



50 Fountain Street

For

M&G Real Estate Limited

Wind Microclimate Report

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Executive Summary

Background

An experience based desktop study has been carried out by Architectural Aerodynamics Ltd. (ArcAero) to assess the pedestrian and terrace level wind microclimate for the proposed 50 Fountain Street development in Manchester, UK.

The study is based on our experience of quantitative assessments using wind tunnel and computational methods for many similar developments across the UK, and further draws on our knowledge of aerodynamic principles and the site-specific wind climate of the 50 Fountain Street site.

Conclusions

The conclusions of the study are as follows:

- Upon introduction of the proposed development wind conditions are expected to meet the safety criteria for all users.
- Wind conditions at the ground level within and around the proposed development are expected to be suitable for planned pedestrian activities.
- Wind conditions at the terraces are expected to be acceptable for general recreational activities, including long-term outdoor seating in the more sheltered, lower terraces on Levels 3 and 5.

1 Introduction

This report summarises experience based desktop study of wind conditions in and around the proposed 50 Fountain Street development in Manchester, UK.

2 The Project

2.1 Site Location and Surrounding Area

The 50 Fountain Street development is situated in Manchester's Central Business District and is bounded by Concert Lane to the northwest, Spring Gardens to the southwest, Fountain Street to the southeast and York Street to the northeast.

The immediate surrounding area is largely characterised by medium to high rise commercial developments, typical of a city centre.

2.2 The Proposed Development

The proposed development will comprise a 9-storey (ground & mezzanine, L01 to L07) office building with recreational terraces and the retained historic façade.

2.3 Soft Landscaping

The wind microclimate has been assessed for the proposed development with the current soft landscaping proposal for the 7th floor terrace received on 20th August 2021 "2606-PLA-XX-00-DR-L-0003.dwg", also shown in Figure 2.1.

3 Typical Assessment Methodology

3.1 The Assessment of Wind Microclimate

The microclimate of any development is 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 wider area.

This assessment considers the wind conditions that would result upon the introduction of the proposed development into the existing space.

The assessment predicts 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 development proposal and the adjacent developments, whether wind conditions are suitable or unsuitable, and whether design adjustment or mitigation measures are required.

The assessment of wind microclimate in the urban environment is not covered by internationally recognised wind codes – which tend to focus on wind loading issues. As such, a typical wind microclimate study will involve one-of or a mixture of an experience-based desk study, a computational fluid dynamics assessment (CFD) and boundary layer wind tunnel studies.

3.2 Experience-Based Desk Study

An experienced wind engineer will be able to draw upon results from hundreds of previous wind tunnel and CFD studies, and along with accurate site wind analyses and robust wind frequency data, is able to draw conclusions about the likely wind conditions on site and provide meaningful feedback regarding changes to the design or landscaping implementation to create suitable wind conditions across the site and surrounds.

3.3 Wind Climate Analysis

Details of the wind climate relevant to the site are provided in Appendix A of this report.

3.4 The LDDC Lawson Criteria

The industry standard criteria for such assessments are commonly referred to as the Lawson criteria. Architectural Aerodynamics use the London Docklands Development Corporation (LDDC) variant of the Lawson Criteria ⁽¹⁾.

The LDDC variant of the Lawson criteria applies a single percentage probability of exceedance of a range of wind speeds related to different pedestrian uses. The current study predicts wind conditions qualitatively and employs the LDDC Lawson criteria to interpret and present expected wind conditions.

3.4.1 Safety

A wind speed of 15 metres-per-second occurring once per year is rated as unsafe, 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 ⁽¹⁾ 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	Standing / short-term sitting
8	C2	Strolling
10	C1	Walking
> 10	C0	Uncomfortable

4 Expected Wind Conditions

4.1 Existing Site

The existing site comprises a four-storey office building and is dominated by medium rise surrounding buildings. As such it is not exposed to prevailing southerly winds. The wind microclimate is therefore expected to be relatively calm.

4.1.1 Safety

Wind conditions within the existing site and surrounds are expected to rate as safe within and around the existing site.

4.1.2 Comfort

Wind conditions on the existing thoroughfares and roadways along Concert Lane, Spring Gardens and Fountain Street are expected to be suitable for at least leisurely strolling and thus for comfortable pedestrian and cyclist access to and passage through the site.

Wind conditions at entrances within and around the site are expected to be suitable for standing throughout the year and thus for comfortable pedestrian ingress / egress.

4.2 Proposed Development within Existing Surrounds

The proposed development represents an increase in height compared to the existing site. It is, however, still well sheltered by the immediate surrounding buildings from most directions. While the upper terraces are slightly exposed to prevailing southerly winds, at ~35m height, the wind speeds are expected to be of moderate strength. The proposed development is also arranged positively with respect to the prevailing wind, with the main facades facing away from prevailing wind directions, thus reducing the likelihood of corner acceleration and downdraughts being directed toward the ground level for critical wind directions.

Primary wind effects that would drive conditions throughout the development are presented in Figure 4.1 and the wind conditions on the ground and rooftop terraces are presented in Figure 4.2 and Figure 4.3.

4.2.1 Safety

All areas within and around the proposed development are expected to meet the safety criteria for pedestrians and occupants.

4.2.2 Comfort

4.2.2.1 *Thoroughfares*

Wind conditions at all thoroughfares within the site are expected to be suitable for at least leisurely strolling throughout the year and thus for comfortable pedestrian access to and passage through the site.

4.2.2.2 *Entrances*

While the main entrance to the site along Spring Gardens somewhat faces southerly prevailing winds, but it is fairly well recessed and as such the wind conditions are expected to be suitable for at least standing and thus for comfortable pedestrian ingress / egress.

Entrances on the terraces are also expected to be suitable for at least standing and thus for pedestrian ingress / egress.

4.2.2.3 Rooftop Terrace

The wind conditions on the rooftop terrace of Level 3 are expected to be suitable for long-term sitting in summer due to the shelter provided from the immediate surrounding buildings, and thus from prevailing southerly winds. Hence, wind conditions are expected to be suitable for recreational activities involving outdoor seating if required.

On Level 6 and 7 terraces, the terraces are more exposed to prevailing winds. However, the presence of the 1.1m tall parapet around the terraces would be expected to be sufficient in creating comfortable wind conditions for at least short-term sitting, from spring to autumn. Thus, conditions are expected to be suitable for general recreational uses including casual seating (such as that indicated in Figure 2.1).

4.2.2.4 Surrounding Area

Wind conditions within the surrounding areas are expected to remain suitable for at least leisurely strolling along thoroughfares and for short periods of standing at entrances. Therefore, conditions remain suitable for existing and proposed pedestrian uses.

5 Conclusions

The conclusions of the study are as follows:

- Upon introduction of the proposed development wind conditions are expected to meet the safety criteria for all users.
- Wind conditions at the ground level within and around the proposed development are expected to be suitable for planned pedestrian activities.
- Wind conditions at the terraces are expected to be acceptable for general recreational activities, including long-term outdoor seating in the more sheltered, lower terraces on Levels 3 and 5.

6 References

1. **Lawson, T.V.** *The determination of the wind environment of a building complex before construction*. Bristol : University of Bristol, Department of Aeronautical Engineering, 1990.
2. **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 – 7th floor soft landscaping

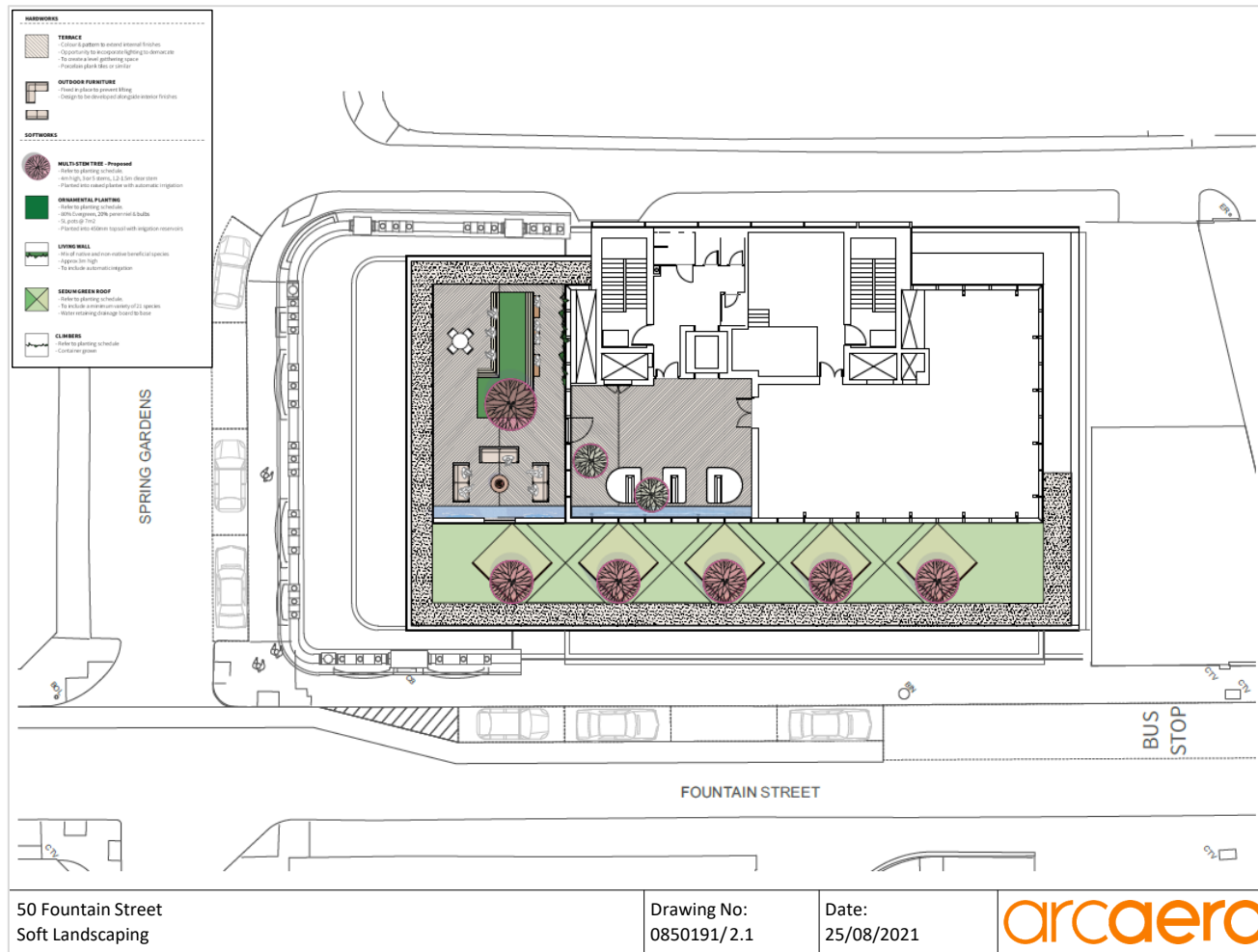


Figure 4.1 – Primary wind effects

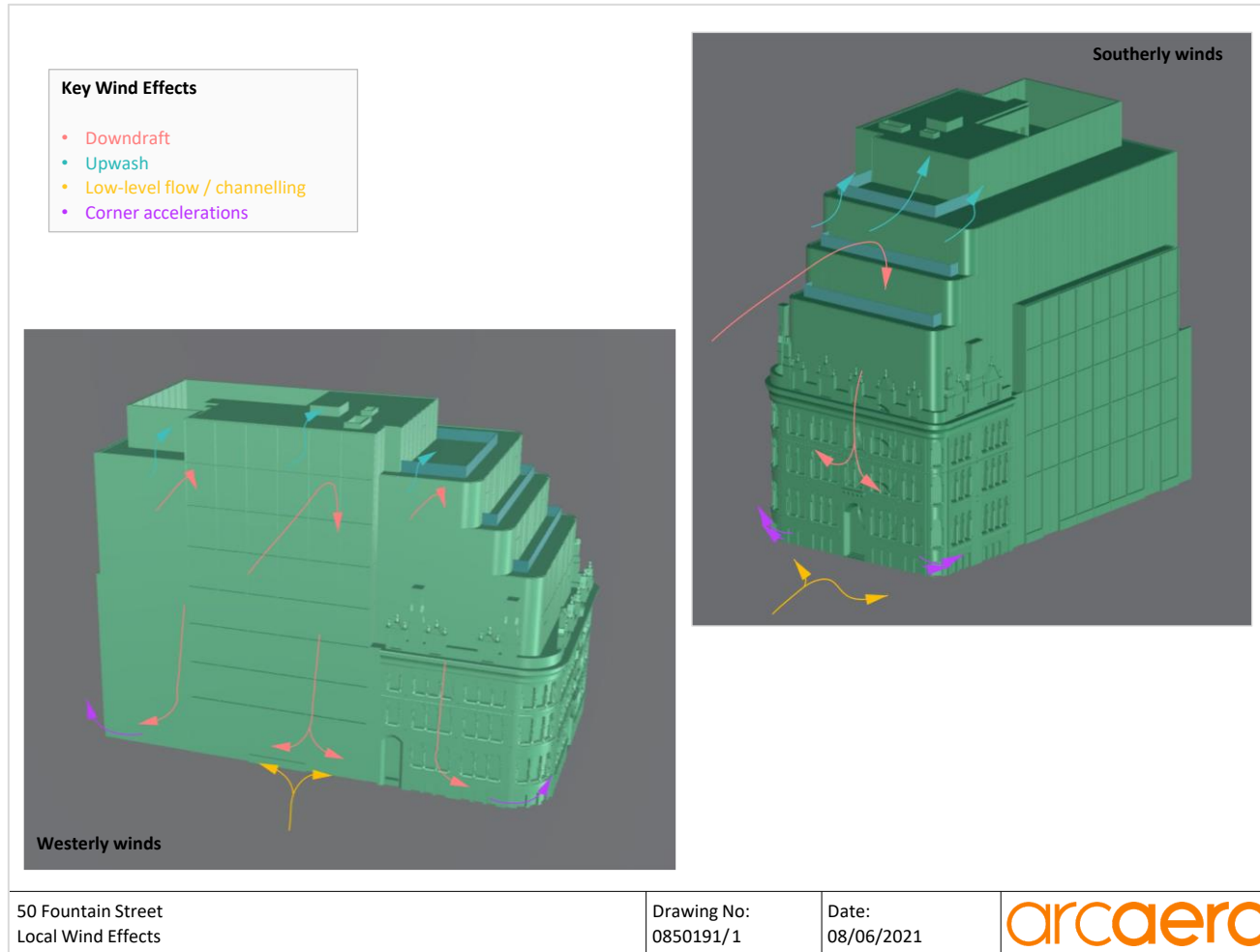


Figure 4.2 – Ground level wind microclimate

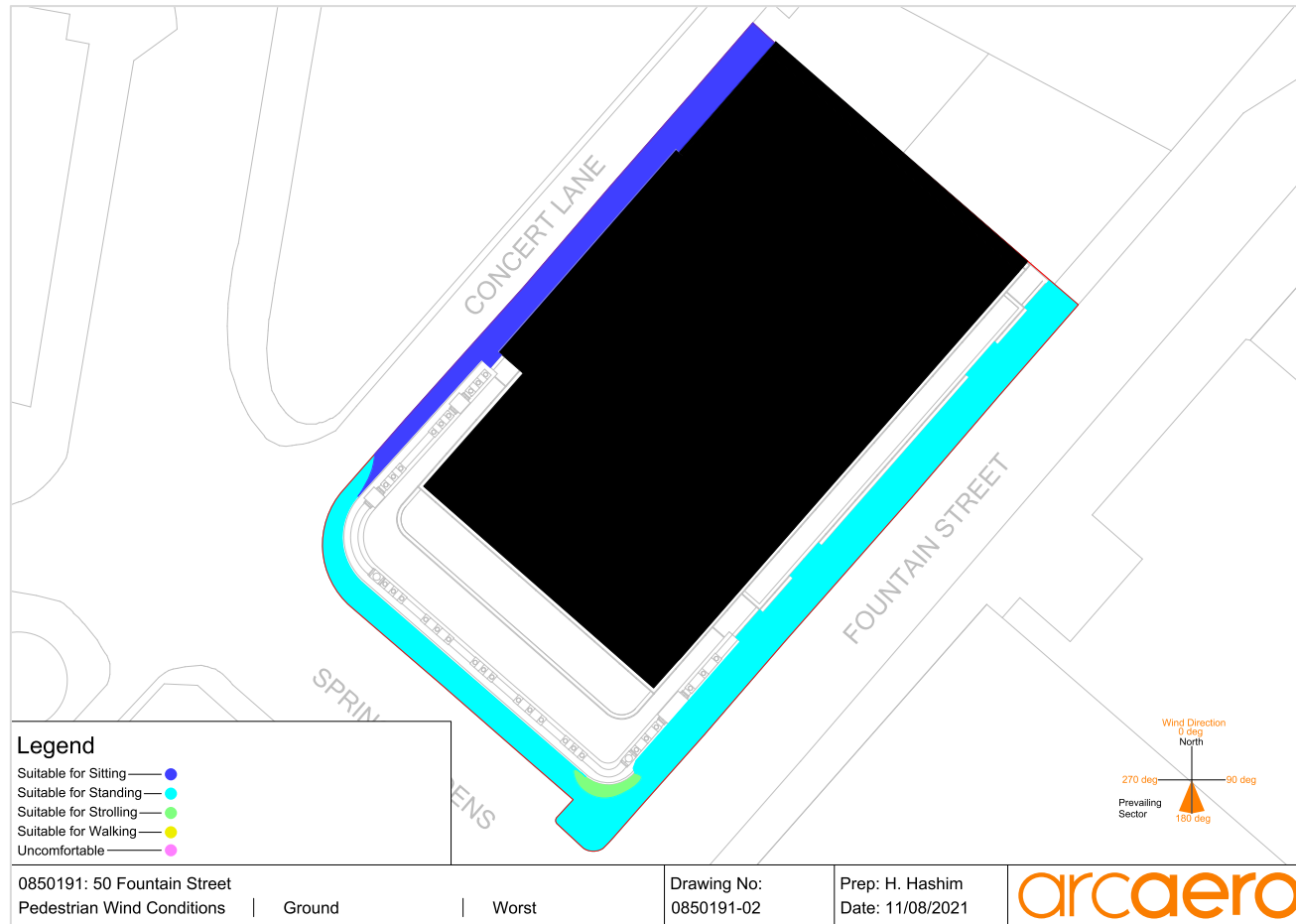
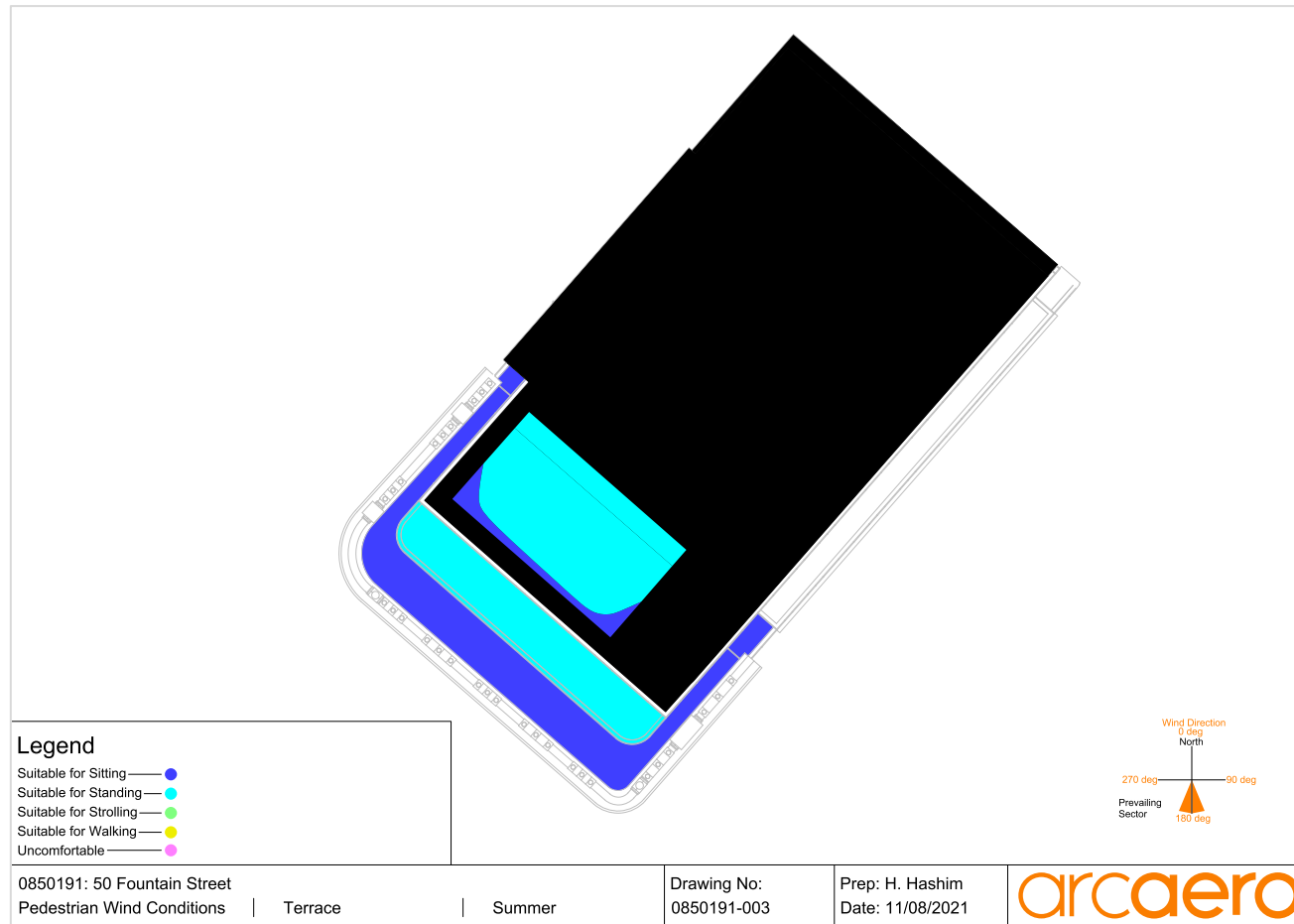


Figure 4.3 – Rooftop levels wind microclimate



Appendix A Wind Climate Analysis

A.1 Site Wind Analysis

A detailed analysis, based on the widely accepted Deaves and Harris model of the atmospheric boundary layer (ABL), as defined in ESDU Item 01008 ⁽²⁾, has been carried out to determine the wind properties at the site.

A.2 Wind Properties at the Site

A.2.1 Wind Frequency Data

Wind microclimate studies require that meteorological data is transposed from a nearby weather station with enough wind data to produce accurate wind frequency statistics. The current study uses data from Manchester Airport. The wind climate data, transposed to reference height at site, is presented graphically in Figure A.1 to Figure A.5.

Figure A.1 - Annual Probability of exceedance at reference height

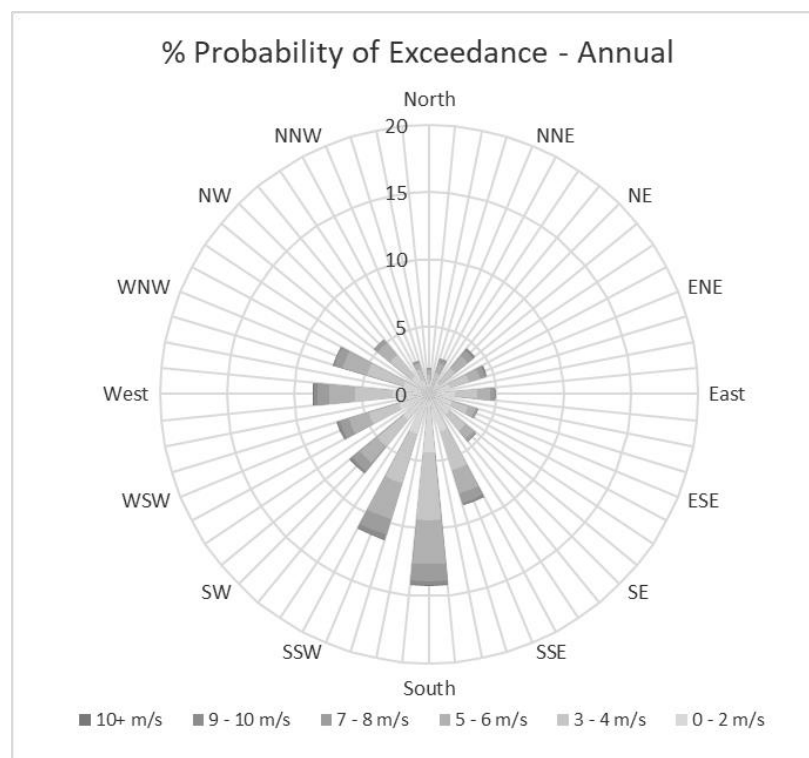


Figure A.2 - Autumn Probability of exceedance at reference height

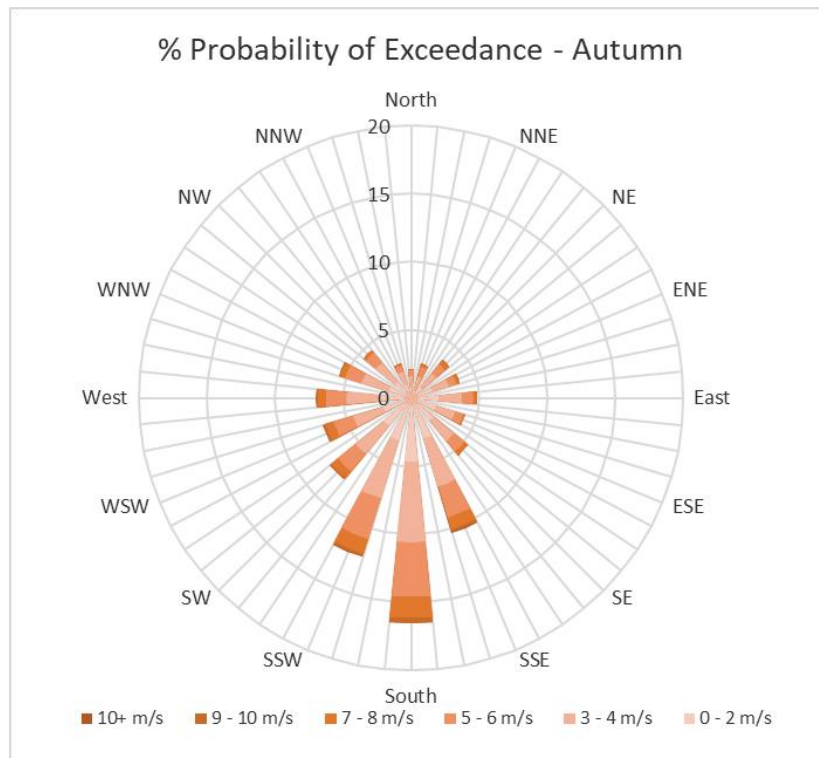


Figure A.3 - Winter Probability of exceedance at reference height

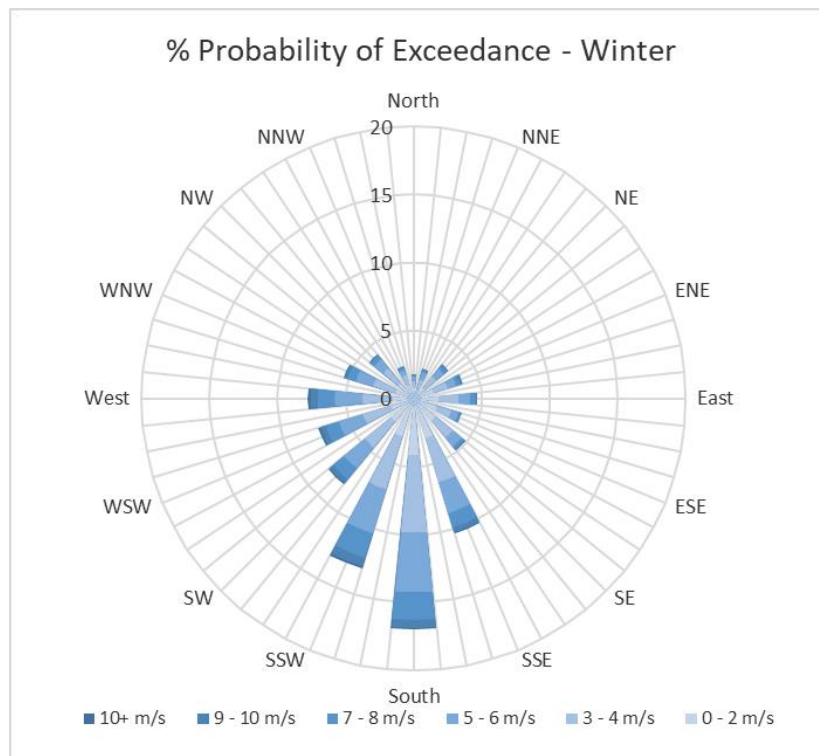


Figure A.4 - Spring Probability of exceedance at reference height

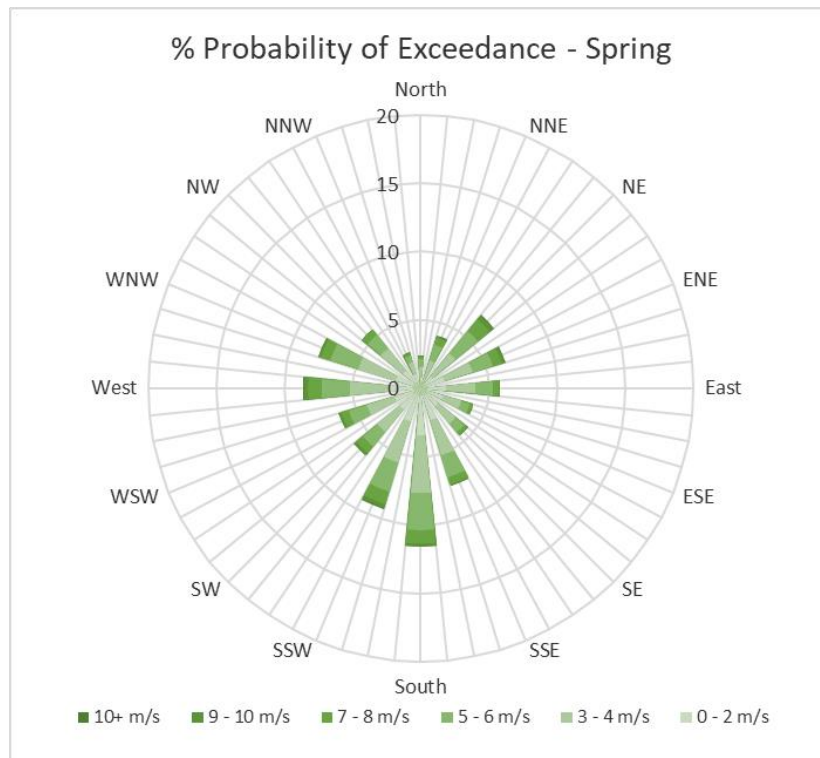


Figure A.5 - Summer Probability of exceedance at reference height

