# 13.0 Wind Microclimate

## 13.1 Introduction

13.1.1 This Chapter reports the likely significant effects of the Proposed Development on the Site and the surrounding area in terms of wind microclimate. Where appropriate, it also identifies proposed mitigation measures to prevent, minimise or control likely negative effects arising from the Proposed Development and the subsequent anticipated residual effects.

13.1.2 The effects of the Proposed Development are considered over both the demolition & construction and operational phases.

13.1.3 The main Wind Microclimate issues covered in this Chapter include following:

- Pedestrian comfort.
- Strong winds.

13.1.4 The wind assessment aims to compare the pedestrian-level wind environment around the Proposed Development against industry standard comfort and distress Lawson Criteria and to the conditions of the existing Site.

13.1.5 Particular attention is paid to wind effects in open amenity spaces, building entrances and pedestrian (including cycling) routes to determine the level of adherence to the recommended guidelines.

13.1.6 This Chapter (and its associated figures and appendices) should be read together with the Introductory Chapters of this ES (Chapters 1 – 5), as well as **Chapter 17: Cumulative Effects**.

13.1.7 This Chapter is accompanied by the following appendices:

- CFD Comfort and Safety Maps (Appendix 13.1)
- Wind Microclimate Directional Results (Appendix 13.2).

## 13.2 Competence

13.2.1 This assessment has been undertaken by Enrico Crobu on behalf of Hoare Lea.

13.2.2 Enrico Crobu (BSc (Hons), MSc, CEng, MCIBSE) is the Wind Microclimate lead at Hoare Lea. Enrico is an Associate Building Physics Engineer with overall 12 years of experience in Building Physics of which 6 years are spent on assessing wind microclimate effects in the built environment.

## 13.3 Legislation, Planning Policy and Guidance

13.3.1 The following national, regional, and local planning policy and guidance is of relevance to the assessment of the effects of the Proposed Development in relation to wind microclimate.

### Planning Policy Context

#### National

13.3.2 The following national level policy and guidance documents are of relevance to the Proposed Development:

#### National Planning Policy Framework (2021)

13.3.3 The UK wide National Planning Policy Framework (NPPF) (Ref. 13.2) came into force in July 2021 and even if there are no national codes of practice or legislative policies relating to the assessment of environmental wind flows in the built environment, the benefits of a high-quality built environment are emphasised in the NPPF. Paragraph 130 of the National Planning Policy Framework states that:

> *"Planning policies and decisions should ensure that developments:*
>
> *a) will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development.*
> *b) are visually attractive as a result of good architecture, layout and appropriate and effective landscaping.*
> *c) are sympathetic to local character and history, including the surrounding built environment and landscape setting, while not preventing or discouraging appropriate innovation or change (such as increased densities).*
> *d) establish or maintain a strong sense of place, using the arrangement of streets, spaces, building types and materials to create attractive, welcoming and distinctive places to live, work and visit.*
> *e) optimise the potential of the site to accommodate and sustain an appropriate amount and mix of development (including green and other public space) and support local facilities and transport networks.*
> *f) create places that are safe, inclusive and accessible and which promote health and well-being with a high standard of amenity for existing and future users; and where crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesion and resilience."*

**Planning Practice Guidance (NPPG) (2019)**

13.3.4 The National Planning Practice Guidance (NPPG) (Ref 13.3) was published in November 2016 to support the NPPF and was updated in October 2019. There is no guidance within the NPPG related to tall buildings and wind microclimate issues.

**National Design Guide (2021)**

13.3.5 The National Design Guide published in January 2021, refers to building form, especially tall buildings, to look at impacts and how they can be resolved with consideration of the context they are in. In addition, consideration should also be given to how developments can be designed to mitigate or adapt for extreme weather.

**Regional**

**London Plan (2021)**

13.3.6 The London Plan: Spatial Development Strategy for Greater London (2021) ('The London Plan') (Ref 13.6) contains general comments about enhancing the environment, open spaces (both public and private) and impacts on the microclimate. The London Plan includes references to wind microclimate under Policy D3 Optimising Site Capacity Through the Design-led Approach, Policy D8 Public Realm and Policy D9 Tall Buildings:

> *Policy D3 "Optimising Site capacity through the design-led approach" at point 3.3.8 states that: "[…] Particular attention should be paid to the design of the parts of a building or public realm that people most frequently see or interact with in terms of its legibility, use, detailing, materials and location of entrances. Creating a comfortable pedestrian environment with regard to levels of sunlight, shade, wind, and shelter from precipitation is important".*
>
> *Policy D8 "Public realm" at point G says that the Development Plans and development proposals should: "[…] ensure buildings are of a design that activates and defines the public realm and provides natural surveillance. Consideration should also be given to the local microclimate created by buildings, and the impact of service entrances and facades on the public realm".*
>
> *Policy D9 "Tall buildings" requires that: The local "[…] Development Plans should define what is considered a tall building for specific localities, the height of which will vary between and within different parts of London but should not be less than 6 storeys or 18 metres measured from ground to the floor level of the uppermost storey".*
>
> *The Policy D9 also identifies the need to assess the environmental and cumulative impact of tall buildings: "wind […] around the building(s) and neighbourhood must be carefully considered and not compromise comfort and the enjoyment of open spaces, including water spaces, around the building". "Air movement affected by the building(s) should […] not adversely affect street-level conditions". "The cumulative visual, functional and environmental impacts of proposed, consented and planned tall buildings in an area must be considered when assessing tall building proposals and when developing plans for an area. Mitigation measures should be identified and designed into the building as integral features from the outset to avoid retro-fitting".*

**Sustainable Design and Construction Supplementary Planning Guidance (2014)**

13.3.7 The Sustainable Design and Construction, Supplementary Planning Guidance (SPG) (2014) part of the London Plan, states in section 2.3.7 that:

> *"Large buildings have the ability to alter their local environment and affect the microclimate. For example, not only can particularly tall buildings cause a long shadow effecting building several streets away, they can influence how wind travels across a Site, potentially making it unpleasant at ground level or limiting the potential to naturally ventilate buildings. One way to assess the impact of large buildings on the comfort of the street environment is the Lawson Comfort Criteria. This tool sets out a scale for assessing the suitability of wind conditions in the urban environment based upon threshold values of wind speeds and frequency of occurrence. It sets out a range of pedestrian activities from sitting through to crossing the road and for each activity defines a wind speed and frequency of occurrence. Where a proposed development is significantly taller than its surrounding environment, developers should carry out an assessment of its potential impact on the conditions at ground level and ensure the resulting design of the development provides suitable conditions for the intended use."*

**Local**

**London Borough of Camden Local Plan (2017)**

13.3.8 The London Borough of Camden Local Plan (2017) (Ref 13.9) contains the following point in the policy A1 "Managing the impact of development", pertaining to wind microclimate:

> *6.24 (Microclimate) Large developments can alter the local climate. Buildings can affect the flow of air and cause wind tunnels which can potentially affect the enjoyment of public spaces. A building's colour can affect how much heat it absorbs and therefore impact upon local air temperatures. Developments should therefore consider local topography and the local microclimate in their design. Developments large enough to alter the local climate will be required to submit a statement demonstrating how the design has considered local conditions. Further detail can be found in our supplementary planning documents Camden Planning Guidance on sustainability and Camden Planning Guidance on amenity.*
>
> *7.35 (Tall buildings) For this policy tall buildings are considered to be those which are substantially taller than their neighbours or which significantly change the skyline. While tall buildings offer the opportunity for intensive use, their siting and design should be carefully considered in order not to detract from the nature of surrounding places and the quality of life for living and working around them. Applications for tall buildings will be considered against Local Plan policies on design and heritage, along with the full range of policies, including those on mixed use, sustainability, amenity and microclimate. The effect on views and provision of communal and private amenity space will also be important considerations. In assessing applications for tall buildings, the Council will have regard to the London Plan Policy 7.7 on the location of tall and large buildings and the Historic England Advice Note 4 on Tall Buildings.*

**The Historic England Advice Note 4 Tall Buildings (2015)**

13.3.9 The Historic England Advice Note 4 Tall Buildings (2015) document states in:

> 4.7 "*Planning applications for tall buildings are likely to require an environmental impact assessment (EIA), which would be expected to address matters […] including […] other relevant environmental issues, particularly sustainability and environmental performance, e.g. the street level wind environment*".
>
> 4.10 that "*consideration of the impact on the local environment is also important, including microclimate […] and impact on pedestrian experience*".

**Guidance**

**Lawson Comfort Criteria (2001)**

13.3.10 The impact of environmental wind on pedestrian spaces and the subsequent suitability of these spaces for planned usage are described by the Lawson Comfort Criteria (Lawson 2001), which are recognised by Local Planning Authorities (LPAs) as a suitable benchmark for wind assessments.

13.3.11 The Lawson Criteria (Ref 13.5) are well-established in the UK for quantifying wind conditions in relation to build developments and, although not a UK 'standard', the criteria are recognised by local authorities as a suitable benchmark for wind assessments. The CoL Guidelines refer to the City Lawson Criteria, a modified version of the Lawson LDDC criteria.

**The Lawson City of London (2021)**

13.3.12 The Lawson CoL, an implementation of the Lawson Comfort Criteria specifically designed for the City of London urban context, has been applied in the wind assessment of the Site. The Lawson CoL applied to areas of London outside of the City provides a conservative methodology to assess the comfort and safety of proposed developments hosting frail or elderly people.

13.3.13 Wind Microclimate Guidelines for Developments in the City of London (2019) (Ref 13.1) were adopted in August 2019 and are considered the most comprehensive framework available for assessing the impact of new developments on the wind microclimate. Although it has been formulated specifically for application within the City of London, the methodologies detailed can be adapted for application in other locations and this document forms the basis of the analysis carried out.

## 13.4 Consultation

13.4.1 As discussed in **Chapter 2: Approach to Assessment**, consideration has been given to the formal EIA Scoping Opinion provided by LBC and consultees and any additional consultation that may have occurred during the design period of the Proposed Development.

**Table 13.1 Consultation Feedback**

| CONSULTEE | COMMENT | WHERE IS THIS ADDRESSED? |
|---|---|---|
| LBC | 3.104 As set out in Section 6.9.3, it is proposed that the assessment will initially evaluate the likely comfort and safety of users of the external spaces within the site (areas in the immediate surrounding area should also be considered), in line with the Lawson criteria, and inform any necessary mitigation measures, using an initial desk-based approach. Should the results of the study indicate significant effects are likely then further detailed analysis through Computation Fluid Dynamics (CFD) testing would be undertaken. It is unclear under what circumstances an ES chapter would be undertaken. | The ES chapter is based on the CFD testing that will allow to capture the complexity of the Proposed Development.<br><br>Reference to methodology and a description of the CFD modelling is provided in this Chapter. |
| LBC | 3.105 The scope of the proposed 'desk-based approach' is unclear but it would only provide very high-level indicative results and given that the proposals will include multiple high-rise buildings, LBC do not consider such an approach to be sufficiently informative or robust in this case. LBC recommends that the assessment is based on CFD testing. | The desk-based approach has been employed to provide high level advice in the early stage of the design process. The Wind assessment for the EIA will be based on CFD testing. |
| LBC | LBC's recommendation is in line with advice provided in the Wind Microclimate Guidelines for Development in the City of London (City of London Corporation / RWDI, 2019). Effects should be clearly assessed in the context of the Lawson comfort and safety criteria and any mitigation measures required to mitigate significant adverse effects should also be tested by CFD or wind tunnel. The assessment should be reported in a Wind ES chapter. | The CFD study, used as the base for the wind assessment described in this Chapter, has analysed a series of configurations as reported in 13.5.1913.1.3. These are assessed using the Lawson criteria and include the study of mitigation measures. |
| LBC | 3.106 The significance of effect criteria that are applied should be comprehensive, transparent, and repeatable. It is recommended that the criteria set out on page 19 of the Wind Microclimate Guidelines for Development in the City of London (City of London Corporation / RWDI, 2019) are used. Should the criteria that are used by the Applicant's consultants require any comparison of the effects of | Wind Microclimate Guidelines for Development in the City of London have been used to assess the Proposed Design in the CFD study. Baseline model has been also assessed using the same guidance. |

| | | |
|---|---|---|
| | the scheme with the baseline conditions (as the criteria recommended by CBRE above do), the baseline conditions should also be assessed by CFD. | |
| LBC | 3.107 The inter-development cumulative wind effects assessment should take into account any committed schemes with the potential to cumulatively interact with the proposed development. | The list of committed schemes, included in the cumulative configuration analysed in this CFD study for the EIA, is reported in **Chapter 17**. |

## 13.5 Assessment Methodology and Significance Criteria

13.5.1 The following section outlines the methodologies applied to identify and assess the potential impacts and likely effects to result from the Proposed Development.

**Scope of the Assessment**

13.5.2 An EIA Scoping Report was issued to LBC in April 2021 (**Appendix 2.1**). LBC's formal Scoping Opinion was issued in September 2021 (**Appendix 2.2**).

13.5.3 The following potential effects were scoped into the assessment:

- Ground level wind conditions; and
- Elevated amenity space wind conditions.

**Likely Significant Effects**

*Demolition and Construction Phase*

13.5.4 Demolition and construction phase will be assessed qualitatively.

*Operational Phase*

13.5.5 The configuration with the completed development will be assessed quantitatively within this chapter to fully assess and quantify this change in wind speeds in relation to the Lawson Criteria

**Extent of The Study Area**

13.5.6 The Site location and surroundings are shown in Figure 13.1 The Site is currently occupied by the O2 Centre, associated O2 Centre car park, Homebase store, Car showrooms and Builder's merchant in Finchley, within LBC. It is bounded by Blackburn Road, which envelops the Site along its southern and northern edge, also extending to the west. Finchley Road (A41) bounds the Site to the east, with Billy Fury Way to the west. The Thameslink Bedford-Brighton railway line runs along the northern edge of the Site, and the London Underground Jubilee and Metropolitan lines run above ground along the southern edge of the Site. The extent of the area analysed in the Wind Microclimate assessment is represented by a circle of 850m radius from the centre of the Site (Figure 13.2).


**Figure 13.1 Boundary of the Site**


**Figure 13.2 Extent of the study area**

**Method of Baseline Collection**

13.5.7 For the purpose of this assessment, no Site visit or surveys were required. Geometry data needed for the construction of the 3D computational domain analysis have been provided by the Project Architects and the Landscape Designers.

**Method of Assessment**

Demolition & Construction Phase

13.5.8 A qualitative assessment of the wind microclimate during demolition and construction has been undertaken and is based on professional judgement informed by an assessment of the background wind microclimate in the area and experience of assessing wind in the built environment.

13.5.9 The residual effects reported for the demolition and construction phases of the Proposed Development are considered to be temporary, whereas effects outlined in the assessment for the complete and occupied Proposed Development are permanent.

Operational Phase

13.5.10 The assessment has been undertaken to investigate the likely pedestrian conditions in and around the Proposed Development when subject to wind conditions from different directions and includes an assessment of the appropriateness of different parts of the site for their intended use. 'Safety and Comfort maps' have been created to illustrate the assessment. These maps include a direct correlation between the wind speeds calculated by the CFD simulations and the wind frequency data for the last ten years. The assessment provides a picture of the conditions related to certain activities, indicating if suitable conditions are achieved for carrying out such activities or if distress is likely to be experienced.

13.5.11 The assessment is based on the City of London Wind Microclimate Guidelines. The guidelines provide general advice on wind microclimate studies required as part of planning applications in the City of London (CoL). Even though the Site is not located within the City of London, the guidelines are considered appropriate for the type of sensitive users (vulnerable people including frail and elderly people) that will utilise the future Site. The Guidelines focus on the primary factors that affect the quality and consistency of wind microclimate studies and include a direct comparison between the baseline conditions and those created by the Proposed Development for 36 wind directions every 10 degrees starting from north. The assessment utilises the Lawson Comfort Criteria for City of London (Lawson CoL) method and determines the significance of wind effects by studying the quantitative nature of the likely wind environment. Quantitative judgements are made in order to identify areas of potential concern. This approach identifies the sensitivity to wind conditions of intended activities (e.g. walking / sitting) and assesses the magnitude of change in suitability of the external environment for these intended uses.

13.5.12 A quantified assessment of the existing wind environment at the Site is used to establish the 'Baseline scenario'. This is followed by an assessment of the Proposed Development modelled within the existing surroundings and finally by an assessment of the Proposed scenario including the effect of Cumulative "consented" developments.

13.5.13 The extent of study area covers an 850m radius from the Site in line with best practice guidance and in line with the overall massing distribution of the Proposed Development that mostly extends along the east-west axis. The assessment considers the geometry and size of the proposed massing including the effect of the surrounding context. A 3D model of the Proposed Development has been produced for the assessment, based on the Detailed and Outline Proposals.

13.5.14 As outlined in **Volume 1, Chapter 2: Approach to the Assessment** of this ES, for the Outline Proposals, the relationship between the Development Plots, Building Lines and limits of deviation are set out in the Design Guidelines, which together with the Parameter Plans are submitted for approval and which therefore set the parameters and form of development. This ES and Chapter includes an assessment of one of the potential forms that the Proposed Development could take within the parameters. It does not include an assessment of all of the possible locations of the footprints of the buildings within the limits of deviation, given the number of permutations this would involve.

13.5.15 However, it is considered that the type and/or magnitude of the effects that are likely to be experienced as a consequence of the Proposed Development will not differ materially as a result of a form of development coming forward which sits on a building footprint which is within the permitted deviation of the building lines contained in the Parameters Plans and Design Guidelines. Therefore, in order to ensure that whatever form of development that comes forward is properly assessed, it is proposed that a condition is imposed on the planning permission to be granted for the Proposed Development requiring that the reserved matters are accompanied by a statement confirming that the effects remain as assessed or, if they do not, a supplementary environmental statement which assesses any new or different significant impacts. This will ensure that Camden Council as the local planning authority is provided with sufficient environmental information when it determines the reserved matters submission.

13.5.16 The methodology combines the use of Computational Fluid Dynamics (CFD) to predict air flows and wind velocities around the Proposed Development, the use of long-term wind data records from a suitable meteorological station and recommended comfort and safety criteria (Lawson Criteria). The recommended guidance is based on the frequency of exceedance of wind speeds for all incoming wind directions; therefore, in addition to the wind modelling, a statistical procedure to combine the wind speed frequencies with historical wind data is be carried out to determine the suitability of the Site for the various pedestrian categories (sitting, standing strolling and business walking).

13.5.17 Where the results of the assessments identify areas for which the recommended standards are not met or where the suitability exceeds that of the intended use, mitigation measures are identified to limit the adverse effect of the Proposed Development and/or achieve suitability for the designated uses.

13.5.18 The assessment employs the Reynolds Averaged Navier-Stokes (RANS) equations. These equations are time independent and use a time average approach that leads to a statistically steady description of the turbulent flow. Nonetheless, the results obtained by the use of RANS equations provide an adequate representation of the flow as if it was studied in a wind tunnel, as also in the wind tunnel the flow conditions are represented with a time averaged approach.

13.5.19 The assessment is supported by CFD modelling of the full range of wind speeds and directions on Site for a total of three configurations, as follows:

- Configuration 1: Existing Site with existing surroundings (Baseline);
- Configuration 2: Proposed Development with existing surroundings (Proposed); and
- Configuration 3: Proposed Development and Cumulative buildings (Cumulative).

13.5.20 Proposed Site landscaping of the Proposed Development has not been included in configurations 2 and 3 that were run as part of the design development work. The results of configurations 2 and 3 therefore assess a worst-case scenario as the CFD study was conducted without trees or landscaping detail, in order to obtain conservative results (i.e., generate a relatively windy microclimate and therefore a robust assessment). Mitigation for the Outline Proposals is discussed but will need to be confirmed when the detailed proposals emerge at the Reserved Matters stages.

13.5.21 Wind speed at each location was measured for 36 wind directions in 10° increments, with 0º representing wind blowing from the north and 90° wind blowing from the east.

## 13.6 Lawson Comfort Criteria

13.6.1 The Lawson Comfort Criteria assess the suitability of wind conditions for pedestrians in outdoor spaces. Wind microclimate comfort strongly depends on the activity undertaken by an individual. The LCC defines separate activity types and for each one of them it defines a threshold calculated as mean wind speed and frequency of occurrence during the year. Once the threshold is exceeded the stated activity becomes unacceptable. If the wind conditions are below the threshold, the stated activity is carried on in suitable wind conditions. For example, in the case of the CoL LCC, an activity like “frequent sitting” in an outdoor café table is suitable (tolerated by the user) only if the wind speed is not greater than 2.5m/s for more than 5% of the time in a year. If this limit is surpassed than the sitting area becomes only suitable for “occasional sitting” activities. The London Docklands Development Corporation (LDDC) variant of the Lawson Comfort Criteria (LCC), also called City of London (CoL) Lawson Criteria, used in this assessment, is described in Table 13.2.

**Table 13.2 Lawson Comfort Criteria for CoL (adapted for the purpose of EIA)**

| COMFORT CATEGORY DESCRIPTION | BEAUFORT SCALE | IMPACT THRESHOLD (M/S) | EXCEEDANCE THRESHOLD | SUITABLE ACTIVITY DESCRIPTION |
|---|---|---|---|---|
| Pedestrian Safety Limit | B7 | 15 | 0.022% | Presents a safety risk for pedestrians, especially to more vulnerable members of the public |
| Uncomfortable | B5 | >8 | 5% | Not comfortable for regular pedestrian access. |
| Walking | B5 | 8 | 5% | Acceptable for external pavements, walkways |
| Standing | B4 | 6 | 5% | Acceptable for entrances, bus stops, covered walkways or passageways beneath buildings. |
| Occasional Sitting | B3 | 4 | 5% | Acceptable for occasional outdoor seating, e.g. general public outdoor spaces, balconies and terraces intended for occasional use, etc |

| | | | | |
|---|---|---|---|---|
| Frequent Sitting | B2 | 2.5 | 5% | Acceptable for frequent outdoor sitting use, e.g. restaurant, café. |

## 13.7 Significance Criteria

Receptor Sensitivity

13.7.1 Sensitive receptors in respect of wind microclimate are the occupants and users of the Site and surrounding area. Given that pedestrians are human receptors and will include vulnerable people, the receptor sensitivity is considered to be 'High'.

Magnitude of Change

~~13.7.2 The magnitude of change has been considered as the change experienced from the baseline conditions at the sensitive receptor. The following scale is used to assess the magnitude of change.~~

- ~~**High**: Any effect on wind conditions which is expected to alter pedestrian safety.~~
- ~~**Medium**: Any effect on wind conditions which is expected to alter pedestrian comfort from unsuitable to suitable or vice versa, for planned activities.~~
- ~~**Low**: Any effect on wind conditions which is expected to alter pedestrian comfort from unsuitable to marginal/tolerable, or vice versa, for planned activities, or from marginal/tolerable, or vice versa, to suitable for planned activities.~~
- ~~**Negligible**: Any effect that does not alter the suitability of existing wind conditions with respect to planned activities (pedestrian comfort).~~

~~13.7.3~~13.7.2 As set out in **Chapter 2: Approach to EIA**, effects that are classified as moderate or above are considered to be significant. Effects classified as below moderate are considered to be not significant.

~~13.7.4~~13.7.3 Wind conditions where the velocity is greater than 15m/s for more than 0.0022% of the year, are reported separately from the LCC and therefore they are not part of the significance criteria. Strong wind exceedance is considered to be significant regardless of its scale.

~~13.7.5 The significance of the effect is determined based on the cases below:~~

- ~~**Major effect**: where the Proposed Development could be expected to have a large improvement or deterioration on receptors.~~
- ~~**Moderate effect**: where the Proposed Development could be expected to have a noticeable improvement or deterioration on receptors.~~
- ~~**Minor effect:** where the Proposed Development could be expected to result in a small improvement or deterioration on receptors, or~~
- ~~**Negligible:** where no discernible improvement or deterioration is expected as a result of the Proposed Development on receptors, including instances where no change is confirmed.~~

~~13.7.6~~13.7.4 The assessment of significance refers to the CoL Lawson Criteria to determine the significance of the effect of the Proposed Development with respect to the wind environment; comparison can be made with the conditions on the existing Site. The nature of an effect can either be positive, negative or neutral as follows:

- **Positive:** the measured criteria are less windy than the baseline or desired conditions.
- **Negative:** the measured conditions are windier than the baseline or desired conditions for the intended use of the Site, or
- **Neutral:** the measured conditions are equivalent to the baseline or desired conditions for the intended use of the Site.

~~13.7.7~~13.7.5 In case of on-site receptors where a direct comparison with the Baseline condition is not possible, for example if the massing of the Proposed Development differs substantially from that of the Baseline, the assessment has taken into account the variation in modelled wind conditions compared to the desired conditions for the required activity. The significance of on-site measurement locations is defined using Table 13.3.

~~13.7.8~~13.7.6 Off-site surrounding areas instead, where building massing and pedestrian activity are not likely to be altered by the Proposed Development, a direct comparison with the baseline conditions is appropriate. In this assessment however, since the wind conditions of the off-site receptors were unaffected by Proposed Development and/or no safety issues were identified, no off-site receptors have been reported as uncomfortable or unsafe. The significance of off-site measurement locations is defined using Table 13.4 below.

**Table 13.3 Significance of On-Site Receptors**

| SIGNIFICANCE | TRIGGER | MITIGATION REQUIRED? |
|---|---|---|
| Major Negative | Conditions are ‘unsafe’. | YES |
| Moderate Negative | Conditions are ‘unsuitable’ (in terms of comfort) for the intended pedestrian use. | YES |
| Negligible | Conditions are ‘suitable’ for the intended pedestrian use. | NO |
| Moderate Positive | Conditions are calmer than required for the intended pedestrian use (by at least one comfort category). | NO |

**Table 13.4 Significance of Off-Site Receptors**

| SIGNIFICANCE | TRIGGER | MITIGATION REQUIRED? |
|---|---|---|
| Major Negative | Conditions that were ‘safe’ in the baseline scenario become ‘unsafe’ as a result of the Proposed Development OR Conditions that were ‘suitable’ in terms of comfort in the baseline scenario become ‘unsuitable’ as a result of | YES |

| | | |
|---|---|---|
| | the Proposed Development OR Conditions that were 'unsafe' in the baseline scenario. | |
| Moderate Negative | Conditions that were 'suitable' in terms of comfort in the baseline scenario are made windier (by at least one comfort category) as a result of the Proposed Development but remain 'suitable' for the intended pedestrian activity. | NO |
| Negligible | Conditions remain the same as in the baseline scenario. | NO |
| Major Positive | Conditions that were 'unsafe' in the baseline scenario become 'safe' as a result of the Proposed Development. | NO |
| Moderate Positive | Conditions that were 'unsuitable' in terms of comfort in the baseline scenario become 'suitable' as a result of the Proposed Development OR Conditions that were 'unsafe' in the baseline scenario are made better as a result of the Proposed Development (but not so as to make them 'safe'). | NO |

## 13.8 Baseline Conditions

13.8.1 This section outlines the existing baseline conditions of the Site.

13.8.2 The Baseline wind microclimate refers to existing wind microclimate conditions identified within the Site in its current status. The Baseline conditions have been studied considering the massing of the existing buildings on Site and all existing surrounding buildings, including the terrain profile and vegetation. The existing Site includes the buildings which will be demolished; it is considered that if these buildings were to be excluded and this part of the Site was then effectively vacant, it would give an unrealistic reflection of the wind microclimate in the Baseline conditions. Figure 13.3 and 13.4 visualise the computational model representing the geometry field used in the Wind Microclimate analysis to assess Baseline conditions.

**Figure 13.3 Baseline computational model**

**Figure 13.4 Baseline computational model, Site.**

13.8.3 Baseline conditions on an annual and seasonal basis are included within Appendix 13.1 Wind Microclimate - Safety and Comfort Maps. A summary at ground level based on the worst-case winter season results is provided below and in Figure 13.5~~Figure 13.5~~.

13.8.4 Safety conditions within and around the Site are safe for pedestrians and cyclists. No LSC exceedances of the 15m/s strong winds threshold have been detected in the analysis of the worst-case scenario (winter).

13.8.5 Conditions within and around the Site are suitable for frequent sitting, occasional sitting, and standing are thus suitable for existing pedestrian activities during summer and winter. No LCC exceedance has been identified.

13.8.6 During the summer season, wind conditions are generally one category calmer than the winter season. Seasonal outputs are provided in **Appendix 13.1**.

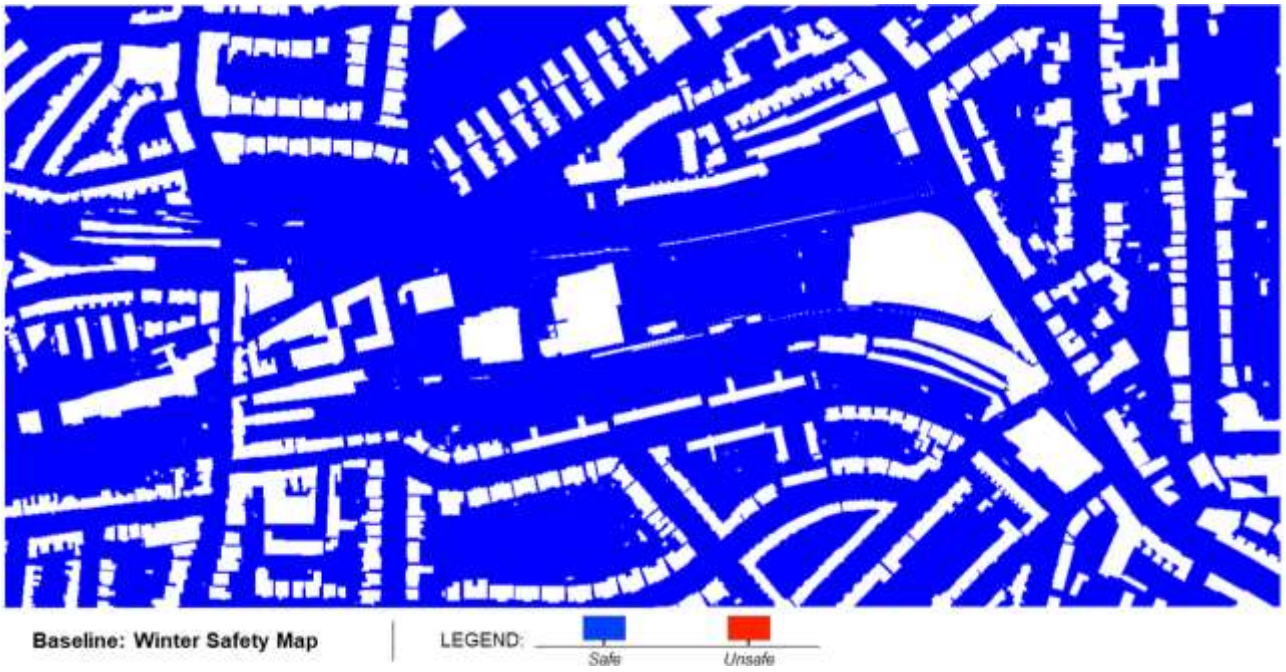


**Figure 13.5 Baseline Winter Safety Map**

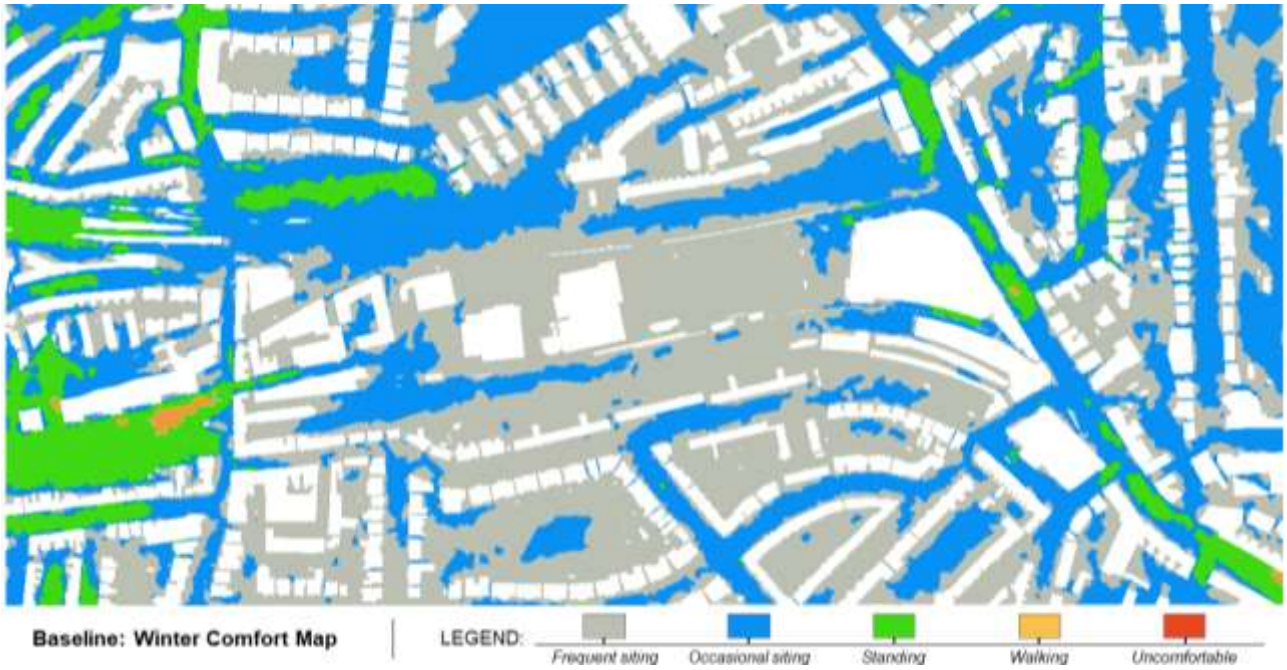


**Figure 13.6 Baseline Winter Comfort Map**

**Future Baseline**

13.8.7 The Baseline conditions are not expected to change significantly from a Wind Microclimate perspective over time. The UK Climate Change Projections 2018 (UKCP18) found an increase in near surface wind speeds over the UK for the 2nd half of the 21st century for the winter season when more significant impacts of wind are experienced. However, the increase in wind speeds is modest compared to natural variability from month to month and season to season. Given these projections, assessment of the Future Baseline is not deemed to be necessary.

## 13.9 Sensitive Receptors

13.9.1 For pedestrian comfort studies, the significance of the wind effect is measured at selected locations at the Site and surrounding area to represent sensitive receptors at a height of 1.5m above the relative pedestrian levels. The following on-site and off-site sensitive receptors have been assessed:

- Pedestrian and cyclist thoroughfares both on-site and off-site
- Pedestrian entrances both on-site and off-site (as indicated in the 3D model geometry provided by the project Architects and reported in the DAS and application plans);
- Pedestrian on ground level amenity spaces both on-site and off-site (as indicated in the 3D model geometry provided by the project Architects and reported in the DAS and application plans).
- 

## 13.10 Proposed Conditions

13.10.1 This section outlines the potential conditions of the Proposed site configuration.

13.10.2 The Proposed conditions have been studied considering the massing of the Proposed Development with the existing surrounding buildings, terrain profile and existing vegetation either within the surroundings or due to be retained within the development. Both Detailed and Outline design have been assessed together as one comprehensive masterplan.

*Ground Level*

13.10.3 Proposed conditions on an annual and seasonal basis are included within Appendix 13.1 Wind Microclimate - Safety and Comfort Maps. A summary of the winter conditions at ground level for the Lawson Safety Criteria (LSC) and the Lawson Comfort Criteria (LCC) are provided below respectively in Figure 13.7~~Figure 13.7~~ and Figure 13.8~~Figure 13.8~~.

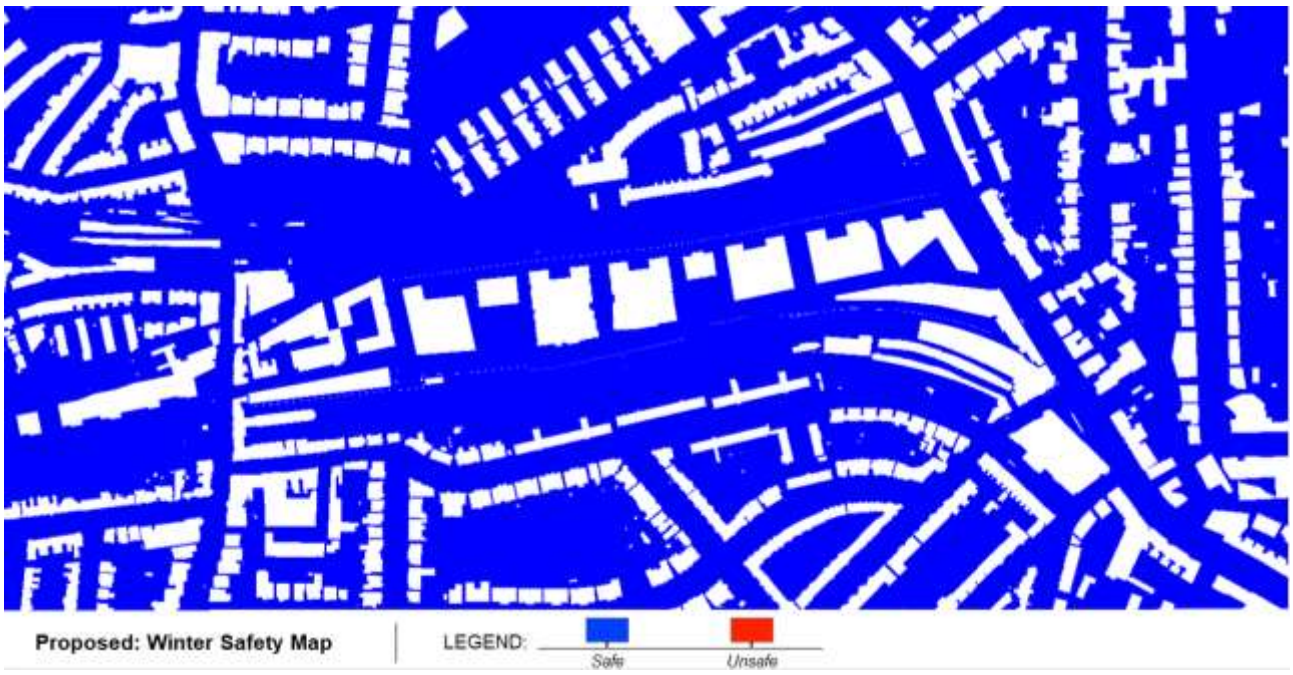


**Figure 13.7 Proposed winter safety map (LSC)**


**Figure 13.8 Proposed winter comfort map (LCC)**

9.1.1. The winter (worst season) exceedance map of the Lawson Safety Criteria (LSC) is presented in Figure 13.7~~Figure 13.7~~. The map indicates that the conditions for members of the public (pedestrians and cyclists) are safe. Areas where the wind has the potential to cause injury are absent for both on-site and off-site receptors.

9.1.2. The exceedances of the Lawson Comfort Criteria (LCC) in winter (worst season) are shown in Figure 13.8~~Figure 13.8~~. Localised wind conditions are in general one to two categories higher than in the Baseline, showing that the construction of the Proposed Development has increased the possibility of higher wind acceleration at ground level to the on-site receptors. However, all effects are compatible with the proposed receptor's activities.

*Terraces, Podiums and Balcony levels*

9.1.3. The winter (worst season) exceedance maps of the Lawson Safety Criteria (LSC) are presented in Figure 13.9~~Figure 13.9~~, Figure 13.10~~Figure 13.10~~ and Figure 13.11~~Figure 13.11~~. The maps indicate that the conditions on Terraces, Podiums and Balconies are generally safe. Numbers indicate wind effects which are referred to in Table 13.5~~Table 13.5~~. There are some limited terrace areas of Buildings N1, N2 and N3 that exceed the safety criteria. The upper roof terraces (grey numbering) are intended as plant areas not accessible by the general public. These areas are not included in the possible effects; a separate note on the maintenance access to terraces has been made in the conclusions.

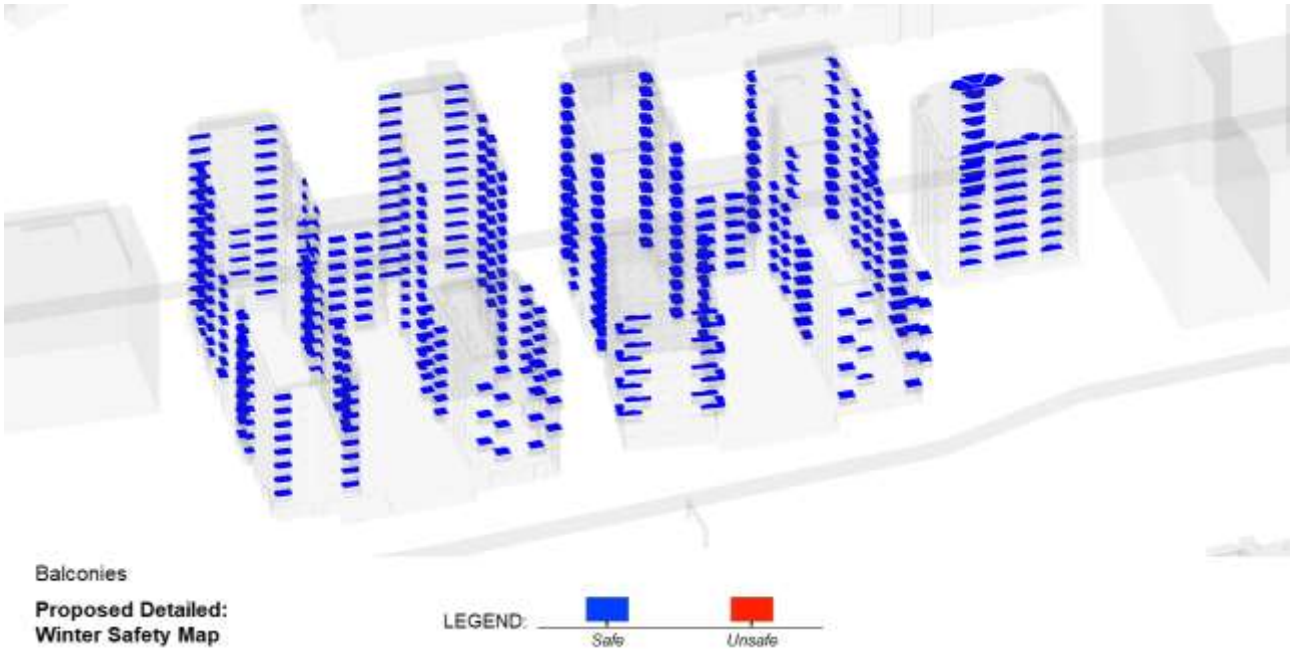


**Figure 13.9 Proposed winter safety map on Balconies (LSC), Detailed Proposals**

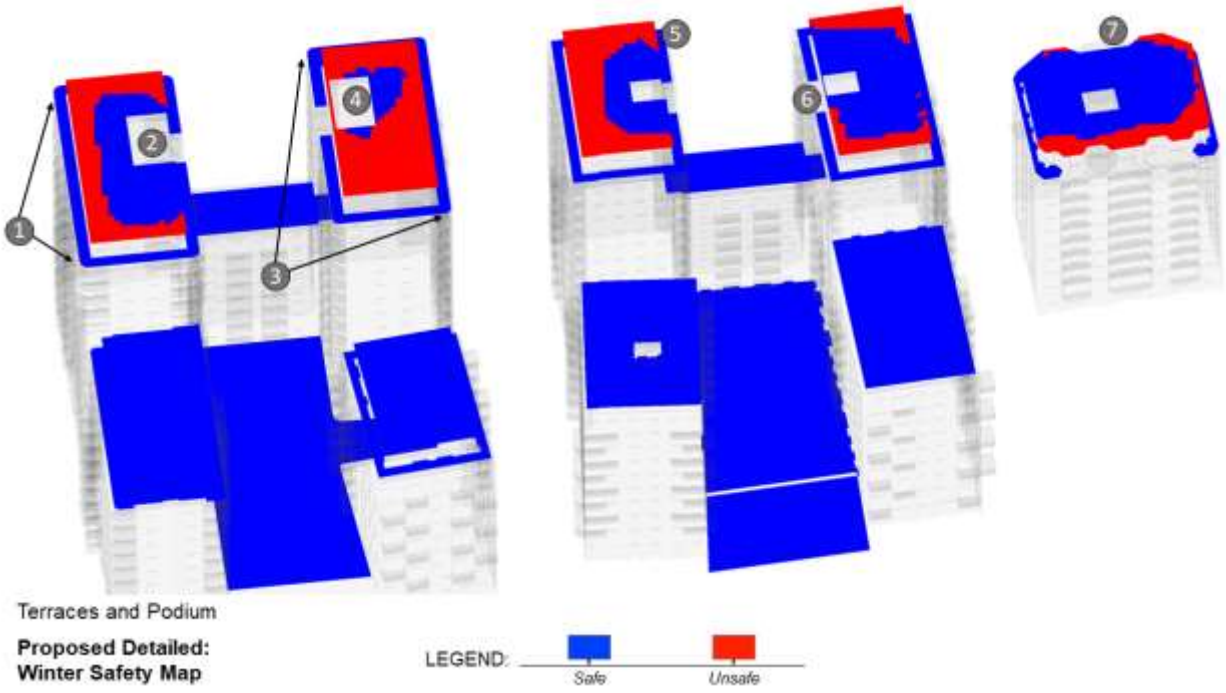


**Figure 13.10 Proposed winter safety map on Terraces and Podiums (LSC), Detailed Proposals.**

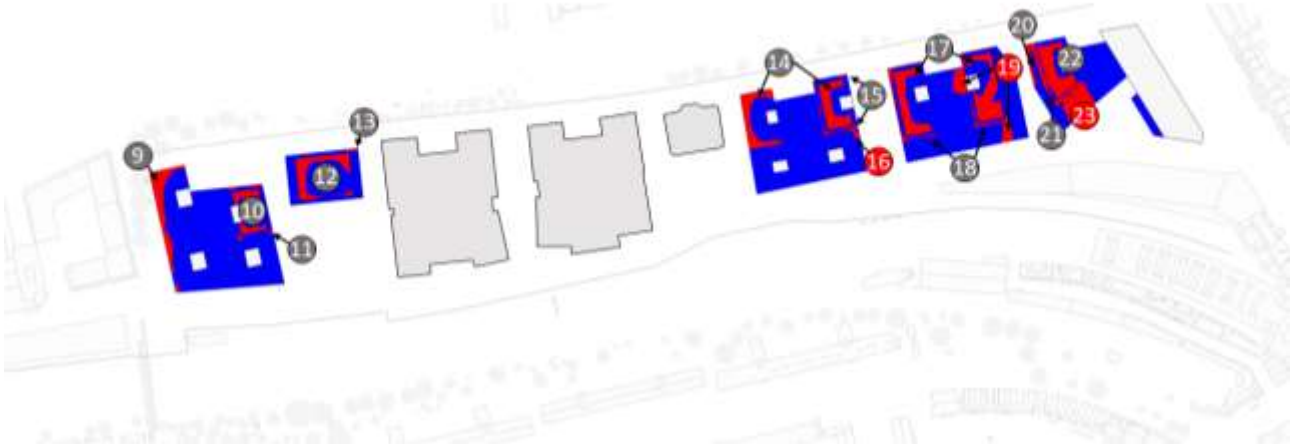


**Figure 13.11 Proposed winter safety map on Terraces and Podium (LSC), Outline Proposals.**

9.1.4. The Lawson Comfort Criteria (LCC) assessment in winter (worst season) has shown that conditions on all balconies of the Detailed Proposals are comfortable throughout the year and therefore no exceedance has been reported in the associated receptors (Figure 13.12~~Figure 13.12~~). The balconies are overall sheltered by the implemented mitigation (solid balustrade), and the wind conditions are almost everywhere compatible with “frequent sitting” and “occasional sitting” activity; although in some cases, especially in the south facing balconies, the edge of the balconies can experience accelerations that make this portion only suitable for standing. The extent of the localised areas only suitable for standing is reduced to be negligible in summer (see Appendix 13.1), when people would be expected to spend periods sitting outside. Therefore, these conditions are considered suitable.

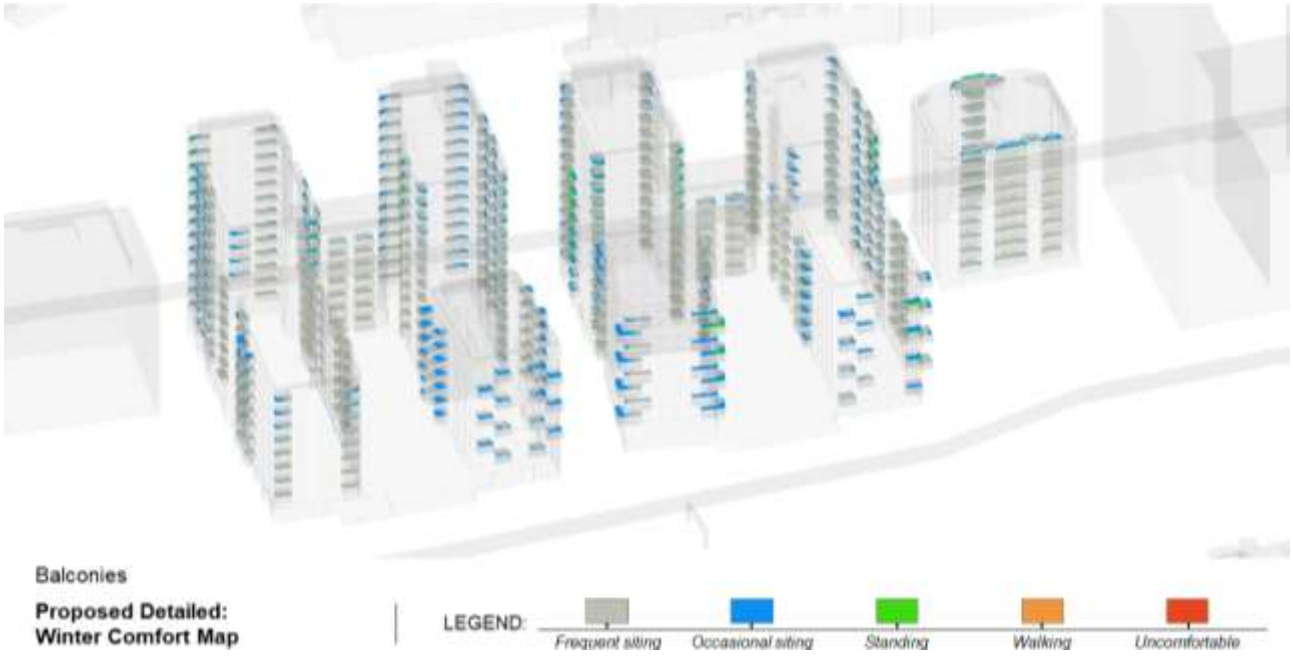


**Figure 13.12 Proposed winter comfort map on Balconies (LCC), Detailed Proposals**

9.1.5. Figure 13.13~~Figure 13.13~~ indicates the LCC exceedances on the terraces. In these locations the wind conditions are one or two categories higher than the standing category. There are some localised areas on the communal roof terraces that are only suitable for standing. However, conditions are suitable for sitting during the summer months (see Appendix 13.1) and, as such, are considered suitable. Some of the receptors have presented comfort issues on roof terraces, with some areas along the perimeter identified as “uncomfortable”. However, as discussed for the safety aspects, these roof terraces are inaccessible to the public and only used for maintenance.

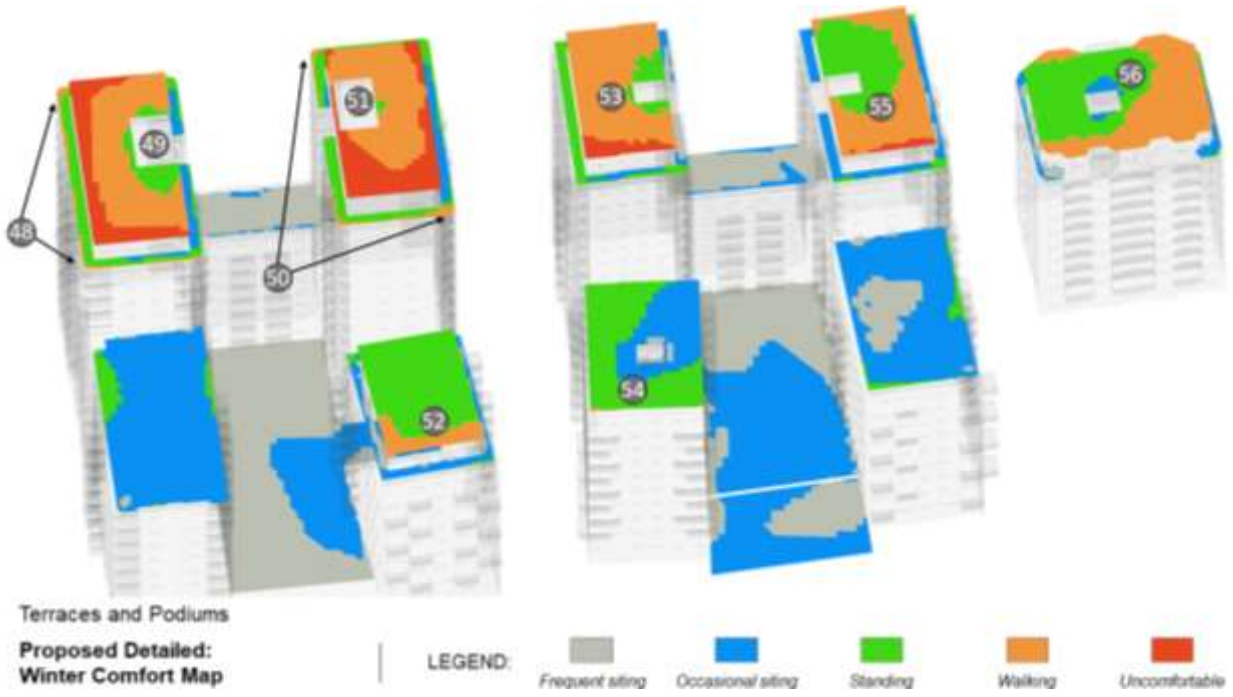


**Figure 13.13 Proposed winter comfort map on Terraces and Podium (LCC), Detailed Proposals**

9.1.6. Figure 13.14~~Figure 13.14~~ shows the LCC exceedances in winter on the terraces and podiums of the Outline Proposals. Wind conditions in winter in all Podiums are suitable for “frequent sitting” and “occasional sitting”, the terraces instead (including the links, the upper terraces as well as the intermediate accessible terraces) show exceedances that suggest these spaces will be only suitable for “standing” and “walking”. “Uncomfortable” conditions have been identified in some of the upper terraces and in a few intermediate terraces (N2 and N1), however it must be noted that, considering the Outline status of the application for these buildings, mitigation strategies still need to be discussed and implemented as the detailed design is developed at the reserved matters stages.

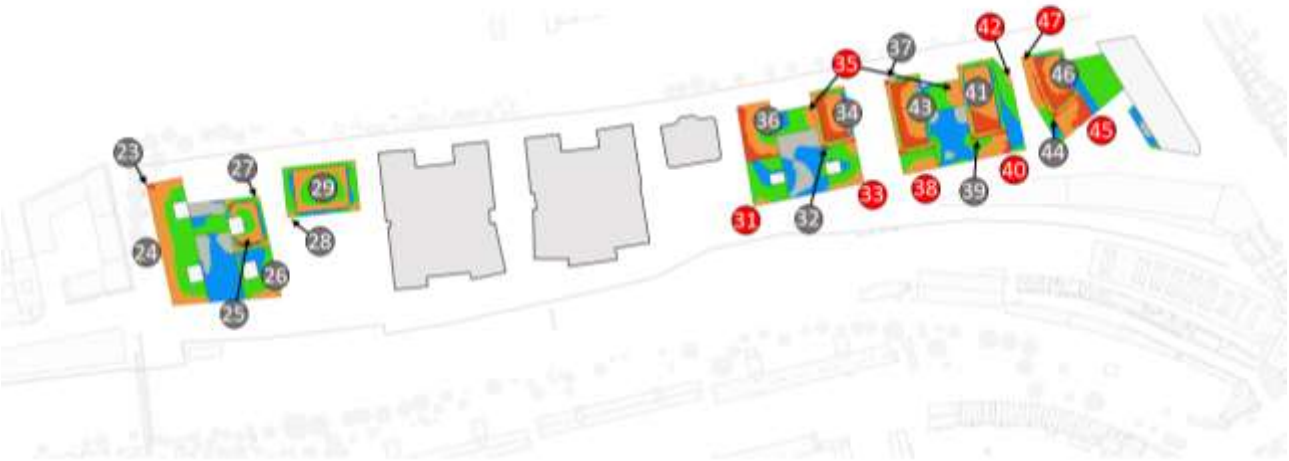


**Figure 13.14 Proposed winter comfort map on Terraces and Podium (LCC), Outline Proposals**

## 13.11 Assessment of Effects, Mitigation and Residual Effects

13.11.1 This section identifies and assesses the scale and nature of the main effects arising from the Proposed Development. The Proposed scenario has been assessed against the Lawson Safety Criteria (LSC) and the Lawson Comfort Criteria (LCC).

13.11.2 All the on-site and off-site receptors that present safety or comfort concerns will be analysed in detail in the following paragraphs, while all other receptors that do not present any risk won't be discussed.

13.11.3 Ground level, Balconies, Podiums and Terraces where wind conditions are compatible with sitting or standing activities won't be discussed.

13.11.4 Roof terraces not accessible by the public, and only used for maintenance, won't be discussed, however a note on these will be made in the "Limitation and Assumptions" paragraph, as access to maintenance will need to be assesses on an *ad hoc* basis and only granted if wind conditions will be favourable.

**Demolition & Construction Phase**

13.11.5 Wind conditions during the demolition and construction works would be expected to gradually adjust from those of the Baseline Scenario, to the likely wind conditions identified for the Completed Development.

13.11.6 Wind conditions during the demolition and construction works of the Proposed Development, on-site would therefore represent a negligible effect. Therefore, no mitigation is required.

**Operational Phase**

**LSC and LCC Effects at Ground Level and Podium**

13.11.7 Sensitive receptor: Public realm, pedestrian thoroughfare and cyclist route. On-site receptor.

13.11.8 The comfort and safety conditions are satisfied in every considered receptor at ground level. The windiness conditions are compatible with the proposed activities.

**Table 13.5 LSC Effects on Terraces and Balconies**

| LSC Effects on Terraces and Balconies | |
|---|---|
| **Sensitive receptor** | Roof, Buildings N1, N2 and N3. On-site receptor. |
| **Potential effects** | LSC Exceedance at locations 16, 19 and 23 (**Figure 13.11**~~**Figure 13.11**~~), where wind accelerates due to corner effects. The LSC Exceedance will impact the roof of Buildings N1, N2 and N3.<br><br>The sensitivity of pedestrians is considered to be **High**, and the magnitude of change, is **High**. Therefore, there is likely to be a direct, temporary, medium-term **Major Negative** effect on Pedestrian ('**significant'**) that will require mitigation. |
| **Additional mitigation** | It is recommended that these terraces incorporate balustrades at least 1.2m in height.<br><br>The wind conditions at these locations are expected to improve significantly. It is anticipated that following additional mitigation there will no longer be an exceedance of the LSC. Where these areas are used as plants, a management procedure will be necessary to avoid unsafe wind conditions. |
| **Residual effects and monitoring** | The magnitude of change, following mitigation, is **Negligible**. Therefore, there is likely to be a direct, permanent, long-term **Negligible** residual effect on pedestrians ('**not significant'**) following the implementation of mitigation measures.<br><br>However, the effectiveness of the mitigation can only be tested at the detailed design stage, so, the residual effects remain as per the above, Major Negative (Significant). |

**Table 13.6 LCC Effects on Terraces and Balconies**

| LCC Effects on Terraces and Balconies | |
|---|---|
| **Sensitive receptor** | Communal roof terraces, Buildings N1 and N2. On-site receptor, Outline design. |
| **Potential effects** | LCC Exceedance at locations 40 and 45 (Figure 13.13~~Figure 13.13~~), where wind accelerates due to corner effects and partial downwash. The LCC Exceedance will impact the communal, south facing, intermediate roof terraces of Buildings N1, N2.<br><br>The sensitivity of pedestrians is considered to be **High**, and the magnitude of change, is **Medium**. Therefore, there is likely to be a direct, temporary, medium-term **Major Negative** effect on Pedestrian ('**significant'**) that will require mitigation. |
| **Additional mitigation** | As the design of the buildings N1, N2 is in the Outline phase, no mitigation strategies have been implemented yet. It is recommended that these terraces incorporate balustrades at least 1.2m in height and plants or small trees/pergolas are used in the south east corner of the common terraces of both Buildings. It is our judgement that following this mitigation there will no longer be an exceedance of the LCC. |
| **Residual effects and monitoring** | The magnitude of change, following mitigation, is **Negligible**. Therefore, there is likely to be a direct, permanent, long-term **Negligible** residual effect on pedestrians ('**not significant'**) following the implementation of mitigation measures.<br><br>However, the effectiveness of the mitigation can only be tested at the detailed design stage, so, the residual effects remain as per the above, Major Negative (Significant). |
| | |
| **Sensitive receptor** | Communal roof terraces, Buildings N2, N3. On-site receptor, Outline design. |
| **Potential effects** | LCC Exceedance at locations 35 (Figure 13.13~~Figure 13.13~~), where wind accelerates due to corner effects and downwash form adjacent facades. The LCC Exceedance will impact the communal links' roof terraces of Buildings N2, N3.<br><br>The sensitivity of pedestrians is considered to be **High**, and the magnitude of change, is **Medium**. Therefore, there is likely to be a direct, temporary, medium-term **Major Negative** effect on Pedestrian ('**significant'**) that will require mitigation. |
| **Additional mitigation** | The design of the buildings N2, N3 is still in the Outline phase, and no mitigation strategies have been implemented yet. This ensures a robust assessment. It is recommended that these terraces incorporate balustrades at least 1.2m in height and, it is suggested that small trees or pergolas are used in the east side of both common terraces. It is our judgement that following this mitigation there will no longer be an exceedance of the LCC. |
| **Residual effects and monitoring** | The magnitude of change, following mitigation, is **Negligible**. Therefore, there is likely to be a direct, permanent, long-term **Negligible** residual effect on pedestrians ('**not significant'**) following the implementation of mitigation measures.<br><br>However, the effectiveness of the mitigation can only be tested at the detailed design stage, so, the residual effects remain as per the above, Major Negative (Significant). |
| | |

| | |
|---|---|
| **Sensitive receptor** | Communal roof terraces, Buildings N1, N2, N3. On-site receptor, Outline design. |
| **Potential effects** | LCC Exceedance at locations 31, 33, 38, 42 and 47 (Figure 13.13~~Figure 13.13~~), where wind accelerates due to corner effects, partial downwash and funnelling at lower terraces in N1. The LCC Exceedance will impact the communal, south facing, intermediate roof terraces of Buildings N1, N2 as well as the north east terrace of N2 and the west terrace of N1.<br><br>The sensitivity of pedestrians is considered to be **High**, and the magnitude of change, is **Medium**. Therefore, there is likely to be a direct, temporary, medium-term **Major Negative** effect on Pedestrian ('**significant'**) that will require mitigation. |
| **Additional mitigation** | As the design of the buildings N1, N2 and N3 is still in the Outline phase, no mitigation strategies have been implemented yet. It is recommended that balustrades at least 1.2m in height are implemented as mitigation strategies. The use of small trees or pergolas is also recommended in all locations. It is our judgement that following this mitigation there will no longer be an exceedance of the LCC. |
| **Residual effects and monitoring** | The magnitude of change, following mitigation, is **Negligible**. Therefore, there is likely to be a direct, permanent, long-term **Negligible** residual effect on pedestrians ('**not significant'**) following the implementation of mitigation measures.<br><br>However, the effectiveness of the mitigation can only be tested at the detailed design stage, so, the residual effects remain as per the above, Major Negative (Significant). |

## 13.12 Limitation and Assumptions

13.12.1 To ensure transparency within the EIA process, the following limitations and assumptions have been identified.

13.12.2 The mitigation measures for the Outline Proposals have not yet been fully developed and so not all residual conditions have been directly assessed. These will be developed at later stages. Nevertheless, the results of the assessment already undertaken are considered appropriate and reliable.

13.12.3 It is recommended that further quantitative assessments are undertaken as the scheme progresses to detailed design (as part of reserved matters application) to identify and verify effective mitigation measures for detailed elements of the wider development site proposals.

13.12.4 The analysis has indicated that the upper roof terraces in totality of the Proposed Development (outline and detailed) will experience unsafe wind conditions. However, as they are indicated as “plant areas” or “brown and green roofs”, no amenity activity should take place on them. Even if these receptors have been considered as inaccessible to people, if not for the sole purpose of maintenance activities, the risk identified in this report should still be considered, and it is therefore recommended that the access to the terraces will be granted for maintenance only if wind conditions will allow it.

13.12.5 A qualitative assessment of the wind microclimate during demolition and construction has been undertaken and is based on professional judgement informed by an assessment of the background wind microclimate in the area and experience of assessing wind in the built environment.

13.12.6 The trees that will be retained on Site have been modelled as porous elements with overall porosity of 50%.

## 13.13 Summary

13.13.1 Baseline conditions: on-site and off-site receptors do not show any safety risk. No uncomfortable condition has been identified at on-site or off-site receptors.

13.13.2 There are no significant effects identified in the assessment of the Detailed Proposed design.

13.13.3 There are no residual significant effects identified in the assessment related to safety issues. However, there is additional mitigation required in several terrace areas of the Outline design. For these areas, the design will be reviewed further at a later stage at these specific locations, which will seek to provide further mitigation relating to these effects.

13.13.4 There are no residual significant effects identified in the assessment related to comfort issues. However, there is additional mitigation required in several terrace areas of the Outline design. For these areas, the design will be reviewed further at later stage at these specific locations, which will seek to provide further mitigation relating to these effects. Mitigation measures are likely to require the use of 1.2m tall balustrades, as this proved to be an effective measure in the assessment of the Detailed Proposed design, and eventually small trees or pergolas incorporated as part of the landscape design of the largest terraces.

13.13.5 The assessment of the Detailed Cumulative scenario does not differ much from the Proposed scenario and there are therefore no significant cumulative effects.

13.13.6 Mitigation measures for the wider development have not yet been fully developed (as part of the outline parts of the planning application) and so not all residual conditions have been directly assessed. Mitigation measures are likely to require the use of 1.2m tall balustrades, and eventually small trees or pergolas incorporated as part of the landscape design of the largest terraces. Balustrades will mitigate accelerations caused by horizontal movement of the airflow, while pergolas and trees will mitigate accelerations caused by downwash produced by taller massing.

13.13.7 The technical details not brought forward yet, that will be developed as the design of the Proposed Development progresses, will be assessed for wind microclimate suitability, to confirm and reinforce the findings of the simulation results already carried out.

13.13.8 Recommendations of the use of roof terraces for maintenance access have been made. Access to these terraces will need to be granted on the basis that this will be need for maintenance purposes and only if wind conditions are suitable.

**Table 13.9: Summary of Proposed Effects**

| DESCRIPTION OF SIGNIFICANT EFFECTS | RECEPTOR | SIGNIFICANCE OF EFFECTS | | | | | SUMMARY OF MITIGATION / ENHANCEMENT MEASURES | SIGNIFICANCE OF RESIDUAL EFFECTS | | | | | RELEVANT POLICY | RELEVANT LEGISLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAJOR / MODERATE / MINOR / NEGLIGIBLE | POSITIVE / NEGATIVE | P / T | D / I | ST / MT / LT | | MAJOR / MODERATE / MINOR / NEGLIGIBLE | POSITIVE / NEGATIVE | P / T | D / I | ST / MT / LT | | |
| LSC Exceedance at roof of Buildings N1, N2 and N3. | Location 16, 19 & 23 | Major | Negative | P | D | LT | Balustrades at least 1.2m in height and management procedure where these are plant areas | Major~~Negligible~~ | Negative | P | D | LT | | |
| LCC Communal roof terraces, Buildings N1 and N2. On-site receptor, Outline design. | Location 40 and 45 | Major | Negative | P | D | LT | Balustrades at least 1.2m in height and plants or small trees/pergolas | Major~~Negligible~~ | Negative | P | D | LT | | |
| LCC Communal roof terraces, Buildings N2, N3. On-site receptor, Outline design. | Location 35 | M~~oderate~~ajor | Negative | P | D | LT | Balustrades at least 1.2m in height and plants or small trees/pergolas | Major~~Negligible~~ | Negative | P | D | LT | | |
| LCC Communal roof terraces, Buildings N1, N2, N3. On-site receptor, Outline design. | 31, 33, 38, 42,47 | M~~oderate~~ajor | Negative | P | D | LT | Balustrades at least 1.2m in height and plants or small trees/pergolas | Major~~Negligible~~ | Negative | P | D | LT | | |

# 14.0 References

**Reference 13.1:** City of London Corporation (2020). City of London Wind Microclimate Guidelines. London, UK
**Reference 13.2:** Department for Communities and Local Government, (2021). National Planning Policy Framework (NPPF), Revised National Planning Policy Framework. London, UK. HMSO
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