

13 Wind Microclimate

13.1 Introduction

- 13.1.1 This chapter of the ES assesses the likely significant effects of the Proposed Development on the environment in respect of Wind Microclimate.
- 13.1.2 In accordance with Regulation 18(5) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this ES is provided in Appendix A.3.
- 13.1.3 This chapter has been prepared by Architectural Aerodynamics Ltd. (ArcAero), a leading wind microclimate consultant with experience of Environmental Impact Assessment (EIA), including peer review, for various developments across the UK. ArcAero staff have additionally acted as Expert Reviewer for many planning authorities within the UK and as Expert Witness for the London Borough of Tower Hamlets for a public inquiry.
- 13.1.4 This chapter should be read in conjunction with the following Appendix, which lays out the wind microclimate assessment in its entirety.
- Appendix 13.1: Wind Microclimate Technical Report

13.2 Policy Context, Legislation, Guidance and Standards

National Planning Policy Framework (NPPF) (2021)ⁱ

- 13.2.1 The latest updated National Planning Policy Framework (NPPF) published in July 2021 contains no national planning policies directly pointing towards resolving wind microclimate issues. However, the benefits of a high-quality built environment are emphasised and an example of this is presented in paragraph 130 which states:

Planning policies and decisions should ensure that developments:

‘...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...’

‘...are visually attractive as a result of good architecture, layout and appropriate and effective landscaping...’

‘...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...’

‘...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...’

Planning Practice Guidanceⁱⁱ

- 13.2.2 The Planning Practice Guidance (MHCLG, 2021) identifies the potential for a building’s size and shape (particularly in the case of tall and large buildings) to affect the wind microclimate. The PPG states in Paragraph 71 (‘Built Form’) that:

“Proposals for tall buildings (and other buildings with a significantly larger scale or bulk than their surroundings) require special consideration. This includes their location and siting; relationship to context; impact on local character, views and sight lines; composition - how they meet the ground and the sky; and environmental impacts, such as sunlight, daylight, overshadowing and wind. These need to be resolved satisfactorily in relation to the context and local character.”

Local Planning Policy

South Gloucestershire Local Plan Core Strategy, 2006-2027 (December 2013)ⁱⁱⁱ

- 13.2.3 There are no specific policies that relate to wind microclimate. However, the benefits of a high-quality built environment are emphasised and examples of this are presented as follows:

Policy CS1 – High Quality Design

Development will only be permitted where the highest possible standards of design and site planning are achieved. Information submitted with an application should be proportionate to scale, significance and impact of the proposal.... in order to assist in meeting climate change and health and well-being objectives, proposals will be required in particular to:

5. enhance existing or develop new public realm (and associated management & maintenance regimes: that enables people to gain access safely and conveniently, particularly to serve the needs of

- Pedestrians and cyclists*
- Children, the disabled and older people*
- with regard to residential and mixed use schemes, provide opportunities for social interaction and play;*

Policy CS25 – Communities of the North Fringe of Bristol Urban Area

Development plan documents and development proposals will take account of the vision and partnership priorities for the communities of the North Fringe of Bristol urban area and will:

6. provide high quality of public realm & spaces, and new local amenities at existing local centres, the UWE and Cribbs Causeway area

Policy CS26 – Cribbs / Patchway New Neighbourhood

Development will be comprehensively planned and phased to ensure full integration between the different uses and provision of ancillary facilities and supporting infrastructure, both within and beyond the area. This area will be a major focus for redevelopment and regeneration, and will deliver:

1. social and physical regeneration through the substantial improvement of community infrastructure, public open space, access and movement, and the provision of a high quality built environment and public realm that is comprehensive and integrated

Policy CS28 – The University of the West of England

In the period up to 2027 the University of the West of England, Frenchay Campus will be further developed for academic and research purposes, including the provision of student housing, and as a focal point for wider community, exhibition & conference, sporting and cultural facilities.

In order to provide for satisfactory integration with surrounding areas, development will be planned on a comprehensive basis in accordance with the vision, Policy CS25 and partnership priorities for the communities of the North Fringe of Bristol, high quality design principles as set out in Policy CS1 and an agreed Concept Statement for the Campus. In particular the Council will support development proposals that provide for:

6. high quality of public realm

13.3 Consultation

13.3.1 An EIA Scoping Report was prepared and submitted to the South Gloucestershire Council (SGC) on 7th December 2021 setting out the intended scope of a wind microclimate assessment for the Proposed Development.

13.3.2 In a Scoping Opinion issued by SGC on 3rd February 2022, the Scoping Opinion provided commentary on the scope of the wind microclimate assessment as follows:

The commitment to wind microclimate modelling is welcomed.

Paragraph 13.4.6 states that “At outline stage these measures will not be quantitatively tested if they are expected to be successful, and they will be verified as needed through reserved matters.” The modelling process undertaken should take in to account the parameter plans and illustrative masterplan proposed in order to provide sufficient confidence around likely effects to inform the Outline application decision-making process.

13.3.3 The current assessment has employed a computational fluid dynamics modelling (CFD) of the maximum parameter plans which conservatively represent a worse-case scenario in terms of wind. Where exceedances are predicted, wind mitigations have been recommended. These measures will be specifically design and verified at suitable stages of the development via further testing, particularly during reserved matters of individual plots / zones as needed.

13.4 Methodology

Study Area

13.4.1 The study considers all wind effects up to a distance of ~500 m from the perimeter of the overall masterplan redline and all features which are likely to impact the wind flow to and through the Site have been replicated. This distance is considered sufficient to capture all wind effects on Site, as well as those effects on the surrounding area.

Baseline Data Collection

13.4.2 Baseline conditions were established directly by undertaking a CFD) simulation of the wind velocities at the existing Site for a full range of wind directions. Once combined with a statistical model that describes wind climate prevailing across the area as a whole, predictions of pedestrian comfort and safety, classified in terms of the Lawson criteria (as clarified in Section 13.4.10), were derived.

Assessment

Overview

- 13.4.3 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 or more of an experience-based desk study, a CFD assessment and boundary layer wind tunnel studies.
- 13.4.4 The current assessment adopts a steady-state ‘RANS’ CFD approach. This method employs turbulence models to approximate the magnitude of velocity fluctuations about the average wind speeds predicted, in order to derive an estimation of the effect of gusts. Full details of the CFD methodology employed are presented in Appendix 13.1.
- 13.4.5 A digital model of the Site and surrounding area has been constructed and assessments have been performed using CFD for 16 wind directions, spaced at 22.5° intervals, to represent all directions.
- 13.4.6 The assessment considers five configurations. These were chosen on the expectation that they represent the conservative key stages of development and are likely to drive the requirement for any mitigation in temporary scenarios. These are as follows:
- Baseline conditions (the Site in the existing context).
 - Phase 1a within the context of existing surrounding conditions.
 - Phase 2 within the context of existing surrounding conditions.
 - The Proposed Development once completed (Completed Development) within the context of existing surrounding conditions.
 - Completed Development within the context of existing surrounding conditions plus approved developments (refer to Section 13.9).

Site Wind Climate

- 13.4.7 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 Bristol Airport. The meteorological data used in this assessment is deemed to be representative of the local wind microclimate for the Bristol area.
- 13.4.8 The wind speed history, provided by weather organisations such as the UK Met Office or the National Oceanic & Atmospheric Administration, is reformatted into the number of observations of wind speeds within each of several wind speed ranges, for each wind direction and for each month of the year. The months are grouped into seasons and a Weibull distribution is fitted to the wind speed distribution for each wind direction, for each season. The resulting weather centre wind data is transposed to open country terrain at sea-level, accounting for upwind terrain. The open country wind data is then transposed to reference height at the Site.
- 13.4.9 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 CFD models are provided in Appendix 13.1. All analysis of wind data and the atmospheric boundary layer has employed the methods set out within National Annex to Eurocode 1 – Actions on Structures^{iv} and various industry standards published by ESDU items 84011^v, 82026^{vi} and 83045^{vii} in accordance with best industry practice.

Assessment Criteria

- 13.4.10 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' (London Docklands Development Corporation) variant of the Lawson Criteria^{viii}.

- 13.4.11 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 activity. This offers a relatively simple and practical manner for the assessment of wind comfort and safety.

Safety

- 13.4.12 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.

Comfort

- 13.4.13 The LDDC variant of the Lawson criteria prescribes that wind conditions are suitable for a given activity when the threshold wind speed 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.
- 13.4.14 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 13.1.

Table 13.1: Lawson Comfort Criteria

Threshold Wind Speed [m/s]	Comfort Rating / Activity		Qualifying Comments
4	C4	Long-term sitting	Reading a newspaper and eating and drinking.
6	C3	Short-term sitting / standing	Appropriate for bus stops, window shopping and building entrances.
8	C2	Strolling	General areas of walking and sightseeing.
10	C1	Walking	Local areas around tall buildings where people are not likely to linger.

- 13.4.15 The assessment takes full account of seasonal variations in wind conditions and pedestrian activities. For example, conditions for recreational activities focus on summer (June, July, August), but also consider spring (March, April, May) and autumn (September, October, November), while conditions for pedestrian thoroughfare, access or waiting (e.g. bus stops) consider all seasons, with winter (December, January, February) usually being the critical season. The assessment is summarised in terms of suitability for various activities. The activities considered, and their relation to the LDDC, are summarised in Table 13.2.

Table 13.2: Suitability Assessment

Suitability	Lawson Comfort Criteria
For passage in areas where tolerance of less comfortable windy conditions is expected, e.g. in substantially built-up	Walking in all seasons.

areas of commerce where transit from A to B is often prompt, with pedestrians unlikely to linger.	
For access to and passage through the Development and surrounding area.	Strolling in all seasons.
For leisure uses excluding such as a park, children's play area, etc.	Standing or short-term sitting from spring to autumn.
For pedestrian ingress/egress at a building entrance, or short periods of sitting or standing such as at a bus stop, taxi rank, meeting point, etc.	Standing or short-term sitting' in all seasons.
For long periods of sitting such as for an outdoor café.	Long-term sitting in summer.

Significance Criteria

- 13.4.16 For the scenario for the Proposed Development is under construction, receptors are defined to be pedestrians and cyclists on the road around the Site and construction workers within the Site. During construction, sensitivity to wind is typically reduced (as explained further in Section 13.7.1). All receptors are considered to be medium sensitivity to the local wind microclimate conditions and are given an equal weighting.
- 13.4.17 For the scenario for the Proposed Development in place, receptors are defined to be pedestrians and cyclists on the road within the Proposed Development and surrounding areas. For the avoidance of doubt, this includes other users of the Site who may be sitting at provided seating areas or otherwise using the Site. All receptors are equally sensitive to the presence or absence of an acceptable wind microclimate. An unacceptable microclimate exists at a receptor when either an exceedance of the safety criteria exists, or when the comfort criteria is not met for the existing / planned pedestrian use at a receptor. All receptors are considered to be highly sensitive to the local wind microclimate conditions and are given an equal weighting.
- 13.4.18 Effect magnitude is defined by the severity of the deviation from the standards set out by the Lawson criteria. Exceedances of the safety criteria are deemed to be the most critical, given their potential effect on pedestrians' wellbeing, i.e. they may be unduly exposed to the potential for harm. Such effects are thus deemed to have a high impact magnitude. Where the comfort criteria are not met, i.e. where the conditions are too windy for a particular receptor to be sufficiently comfortable for existing or planned pedestrian uses and thus inconvenient but not unsafe, such effects are deemed to be of medium impact magnitude. Where the comfort criteria are marginally exceeded, to the extent that the exceedance is expected to be perceptible, but tolerable, such effects are deemed to be of very low impact magnitude.
- 13.4.19 On this basis, therefore, exceedances of the safety criteria are considered to be of major effect significance, while exceedances of the comfort criteria are considered to be of moderate or minor significance. Where the Proposed Development is unlikely to cause a noticeable change at a receptor, despite its level of sensitivity or there is a considerable change at a receptor which is not considered sensitive to a change, this will be considered negligible.
- 13.4.20 Major and moderate effects are considered to be significant in EIA terms. Minor effects, as noted above being tolerable, are not considered to be significant.
- 13.4.21 The following are the significance criteria used to assess likely wind conditions as a result of the introduction of the Proposed Development:
- Major Beneficial: Any effect on wind conditions which is expected to improve pedestrian safety, namely an improvement in conditions from being considered unsafe to being considered safe.
 - Moderate Beneficial: Any effect on wind conditions which is expected to improve pedestrian comfort from unsuitable to suitable for planned activities.

- Minor Beneficial: Any effect on wind conditions which is expected to improve pedestrian comfort from unsuitable to marginal/tolerable for planned activities, or from marginal/tolerable to suitable for planned activities.
- Negligible: Any effect that does not alter the suitability of existing wind conditions with respect to planned activities.
- Minor Adverse: Any effect on wind conditions which worsens pedestrian comfort from suitable to marginal/tolerable for planned activities, or from marginal/tolerable to unsuitable for planned activities.
- Moderate Adverse: Any effect on wind conditions that worsens pedestrian comfort from suitable to unsuitable for planned activities.
- Major Adverse: Any effect on wind conditions adversely affecting pedestrian safety, namely a deterioration in conditions from being considered safe to being considered unsafe.

13.4.22 The preceding description of significance of effect relates to the matrix defining significance of effect in relation to magnitude of change and sensitivity, on the basis that effects relating to safety are deemed to have a major magnitude of change and high sensitivity, while effects relating to comfort are deemed to have moderate sensitivity with moderate or minor magnitude of change for non-marginal and marginal effects on wind conditions, respectively.

Limitations

13.4.23 The studies have been conducted via CFD, which does not explicitly model the turbulence of the wind. Instead, numerical methods have been used to estimate the gust wind speeds.

13.4.24 The computational model also omits soft landscaping proposals, again ensuring a conservative scenario has been assumed.

13.4.25 The conditions for the Site during construction have not been directly assessed by the wind tunnel tests. Instead, professional judgement has been used to assess conditions during construction. During the construction stage, built form within the Site will be demolished and construction of the Proposed Development will occur gradually, across the entire construction stage. In the first instance when the demolition of the existing built form occurs, there is considered to be limited opportunity for accelerated wind due to channelling or downdraughts. Nonetheless, as the built form (specifically the massing) of the Proposed Development gradually occurs there will be instances where accelerated wind conditions may occur, albeit these will be gradual over the course of the construction stage. As the massing nears completion, the level of effect is likely to be similar to that being considered / assessed at the operational phase, albeit, in instances mitigation measures required for appropriate wind conditions at the operational phase may or may not be implemented, depending on the nature of the mitigation and as such wind levels may be greater than that determined at the operational phase. Nonetheless, given that the Site will still be within the construction stage, the receptors within the Site (i.e. construction workers) are generally considered to be of a lower sensitivity (and subject to greater health and safety working practices than the general public during the operational stage) that even should adverse effects be greater than that at operation, the resulting level of effect would be less than reported at the operational stage. Therefore, it is considered that an assessment of operational effects would represent an appropriate approximation of a worst-case scenario during construction.

13.5 Baseline Conditions

13.5.1 The existing Site comprises the former Filton airport runway and as such it is exposed to wind from all directions.

- 13.5.2 Wind conditions in and around the Site largely satisfy the safety criteria for wind. Localised exceptions are predicted to occur to the commercial buildings along the Cribbs Causeway located to the west of the Site perimeter; The Mall Cribbs Causeway and Aerospace Bristol hangar located to the north of the Site perimeter; and to the industrial developments to the south of the Site.
- 13.5.3 Wind conditions are suitable only for fast walking across the former Filton Airfield, however since the areas are generally inaccessible to the public, the wind conditions are considered acceptable.
- 13.5.4 The surrounding area is generally suitable for at least strolling, with some building corners of the immediate surrounding buildings around the perimeter of the Site experiencing wind conditions which would be considered suitable for at least fast walking.
- 13.5.5 The results for the existing Site conditions are presented graphically within Figure 4.1 for safety, and Figure 4.2 and Figure 4.3 for worst-seasonal and summer conditions respectively in Appendix 13.1.

Baseline Evolution

- 13.5.6 The UK Climate Projections (UKCP18) published by the Met Office presents a number of different predicted scenarios. The 'Climate Projects Report' published by UKCP18 presents the probable changes in wind speed for 2070 - 2099 in both the summer and winter seasons. With these predictions, the current trends in the climate change are not likely to have any significant effects on the predicted wind microclimate conditions in and around the Proposed Development.
- 13.5.7 Further to the UKCP18, an update to the 'ABI Research Paper No 19' of 2009 on "UK Windstorms and Climate Change" was published by AIR WORLDWIDE and the Met Office on the 31st January 2017, it is stated that:
- "Under a global temperature increase of 1.5°C, the number of storms over the UK generally decreases with the largest decrease in storm occurrence over the southwestern UK. Under a global temperature increase of 3.0 and 4.5° C, the number of storms over the UK generally increases by up to 15% of the CMIP5 baseline. An exception to this is over southern UK where we see a decrease which gradually lessens with increasing temperature".*
- 13.5.8 As expected, the changes generally follow the same pattern as the changes in storm track density, with areas of decreased frequency experiencing weaker wind speeds and areas of increased frequency experiencing stronger ones.
- 13.5.9 These findings would seem to suggest that the impact of climate change on frequency of storms and strength of wind speeds at the Site and surrounds of the Proposed Development are likely to slightly reduce over the course of the next few decades. In this context, the use of historical data, is therefore deemed to be slightly conservative.
- 13.5.10 In addition, on average throughout the year, near-surface wind speeds are projected to decrease. However, during the winter season, where more significant impacts of winds are experienced (Met Office, 2019), near-surface winds speeds are projected to rise towards the second half of the 21st Century.
- 13.5.11 However, these projections are modest compared to natural variability from month to month and season to season. Projections of future wind and storm occurrence and intensity are uncertain and confidence in projections is low. Research has shown that there are no compelling trends in maximum gust speeds over the last four decades (Kendon et al., 2019) and therefore there is no evidence that links climate change and storms.

- 13.5.12 Due to the little evidence that storms may increase in frequency or severity as a result of climate change, likely significant effects resulting from storms and high winds are scoped out of further assessment.

13.6 Embedded Mitigation

- 13.6.1 The wind microclimate has been assessed for the Proposed Development in the absence of the soft landscaping proposals for the overall masterplan. This includes the proposed Brabazon Park landscaping, the effect of which is assessed as part of the studies focusing on the Park. As development progresses, it is expected that individual zones or plots which require mitigation (as identified within the current study) will undergo separate wind microclimate assessments to determine the need for, and verify required wind mitigation.

13.7 Assessment of Likely Effects

Construction Phase

- 13.7.1 During the construction works, there would be potential for wind to blow into and across any open areas of the Site with the potential to inconvenience passers-by. However, given the dusty and untidy conditions typical of a construction site and the fact that adjacent pavements will be used for thoroughfares only and not for more sensitive recreational uses (such as outdoor cafes that may be present upon completion), pedestrians moving in the vicinity would be likely to have lowered expectations, in terms of comfort. Construction activity is likely to be less sensitive to general wind conditions due to the nature of the Site during construction (ie site hoardings, restricted site access for workers) compared to when the Proposed Development is completed. Conditions within the Site will be acceptable for construction workers and other Site operatives.
- 13.7.2 During construction, conditions are expected to transition gradually from those experienced in the existing condition to those for the Completed Development. Towards the end of the construction process, while the buildings are at an advanced stage of construction, the relevant mitigation / soft landscaping proposals that would be determined during the reserved matter stage would be required to be in place before these areas are accessible to pedestrians.
- 13.7.3 The Completed Development has no material effect upon the wind microclimate in the surrounding areas. The magnitude of effect on the surrounding areas during construction will therefore be negligible. In terms of comfort therefore, there is a negligible significance of effect (**short-term, direct and negligible**) upon the surrounding areas.
- 13.7.4 Wind conditions within the Site would be acceptable for construction workers, representing a **negligible** magnitude and thus significance of effect (**short-term, direct and negligible**).

Operational Phase

Phase 1a within Existing Surrounds

- 13.7.5 The results for the Phase 1a within existing surrounds are presented graphically within Figure 4.4 for safety, Figure 4.5 for worst-seasonal and Figure 4.6 for summer comfort respectively in Appendix 13.1. Phase 1a has been assessed as it is considered the worst-case Phase scenario.

Safety

- 13.7.6 Wind conditions within the Site generally satisfy the safety criteria for wind. There are some localised areas to the southwestern and northwestern corners of the West Lake Districts, Primary Schools within the Neighbourhood Centre and East Lake Town Centre developments where wind conditions are not predicted to meet the safety criteria for wind. These exceedances are due to the exposure of building facades to the prevailing westerly winds rather than the form and mass of the development itself. In the absence of soft landscaping and any mitigation

measures, this represents a **major, medium-term, direct adverse** effect of the Proposed Development.

13.7.7 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

13.7.8 In the surrounding areas, wind conditions remain largely as per the existing Site.

Comfort

Thoroughfares

13.7.9 Within the Phase 1a development, wind conditions are largely suitable for strolling and thus for pedestrian access to and passage through the Site. This therefore represents a **medium-term, direct and negligible** impact of the Proposed Development.

13.7.10 Exceptions occur around the corners of the developments within the East Lake Town Centre where conditions are only suitable for at least fast walking. Additionally, the wind conditions to the building corners of the West Lake Districts and Primary Schools within the Neighbourhood Centre developments are only suitable for at least fast walking. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.11 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

13.7.12 Elsewhere outside of the Phase 1a development, conditions are generally suitable for fast walking and would be considered tolerable for construction workers. This represents a **medium-term, direct and negligible** effect of the Proposed Development.

Entrances

13.7.13 Potential entrances that are located on the eastern façade of buildings would be expected to be suitable for standing and thus for comfortable pedestrian ingress / egress. This therefore represents a **medium-term, direct and negligible** effect of the Proposed Development.

13.7.14 Other entrances that would be located on the other sides of the façade would be expected to be generally suitable for at least strolling and thus too windy for comfortable use. Recessing entrances or introduction of side screens are recommended to alleviate the wind conditions if entrances are expected to be introduced to the north, south or west of the facades, along with other temporary mitigation for the interim phases of development as needed. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.15 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

Recreational Spaces

Neighbourhood Centre – Community Hub

- 13.7.16 Wind conditions to the outdoor sports facilities of the primary school and recreational areas are generally suitable for strolling in summer and throughout the year, and thus too windy for comfortable use. Temporary mitigation or landscaping will be introduced as needed to create suitable conditions for the proposed uses throughout this area. These exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

Brabazon Park

- 13.7.17 The wind conditions to the Brabazon Park North are suitable for short-term sitting in summer and thus for general recreational activities. This represents a **medium-term, direct and negligible** effect of the Proposed Development.

- 13.7.18 The wind conditions to the northern part of the Brabazon Park Central would be expected to be suitable for short-term sitting in summer and thus for general recreational activities. However, conditions are predicted to be suitable for only strolling in summer towards the southern part of the Brabazon Park Central and thus too windy for comfortable uses. Temporary wind mitigation has been developed for Brabazon Park which comprises a 2.4m tall solid fence along the western edge of the Park and it is expected this will be retained while parts of the park are exposed to prevailing winds, thus creating conditions which are generally suitable for use. These exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

East Lake – Town Centre

- 13.7.19 Ahead of the overall completion of the Proposed Development, the wind conditions to the proposed City Green are generally suitable for short-term sitting in summer and thus for general recreational activities. This therefore represents a **medium-term, direct and negligible** effect of the Proposed Development.
- 13.7.20 Towards the western area of the City Green, conditions here are only suitable for strolling in summer and thus would benefit from the introduction of soft landscaping. Further, conditions within the City Green would be expected to be suitable for strolling in autumn and spring and thus further enhancement would be recommended to extend the comfortable conditions into these months. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.
- 13.7.21 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

Surrounding Area

- 13.7.22 In the surrounding areas, wind conditions remain largely as per the existing Site with conditions generally suitable for at least strolling. The Proposed Development has improved wind conditions around buildings to the northeastern and eastern perimeters of the Site where conditions are now suitable for strolling due to the sheltering provided by the Phase 1a development. This represents a **medium-term, direct and moderate beneficial** effect of the Proposed Development.

Phase 2 within Existing Surrounds

- 13.7.23 The results for the Phase 2 within existing surrounds are presented graphically within Figure 4.7 for safety, Figure 4.8 for worst-seasonal and Figure 4.9 for summer comfort respectively in Appendix 13.1.

Safety

13.7.24 Wind conditions within the Phase 2 development generally satisfy the safety criteria for wind for all users. Exceptions persist to the southwestern and northwestern corners of the East Lake Town Centre developments where wind conditions are not predicted to meet the safety criteria for wind. Additionally, exceedances are also predicted to occur to the western blocks of Brabazon West development. These exceedances are in line with expectations of buildings exposed to prevailing westerly winds and would be mitigated through the introduction of temporary screening or landscaping as required as the development progresses. In the absence of soft landscaping and any mitigation measures, this represents a **medium-term, direct and major adverse** effect of the Proposed Development.

13.7.25 Conditions within the West Lake Districts and Primary Schools within the Neighbourhood Centre have now met the safety criteria for wind due to the increased sheltered provided by the introduction of Phase 2. This represents a **medium-term, direct and negligible** effect of the Proposed Development.

13.7.26 In the surrounding areas, wind conditions remain largely as per the existing Site. This represents a **medium-term, direct and negligible** effect of the Proposed Development.

Comfort

Thoroughfares

13.7.27 Within the introduction of Phase 2, wind conditions are largely suitable for strolling and thus for pedestrian access to and passage through the Site. This therefore represent a **medium-term, direct and negligible** effect of the Proposed Development.

13.7.28 Exceptions occur to the following areas:

- Western building corners of Brabazon West Hills Neighbourhood
- Northeast corner of northern block of the Brabazon West The Cedars
- Building corners of the eastern blocks of the Neighbourhood Centre developments
- the corners of the developments within the East Lake Town Centre

13.7.29 Here, conditions are generally too windy for comfortable pedestrian passage in the windier months and would benefit from temporary mitigation or landscaping, which would be developed as the Proposed Development progresses. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.30 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

13.7.31 Elsewhere outside of the Phase 2 development, conditions are generally suitable for fast walking and would be considered tolerable for construction activities. This represents a **medium-term, direct and negligible** effect of the Proposed Development.

Entrances

13.7.32 Potential entrances throughout the development would be expected to be generally suitable for standing and thus for comfortable pedestrian ingress / egress. This therefore represents a **medium-term, direct and negligible** effect of the Proposed Development.

13.7.33 Entrances in areas more exposed to prevailing westerly winds, particularly on the western elevations including southern blocks of West Lake District and Neighbourhood Centre and western blocks of Brabazon West Trym Bank would be expected to be generally suitable for at least strolling and thus too windy for comfortable use in the windier months. Recessing entrances or introduction of side screens are recommended to alleviate the wind conditions if entrances are expected to be introduced to the north, south or west of the building facades. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.34 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

Recreational Spaces

Brabazon West – Hills Neighbourhood

13.7.35 The wind conditions to the proposed recreational areas within the Brabazon West development are suitable for short-term sitting in summer and thus for comfortable general recreational activities. This therefore represents a **medium-term, direct and negligible** effect of the Proposed Development.

13.7.36 Exceptions however are predicted to the outdoor sports facilities of the primary school, where conditions here are generally suitable for strolling and thus too windy for comfortable use. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.37 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

Neighbourhood Centre – Community Hub

13.7.38 The wind conditions to the Neighbourhood Centre village greens would be expected to be suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **medium-term, direct and negligible** effect of the Proposed Development.

13.7.39 Wind conditions to the outdoor sports facilities of the primary school are generally suitable for short-term sitting in summer and for proposed recreational spaces. Exceptions still persists towards the northern area of the facilities where conditions here are only suitable for strolling. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.40 Wind conditions to the outdoor sports facilities of the secondary school are generally suitable for short-term sitting in summer and for proposed recreational uses. Exceptions are predicted to occur towards the northern area of the facilities where conditions here are only suitable for strolling. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.41 These exceedances are due to exposure to prevailing winds and will be mitigated through the implementation of soft landscaping and where needed, specific wind mitigation and temporary screening.

13.7.42 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable

conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

Brabazon Park

13.7.43 Upon the completion of Phase 2, wind conditions to the Brabazon Park North remain suitable for short-term sitting in summer and thus for general recreational activities. This represents a **medium-term, direct and negligible** effect of the Proposed Development.

13.7.44 The wind conditions to the northern part of the Brabazon Park Central would be expected to remain suitable for short-term sitting in summer and thus for general recreational activities. However, conditions to the southern part of the Brabazon Park Central are predicted to remain suitable for only strolling in summer and thus too windy for comfortable uses. Temporary wind mitigation has been developed for Brabazon Park and it is expected this will be retained while parts of the park are exposed to prevailing winds, thus creating conditions which are generally suitable for use. These exceedances represent a **medium-term, direct and moderate adverse** effect of the Proposed Development.

13.7.45 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

East Lake – Town Centre

13.7.46 Upon the completion of Phase 2, the wind conditions to the proposed City Green are generally suitable for short-term sitting in summer and thus for general recreational activities. Comfortable conditions in these areas represent **medium-term, direct and negligible** effects of the Proposed Development.

13.7.47 Towards the western area of the City Green, conditions are only suitable for strolling in summer and thus would benefit from the introduction of soft landscaping. Further, conditions within the City Green would be expected to be suitable for strolling in autumn and spring and thus further enhancement would be recommended to extend the comfortable conditions into these months. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **medium-term, direct and moderate adverse effect** of the Proposed Development.

13.7.48 It is expected that the soft landscaping and mitigation measures will be developed as the outline elements of the Proposed Development progress to the RMA stage, to create suitable conditions for the proposed uses throughout this area. Such potential measures have been recommended in section 13.8.

Innovation District – University & Research

13.7.49 Upon the completion of Phase 2, the proposed recreational areas to the east of the Innovation District are suitable for short periods of sitting in summer and thus for general recreational activities. Comfortable conditions in these areas represent **medium-term, direct and negligible** effects of the Proposed Development.

Enterprise District – Business

13.7.50 Ahead of the completion of the masterplan, the proposed Aerospace Park is suitable for short periods of sitting in summer and thus for general recreational activities. Comfortable conditions in these areas represent **medium-term, direct and negligible** effects of the Proposed Development.

13.7.51 The wind conditions along the Aerospace Promenade linear park are generally suitable for short periods of sitting in summer and thus for proposed uses. This represents a **medium-term, direct and negligible** effect of the Proposed Development. Any proposed recreational spaces along the Promenade linear park that would expect occasional sitting such as benches would be recommended to avoid any building corners for comfortable use.

Surrounding Area

13.7.52 In the surrounding areas, wind conditions remain largely as per the existing Site with conditions generally suitable for at least strolling. However improvements are observed towards the surrounding buildings to the northeastern and eastern perimeters of the Site where conditions are now suitable for strolling due to the sheltering of the Phase 2 development. This represents a **medium-term, direct and moderate beneficial** effect of the Proposed Development.

Completed Development

13.7.53 The results for the completed masterplan development within existing surrounds are presented graphically within Figure 4.10 for safety, Figure 4.11 for worst-seasonal and Figure 4.12 for summer comfort respectively in Appendix 13.1.

Safety

13.7.54 With the completion of the overall masterplan, all areas within the Site substantially satisfy the safety criteria for wind, for all users, generally this represents a **long-term, direct and negligible** effect of the Proposed Development.

13.7.55 A sole exception is expected to occur at the base of the tallest block of the East Lake Town Centre developments. In the absence of soft landscaping and any mitigation measures, this represents a **long-term, direct and major adverse** effect of the Proposed Development.

13.7.56 In the surrounding areas, wind conditions remain largely as per the existing Site, representing a **long-term, direct and negligible** impact of the Proposed Development.

Comfort

Thoroughfares

13.7.57 Upon the completion of the masterplan, the wind conditions within the Site are substantially suitable for strolling or better and thus for comfortable pedestrian access to and passage through the Site. This generally represents a **long-term, direct and negligible** effect of the Proposed Development.

13.7.58 However, some localised exceptions still exist:

- Southern and northern corners of the eastern blocks of the Brabazon West Trym Bank developments
- northwestern corner of the south block and southeastern corner of the southeast block of West Lake District developments
- northern and southern corners of the east blocks of the Neighbourhood Centre developments
- northwestern and southern corners of the tallest block of the East Lake Town Centre developments

- 13.7.59 Here, conditions are generally suitable for fast walking in spring and winter months and would benefit from the introduction of soft landscaping. In the absence of soft landscaping and any mitigation measures, this represents a **long-term, direct and minor adverse** effect of the Proposed Development.

Entrances

- 13.7.60 Throughout the masterplan, wind conditions are substantially suitable for short-term standing for entrances located on eastern and southern facades and those not immediately exposed to westerly winds would thus be comfortable for pedestrian ingress / egress. These represent a **long-term, direct and negligible** effect of the Proposed Development.

- 13.7.61 Other entrances that would be located on the other sides of the façade, including western blocks of Brabazon West Trym Bank, southern blocks of Brabazon West Hills Neighbourhood and The Cedars and southern blocks of West Lake District and Neighbourhood Centre would be expected to be generally suitable for at least strolling and thus too windy for comfortable use. Recessing entrances or introduction of side screens are recommended to alleviate the wind conditions if entrances are expected to be introduced to the north, south or west of the building facades. Alternative, suitable landscaping strategies would be expected to alleviate adverse wind conditions. In the absence of soft landscaping and any mitigation measures, this represents a **long-term, direct and moderate adverse** effect of the Proposed Development.

Recreational Spaces

Brabazon West – Trym Bank

- 13.7.62 The wind conditions to the linear park running from the northern to the southern perimeters of the Brabazon West Trym Bank would be expected to be suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Proposed Development.
- 13.7.63 The wind conditions to the recreational areas to the western parameter of the Brabazon West Trym Bank would be expected to be suitable for strolling in summer and thus too windy for proposed uses. It is expected that purposeful landscaping in this area would create conditions suitable for proposed pedestrian uses. Without further mitigation, these exceedances represent a **long-term, direct and moderate adverse** effect of the Proposed Development.

Brabazon West – Hills Neighbourhood

- 13.7.64 The wind conditions to the community allotments to the northwest of the Brabazon West Hills Neighbourhood would be expected to be suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Proposed Development.
- 13.7.65 The wind conditions to the linear park running from the northern to the southern perimeters of the Brabazon West Hills Neighbourhood would be expected to be suitable for short periods of sitting in summer and thus for general recreational purposes. This represents a **long-term, direct and negligible** effect of the Proposed Development.
- 13.7.66 Wind conditions to the outdoor sports facilities of the primary school are generally suitable for short-term sitting in summer and for proposed recreational spaces. Exceptions are predicted to occur to the southern area of the facilities where conditions would be expected to be suitable for strolling in summer. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term, direct and moderate adverse** effect of the Proposed Development.

Neighbourhood Centre – Community Hub

13.7.67 Following the completion of the masterplan, the wind conditions to the Neighbourhood Centre village greens would be expected to remain suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Proposed Development.

13.7.68 Wind conditions to the outdoor sports facilities of the primary school are generally suitable for short-term sitting in summer and for proposed recreational spaces. Exception still persists towards the northern area of the facilities where conditions here are only suitable for strolling. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term, direct and moderate adverse** effect of the Proposed Development.

13.7.69 Wind conditions to the outdoor sports facilities of the secondary school are generally suitable for short-term sitting in summer and for proposed recreational uses. Exception still persists towards the northern area of the facilities where conditions here are only suitable for strolling. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term, direct and moderate adverse** effect of the Proposed Development.

West Lake District

13.7.70 The wind conditions to the skate park located to the southwestern of the West Lake District would be expected to be generally suitable for short periods of sitting in summer and thus for general recreational activities. A small portion of the southwestern area of the park are expected to be suitable for only strolling in summer and thus too windy for comfortable use. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term, direct and moderate adverse** effect of the Proposed Development.

Brabazon Park

13.7.71 Upon the completion of the masterplan, all recreational areas within the Park are suitable for at least short-term sitting from spring to autumn and are thus comfortable for general recreational activities. Separate studies will be undertaken at suitable stages in the design process, and in time to allow any required mitigation measures to be implemented prior to occupation of the Site, to ensure adequate shelter for long-term seating spaces within the Park.

East Lake – Town Centre

13.7.72 Following the completion of the masterplan, the wind conditions to the proposed City Green are generally suitable for short-term sitting in summer and thus for general recreational activities. Towards the eastern area of the City Green, conditions here are only suitable for strolling in summer and thus would benefit from the introduction of soft landscaping. Further, conditions within the City Green would be expected to be suitable for strolling in autumn and spring and thus further enhancement would be recommended to extend the comfortable conditions into these months. These exceedances represent a **long-term, direct and moderate adverse** effect of the Proposed Development.

Innovation District – University & Research

13.7.73 Following the completion of the masterplan, the wind conditions to the proposed recreational areas to the east of the Innovation District remain suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Proposed Development.

Enterprise District – Business

13.7.74 Upon the completion of the masterplan, the proposed Aerospace Park remain suitable for short periods of sitting in summer and thus for general recreational activities. The wind conditions along the Aerospace Promenade linear park are generally suitable for short periods of sitting in

summer and thus for proposed uses. This represents a **long-term, direct and negligible** effect of the Proposed Development.

Surrounding Area

13.7.75 In the surrounding areas, wind conditions remain largely as per the existing Site with conditions generally suitable for at least strolling. However improvements are observed towards the surrounding buildings to the northeastern and eastern perimeters of the Site where conditions are now suitable for strolling due to the sheltering of the completed masterplan. This represents a **long-term, direct and moderate beneficial** effect of the Proposed Development.

13.8 Further Mitigation and Enhancement

13.8.1 Exceedances of the comfort and safety criteria across the study area are not excessive but they do warrant the introduction of mitigation measures in some form. These measures will be specifically designed and verified at suitable stages of the development via further testing, particularly during reserved matters applications (RMA stage) for individual plots / zones as needed and these can be secured by condition in the RMA stage. Examples of mitigation that may be effective would include, but would not be limited to, the following:

- Recessing entrances by at least 1.5m if this was compatible with the design of the building, or the introduction of side screens
- Introduction of soft landscaping elements such as tree planting, green screens and planters or green infrastructure as per the Landscape Parameter Plan to the thoroughfares or any recreational areas (including the recreational areas within the schools) that exceed comfort criteria
- Where required, screens, canopies and other architectural features may also be implemented.

13.8.2 The above measures could be considered as temporary measures during the various phases, ahead of the completion of the Proposed Development, and hence could be removed upon completion of the masterplan. However, this is subject to the final landscaping / mitigation measures of the Proposed Development.

13.9 Cumulative Effects

13.9.1 A number of cumulative schemes, agreed through EIA Scoping, have been considered in the assessment. These schemes are:

- Cribbs Urban Village (PT14/0565/O)
- Wyck Beck Road / Fishpool Hill Patchway (PT12/1930/O)
- Land off Charlton Road (PT15/4165/F)
- Laurel Hill (PT14/2646/O and PT14/1886/O)
- Land South of Merlin Road (Ice Rink and Sky Diving Centre) (PT15/5319/O and PT18/1459/F)
- East Works Site (PT18/4908/F)
- Application Site A – Arena complex comprises the Brabazon Hangars (19/05500/P)

- Application Site B – West Way (P19/16740/F)
- Application Site C – Temporary Car Park (P19/16741/F)
- Application Site D – Pedestrian Bridge (P19/16742/F)
- Northfield Park Charlton Hayes (PT14/5028/O)
- East Works Site (PT15/1634/RVC)
- Former Filton Airfield (P21/05318/RM)
- P21/08021/RM and P21/08021/RM
- Former Filton Airfield (P21/06296/F)
- Former Filton Airfield South Glos (P20/24199/F)
- Land At Norton Farm Berwick Drive (PT18/6360/F)

13.9.2 Other developments are located >500m from the Site perimeter and sit outside of the test radius. These developments are sufficiently far from the Proposed Development that potential cumulative effects will be negligible and are therefore scoped out of the assessment. These developments comprise:

- Cribbs/Patchway New Neighbourhood Allocation (adopted 2014)
- Asda extension Highwood Lane Patchway Bristol South Gloucestershire (PT15/4386/O)
- Land At Harry Stoke (PT06/1001/O)
- Land At The South Of The Railway East Of Harry Stoke (PT16/4782/O)
- North of the railway East of Harry Stoke (PT16/4928/O)
- North of the railway East of Harry Stoke NN (Full element of PT16/4928/O superseded by P20/03681/F)
- Old Gloucester Road within EoHSNN (PT17/5873/O)
- Northfield Park, Patchway (PT17/5387/F)
- Land Off Fox Den Road (P20/05916/F)

Safety

13.9.3 Following the introduction of the cumulative surrounds, all areas within the Site substantially satisfy the safety criteria for wind, for all users, generally this represents a **long-term, direct and negligible** effect of the Completed Development within cumulative surrounds.

13.9.4 A sole exception is expected to occur at the base of the tallest block of the East Lake Town Centre developments. In the absence of soft landscaping and any mitigation measures, this represents a **long-term, direct and major adverse effect** of the Completed Development within the cumulative surrounds.

- 13.9.5 In the surrounding areas, wind conditions remain largely as per the existing Site, representing a **long-term, direct and negligible** impact of Completed Development within the cumulative surrounds.

Comfort

Thoroughfares

- 13.9.6 Following the introduction of the cumulative surrounds, the wind conditions within the Site are substantially suitable for strolling or better and thus for comfortable pedestrian access to and passage through the Site. This generally represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.
- 13.9.7 Due to the sheltering of the cumulative surrounds, thoroughfares to the western perimeter of the masterplan have become suitable for strolling throughout the year, and thus for comfortable pedestrian access to and passage through the Site. This generally represents a **long-term, direct and moderate beneficial effect** of the Completed Development within the cumulative surrounds.
- 13.9.8 However, some localised exceptions still exist:
- northwestern corner of the south block and southeastern corner of the southeast block of West Lake District developments
 - northern and southern corners of the east blocks of the Neighbourhood Centre developments
 - northwestern and southern corners of the tallest block of the East Lake Town Centre developments
- 13.9.9 Here, conditions are generally suitable for fast walking in spring and winter months and would benefit from the introduction of soft landscaping. In the absence of soft landscaping and any mitigation measures, this represents a **long-term, direct and minor adverse effect** of the Completed Development within the cumulative surrounds.

Entrances

- 13.9.10 Throughout the masterplan, wind conditions are substantially suitable for short-term standing for entrances located on eastern and southern facades and those not immediately exposed to westerly winds would thus be comfortable for pedestrian ingress / egress. These represent a **long-term, direct and negligible effect** of the Completed Development within the cumulative surrounds.
- 13.9.11 Other entrances that would be located on the other sides of the façade, including western blocks of Brabazon West Trym Bank, southern blocks of Brabazon West Hills Neighbourhood and The Cedars and southern blocks of West Lake District and Neighbourhood Centre would be expected to be generally suitable for at least strolling and thus too windy for comfortable use. Recessing entrances or introduction of side screens are recommended to alleviate the wind conditions if entrances are expected to be introduced to the north, south or west of the building facades. Alternative, suitable landscaping strategies would be expected to alleviate adverse wind conditions. In the absence of soft landscaping and any mitigation measures, this represents a **long-term, direct and moderate adverse effect** of the Completed Development within the cumulative surrounds.

Recreational Spaces

Brabazon West – Trym Bank

13.9.12 The wind conditions to the linear park running from the northern to the southern perimeters of the Brabazon West Trym Bank would be expected to be suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.

13.9.13 The wind conditions to the recreational areas to the western parameter of the Brabazon West Trym Bank would be expected to improve to become suitable for short periods of sitting in summer and thus for general recreational uses. This represents a **long-term, direct and minor beneficial effect** of the Completed Development within the cumulative surrounds.

Brabazon West – Hills Neighbourhood

13.9.14 The wind conditions to the community allotments to the northwest of the Brabazon West Hills Neighbourhood would be expected to be suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.

13.9.15 The wind conditions to the linear park running from the northern to the southern perimeters of the Brabazon West Hills Neighbourhood would be expected to be suitable for short periods of sitting in summer and thus for general recreational purposes. This represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.

13.9.16 Wind conditions to the outdoor sports facilities of the primary school are generally suitable for short-term sitting in summer and for proposed recreational spaces. Exceptions are predicted to occur to the southern area of the facilities where conditions would be expected to be suitable for strolling in summer. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term, direct and moderate adverse effect** of the Completed Development within the cumulative surrounds.

Neighbourhood Centre – Community Hub

13.9.17 Following the introduction of the cumulative surrounds, the wind conditions to the Neighbourhood Centre village greens would be expected to remain suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.

13.9.18 Wind conditions to the outdoor sports facilities of the primary school are generally suitable for short-term sitting in summer and for proposed recreational spaces. Exception still persists towards the northern area of the facilities where conditions here are only suitable for strolling. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term, direct and moderate adverse effect** of the Completed Development within the cumulative surrounds.

13.9.19 Wind conditions to the outdoor sports facilities of the secondary school are generally suitable for short-term sitting in summer and for proposed recreational uses. Exception still persists towards the northern area of the facilities where conditions here are only suitable for strolling. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term, direct and moderate adverse effect** of the Completed Development within the cumulative surrounds.

West Lake District

13.9.20 The wind conditions to the skate park located to the southwestern of the West Lake District would be expected to be generally suitable for short periods of sitting in summer and thus for general recreational activities. A small portion of the southwestern area of the park are expected to be suitable for only strolling in summer and thus too windy for comfortable use. In the absence of soft landscaping and any mitigation measures, these exceedances represent a **long-term,**

direct and moderate adverse effect of the Completed Development within the cumulative surrounds.

Brabazon Park

- 13.9.21 Following the introduction of the cumulative surrounds, all recreational areas within the Park are suitable for at least short-term sitting from spring to autumn and are thus comfortable for general recreational activities. Separate studies will be undertaken at suitable stages in the design process, and in time to allow any required mitigation measures to be implemented prior to occupation of the Site, to ensure adequate shelter for long-term seating spaces within the Park.

East Lake – Town Centre

- 13.9.22 Upon the introduction of the cumulative surrounds, the wind conditions to the proposed City Green are generally suitable for short-term sitting in summer and thus for general recreational activities. Towards the eastern area of the City Green, conditions here are only suitable for strolling in summer and thus would benefit from the introduction of soft landscaping. Further, conditions within the City Green would be expected to be suitable for strolling in autumn and spring and thus further enhancement would be recommended to extend the comfortable conditions into these months. These exceedances represent a **long-term, direct and moderate adverse effect** of the Completed Development within the cumulative surrounds.

Innovation District – University & Research

- 13.9.23 Following the introduction of the cumulative surrounds, the wind conditions to the proposed recreational areas to the east of the Innovation District remain suitable for short periods of sitting in summer and thus for general recreational activities. This represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.

Enterprise District – Business

- 13.9.24 Upon the introduction of the cumulative surrounds, the proposed Aerospace Park remains suitable for short periods of sitting in summer and thus for general recreational activities. The wind conditions along the Aerospace Promenade linear park are generally suitable for short periods of sitting in summer and thus for proposed uses. This represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.

Surrounding Area

- 13.9.25 In the surrounding areas, wind conditions remain largely as per the Completed Development within the existing surrounds. This represents a **long-term, direct and negligible** effect of the Completed Development within the cumulative surrounds.
- 13.9.26 The results for the completed masterplan within future surrounds are presented graphically within Figure 4.13 for safety, Figure 4.14 for worst-seasonal and Figure 4.15 for summer comfort respectively in Appendix 13.1.

13.10 Residual Effects

- 13.10.1 Mitigation as proposed within this chapter will be considered and incorporated where required into reserved matters applications for each plot or phase as the development progresses.
- 13.10.2 As discussed in **Section 13.8**, these measures will be specifically designed and verified at suitable stages of the development via further testing, particularly during reserved matters applications (RMA stage) for of individual plots / zones as needed and these can be secured by condition in the RMA stage.

13.10.3 Following implementation of recommended mitigation as set out in **Section 13.8**, wind conditions in those isolated areas where significant effects have been identified would become suitable for planned pedestrian and occupant uses. On this basis, the residual effect of the Proposed Development with regards to wind microclimate would become negligible.

13.11 Monitoring

13.11.1 As no residual significant adverse environmental effects have been identified, no monitoring is proposed. Further studies will be undertaken as the development progresses to ensure this remains the case.

13.12 Summary

13.12.1 Upon the completion of the masterplan, wind conditions substantially meet the safety criteria and are generally suitable for designated pedestrian uses.

13.12.2 Exceedances of the safety criteria primarily during Phase 1a and Phase 2 are due to exposure of the development to prevailing winds and would be readily mitigated via temporary mitigation as needed.

13.12.3 Pedestrian activities throughout the masterplan would be expected to fall within their respective comfort criteria with the detailed design of the Proposed Development and with the introduction of the landscaping proposals.

13.12.4 Isolated and temporary exceedances of the comfort criteria would be readily mitigated via the introduction of soft landscaping and mitigation measures as needed. It is expected that these will be developed as part of the reserved matters applications for each plot or phase as the development progresses.

13.13 References

- i) National Planning Policy Framework (Ministry of Housing, Communities and Local Government, 2021)
- ii) Planning Practice Guidance (Ministry of Housing, Communities and Local Government, 2021)
- iii) South Gloucestershire Local Plan Core Strategy, 2006-2027 (South Gloucestershire Council, December 2013)
- iv) UK National Annex to Eurocode 1 – Actions on Structures, Part 1-4: General Actions – Wind Actions. 1991. NA to BS EN 1991-1-4:2005.
- v) Engineering Science Data Unit (2012) Item 84011 Wind speed profiles over terrain with roughness changes
- vi) Engineering Science Data Unit (2002) Item 82026 Strong winds in the atmospheric boundary layer Part 1: hourly-mean wind speeds
- vii) Engineering Science Data Unit (2012) Item 83045 Strong winds in the atmospheric boundary layer Part 2: discrete gust speeds
- viii) Lawson, T.V. (1990) The determination of the wind environment of a building complex before construction