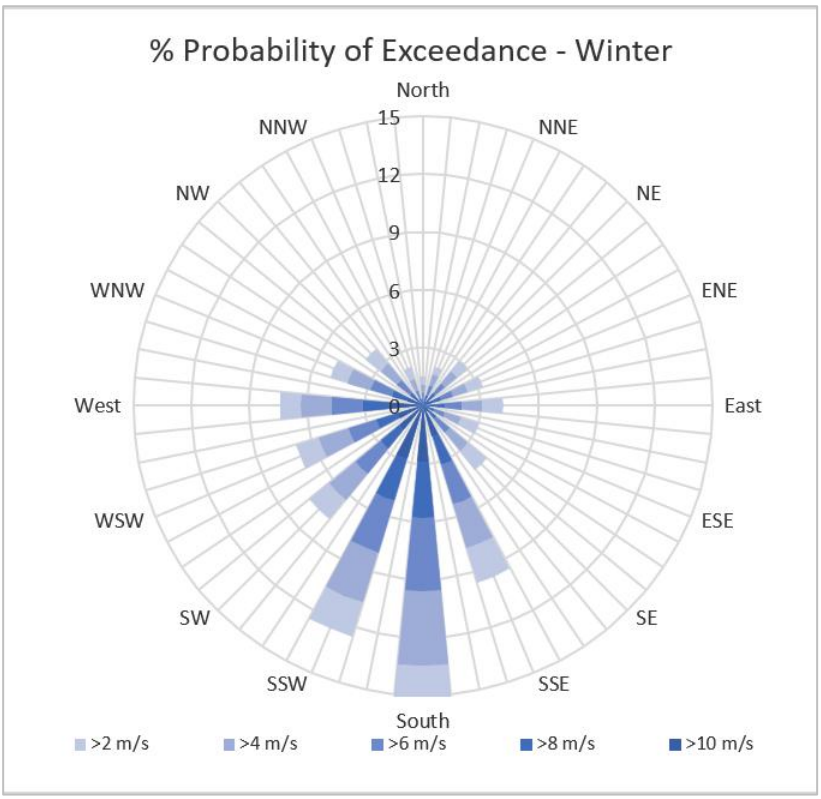


Figure B.15 – Cumulative wind speed probability distribution at site, winter



Appendix C Pedestrian / Occupant Uses

Figure C.1 – Assumed pedestrian uses, existing site within existing surrounds, ground

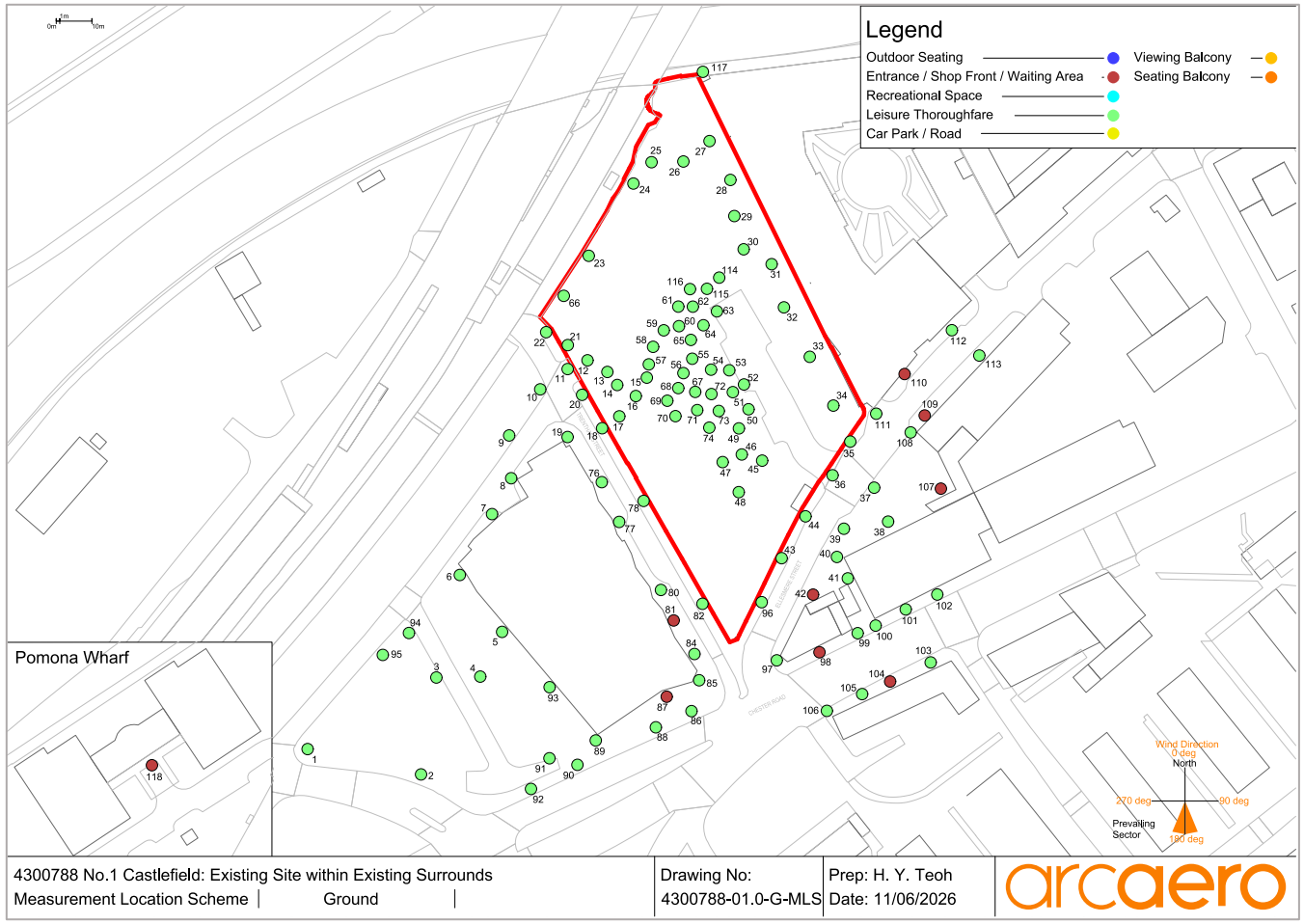


Figure C.2 – Assumed pedestrian uses, Proposed development in existing site, ground

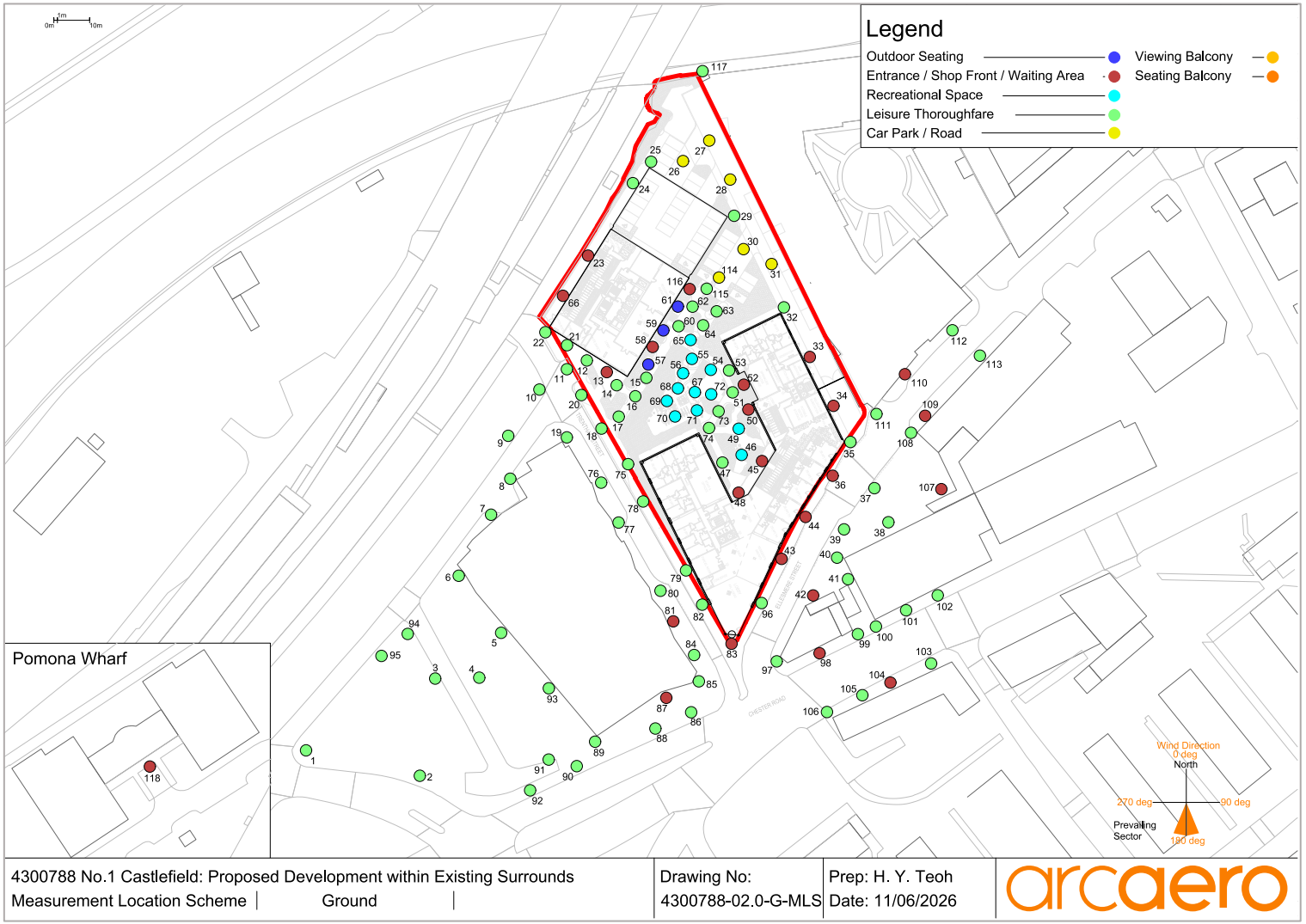


Figure C.3 – Assumed pedestrian uses, Proposed development in existing site, terrace / balcony levels

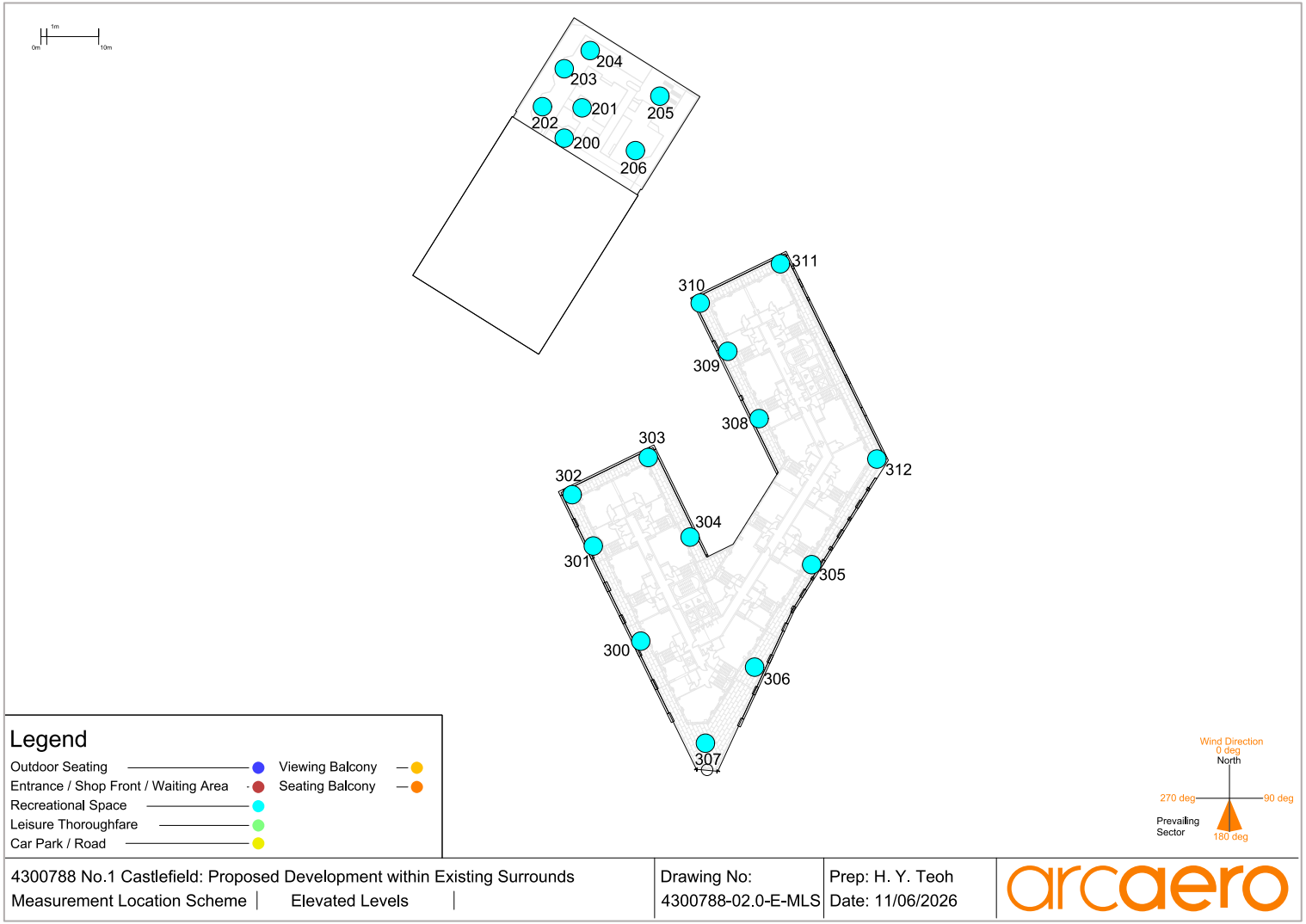


Figure C.4 – Assumed pedestrian uses, Proposed development in cumulative site, ground

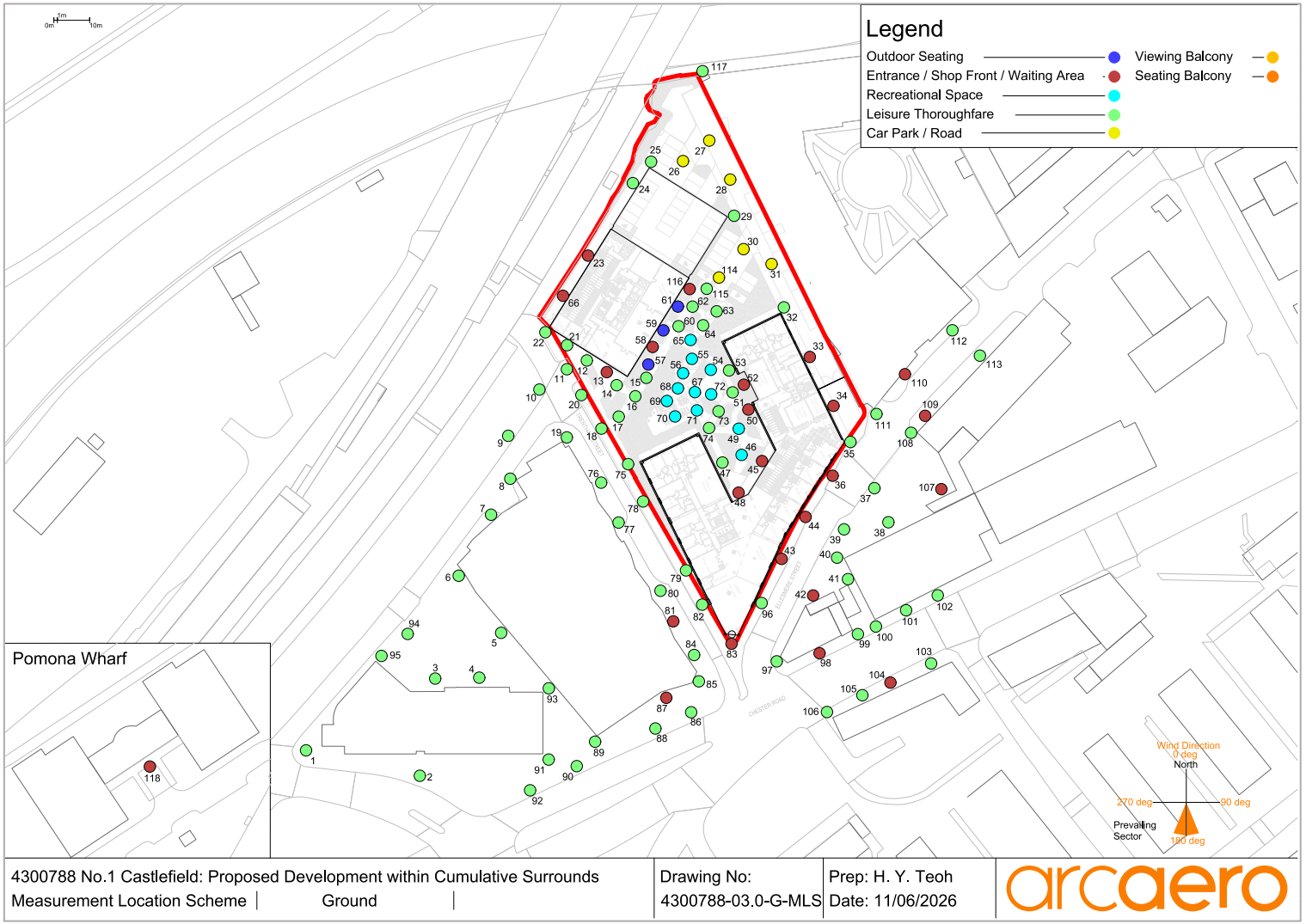


Figure C.5 – Assumed pedestrian uses, Proposed development in cumulative site, terrace / balcony levels

