



Reading Police Station Wind Microclimate

Client: John Thompson & Partners LLP

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Date: 30th April 2026

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Executive Summary

Wind microclimate studies assess how new developments alter local wind conditions. They estimate how often wind speeds at pedestrian level exceed thresholds for safety and comfort, helping to determine whether areas are suitable for their intended use, or if design changes are needed.

The Reading Police Station development was assessed by ArcAero Computational Fluid Dynamics (CFD) and the London Docklands Development Corporation (LDDC) variant of the Lawson criteria. The study predicts pedestrian wind conditions following the introduction of the proposed buildings and evaluates their suitability for public comfort and safety.

The findings of the assessment are as follows:

- Wind conditions across the existing site comply with Lawson safety and comfort criteria for anticipated pedestrian activities.
- Following the introduction of the proposed development within the existing surroundings, without mitigation in place, wind conditions at ground level and elevated terraces are predicted to generally comply with Lawson safety criteria. Minor exceptions are noted at the Level 12 terrace and two balconies above Level 12. Wind conditions are generally suitable for their intended uses meeting the comfort criteria, with localised comfort exceedances at a few outdoor seating areas and entrances along Flint Street.
- With the inclusion of cumulative surrounding developments, wind conditions remain broadly comparable to those predicted for the proposed development within the existing surroundings with some improvements.
- Following the introduction of mitigation measures (including the movement of raised balconies) wind conditions satisfy the safety criteria and are suitable for the intended uses within both the existing and cumulative surrounding contexts.

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1. Project Introduction



Figure 1: Representation of the proposed development

Overview

This report summarises the results of a CFD study, commissioned by John Thompson & Partners LLP, to assess the wind microclimate for the detailed proposals for the Reading Police Station development in Reading, United Kingdom.

The assessment focuses on pedestrian safety and comfort, with particular attention to entrances, walkways, seating areas, and outdoor amenity spaces, including elevated terraces and balconies.

Predictions have been made using Computational Fluid Dynamics (CFD), based on the Lawson (LDDC) criteria.

The study informs both design refinement and planning compliance, ensuring that wind conditions are appropriate for the intended use of public and private external spaces.

Reading Police Station

The Reading Police Station development is bounded by community gardens and then The Hexagon to the North, Cusden Walk to the East, Castle Street to the South and A329 Road to the West.

Further afield, the surrounding townscape is characterised by a mix of low- to mid-rise commercial and residential buildings.

The proposed development comprises two blocks, namely Block A and Block B, with heights of approximately 10 and 16 storeys, corresponding to about 35 m and 55 m, respectively.

Digital models used in this study are based on project-specific drawing information, detailed in Appendix A.

2. Modelling Approach

CFD Methodology

Computational Fluid Dynamics (CFD) modelling was undertaken using a steady-state Reynolds-Averaged Navier-Stokes (RANS) approach. This method employs turbulence models to approximate the effect of wind gusts by predicting fluctuations about the mean wind speed.

Key aspects of the modelling setup include:

- The Shear Stress Transport (SST) $k-\omega$ turbulence model was used for its accuracy in near-wall regions and flow separation.
- All architectural features greater than 0.5 metres in scale were explicitly included in the model geometry.
- A refined mesh resolution was applied in critical areas, with cell sizes as small as 0.2 metres.
- At pedestrian level (1.5 metres height), a minimum of five vertical cell layers were used to accurately resolve ground-level wind conditions.
- 16 wind directions were assessed at 22.5° increments, capturing a full compass range of prevailing and secondary winds.

Mean wind speeds and gust-equivalent mean wind speeds were derived from the simulations, following accepted industry guidance. Analysis was carried out using the Lawson criteria (LDDC variant)^[1] for wind comfort and safety, in accordance with industry standard practice.

Further technical detail is provided in Appendix B.

Digital Model Domain

A detailed 3D model of the site and its surroundings was used for the CFD simulations. The study domain extended up to 450 metres in all directions from the site, incorporating all existing and planned built forms and topographical features likely to influence airflow patterns.

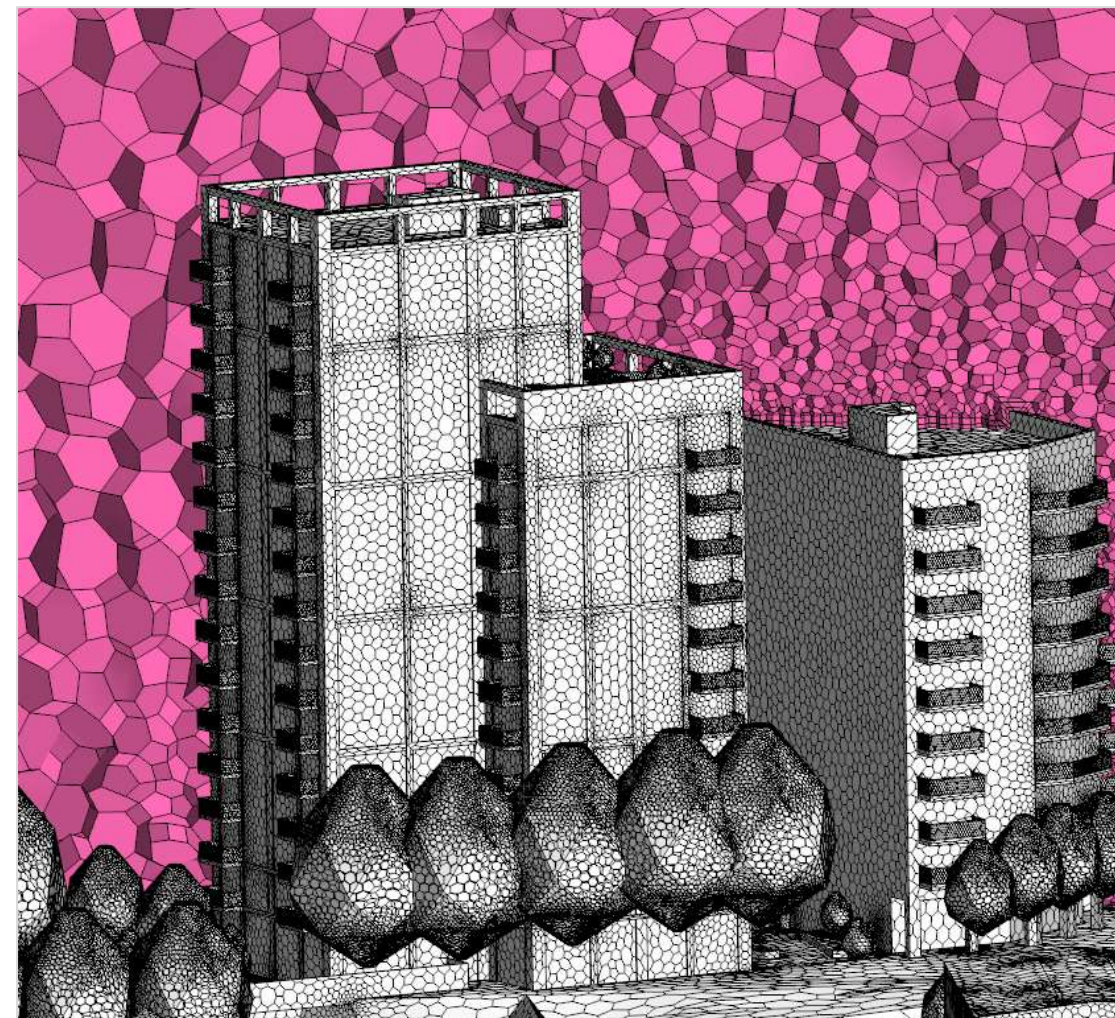


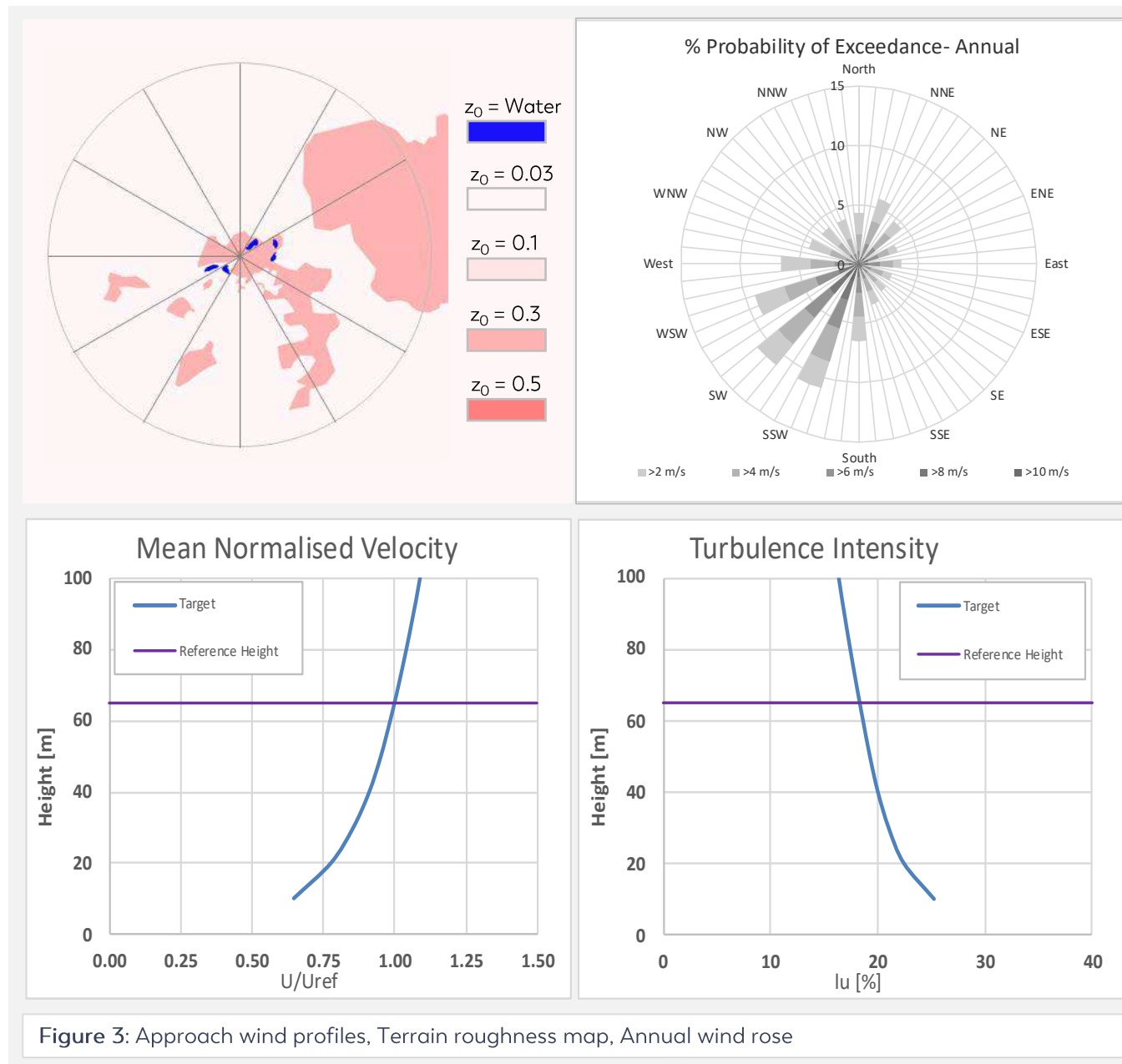
Figure 2: Computational mesh for CFD simulations

ABL & Wind Climate Data

Wind frequency and direction statistics were derived from long-term meteorological data obtained from London Heathrow Airport.

- Wind data was transposed to the site location and adjusted for local terrain roughness.
- The atmospheric boundary layer (ABL) and wind speed profiles were modelled using methods set out in ESDU Item 01008^[2], consistent with best industry practice for microclimate analysis.
- Seasonal variation in wind intensity and directional frequency was accounted for to distinguish worst-case winter safety conditions and seasonal comfort conditions.

ArcAero's terrain roughness assessment, resulting approach wind profiles and annual wind rose are presented in Figure 3.



3. Understanding Wind Comfort and Safety Criteria

The Lawson Criteria

Pedestrian wind conditions are assessed using the Lawson ‘LDDC’ criteria^[1], which define thresholds for safety, and separate comfort thresholds based on typical outdoor activities. These thresholds are compared against predicted wind speeds using long-term meteorological data.

For safety, a 15 m/s threshold is typically applied. Wind speeds exceeding this level more than once per year ($\sim 0.022\% \approx 2$ hours per year) may destabilise vulnerable individuals and are considered a risk to pedestrian safety.

For comfort, wind speeds should not exceed activity-specific thresholds more than 5% of the time. Stricter criteria are applied in areas where pedestrians are expected to pause, wait, or linger, such as café seating, waiting areas, entrances, or playparks. In contrast, higher thresholds apply to routes where continuous movement is expected.

Comfort conditions are assessed seasonally:

- Worst-seasonal conditions are used to evaluate spaces with year-round use, such as entrances, footpaths, and through-routes. This ensures windiness is acceptable during the windiest part of the year, which typically occurs in winter, but sometimes in spring, or autumn.
- Summer amenity conditions are typically applied to seasonal-use areas, such as external seating terraces and roof gardens, using climate statistics for June, July and August.

Table 1 sets out the LDDC variant of the Lawson comfort criteria, with Figure 4 providing visual examples of the primary activities reflected.

Figure 4: Visual examples of typical outdoor activities



	Threshold Wind Speed (m/s)	Lawson Classification	Examples
	4	Long-term sitting	Bar / café
	6	Standing / short-term sitting	Bus stop, school pick-up point, playpark, viewing terrace
	8	Strolling	Residential routes, public realm, shopping streets
	10	Walking	Commuter routes, business district
	>10	Uncomfortable	Unsuitable for regular pedestrian use

Table 1: Lawson comfort criteria

4. Assessment Scenarios

The following scenarios have been modelled:

- Existing site conditions, Existing surrounding context (EinE) - shown in Figures 4.4.1 to 4.4.4
- Proposed development, Existing surrounding context (PinE)
- Proposed development, Cumulative surrounding context (PinC)
- Proposed development, Existing surrounding context with Mitigation (PinE Mit)
- Proposed development, Cumulative surrounding context with Mitigation (PinC Mit)

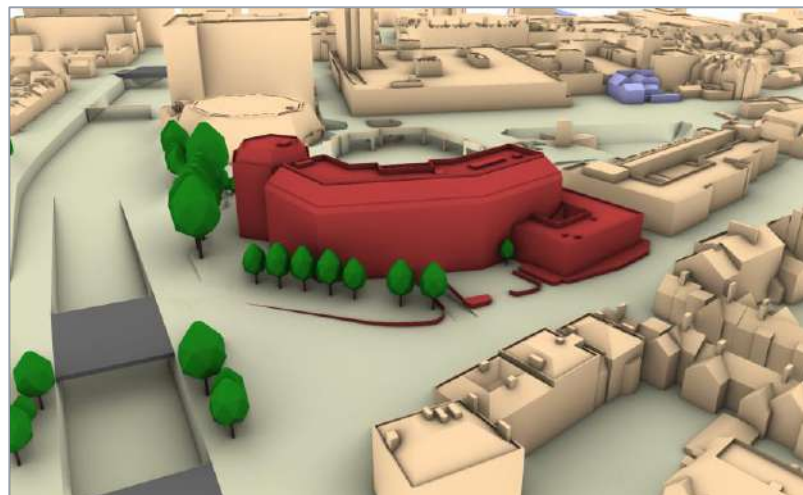


Figure 4.4.1:EinE Closeup looking north



Figure 4.4.2:EinE Surrounds looking north

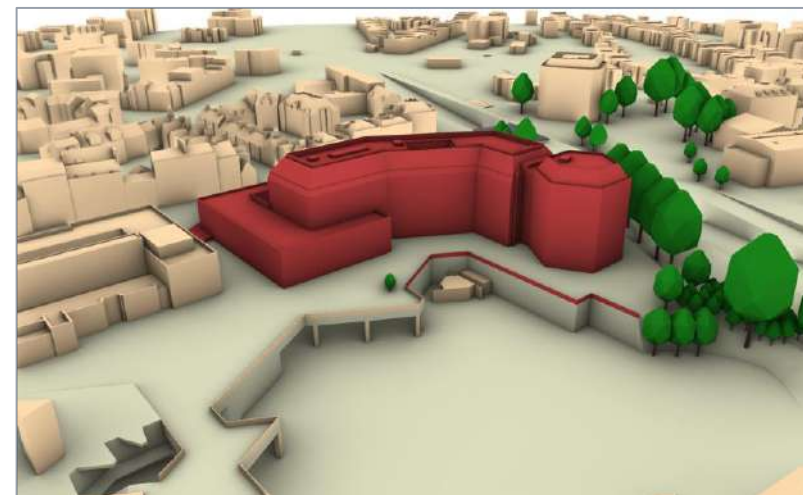


Figure 4.4.3:EinE Closeup looking south



Figure 4.4.4:EinE Surrounds looking south

Scenario Figures - Buildings Key	
Building Colour	Category
Red	Existing site
Orange	Proposed Development
Tan	Surrounding Buildings: Unchanged
Light Blue	Surrounding Buildings: To be removed
Dark Blue	Surrounding Buildings: Cumulative Developments

The following scenarios have been modelled:

- Existing site conditions, Existing surrounding context (EinE)
- Proposed development, Existing surrounding context (PinE) - shown in Figures 4.5.1 to 4.5.4
- Proposed development, Cumulative surrounding context (PinC)
- Proposed development, Existing surrounding context with Mitigation (PinE Mit)
- Proposed development, Cumulative surrounding context with Mitigation (PinC Mit)



Figure 4.5.1:PinE Closeup looking north



Figure 4.5.2:PinE Surrounds looking north



Figure 4.5.3:PinE Closeup looking south



Figure 4.5.4:PinE Surrounds looking south

Scenario Figures - Buildings Key	
Building Colour	Category
Red	Existing site
Orange	Proposed Development
Tan	Surrounding Buildings: Unchanged
Blue	Surrounding Buildings: To be removed
Cyan	Surrounding Buildings: Cumulative Developments

The following scenarios have been modelled:

- Existing site conditions, Existing surrounding context (EinE)
- Proposed development, Existing surrounding context (PinE)
- Proposed development, Cumulative surrounding context (PinC) - shown in Figures 4.6.1 to 4.6.4
- Proposed development, Existing surrounding context with Mitigation (PinE Mit)
- Proposed development, Cumulative surrounding context with Mitigation (PinC Mit)

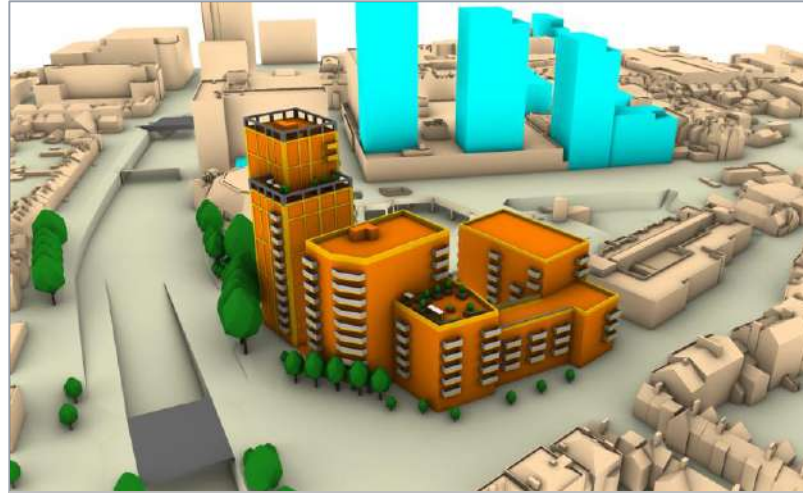


Figure 4.6.1:PinC Closeup looking north

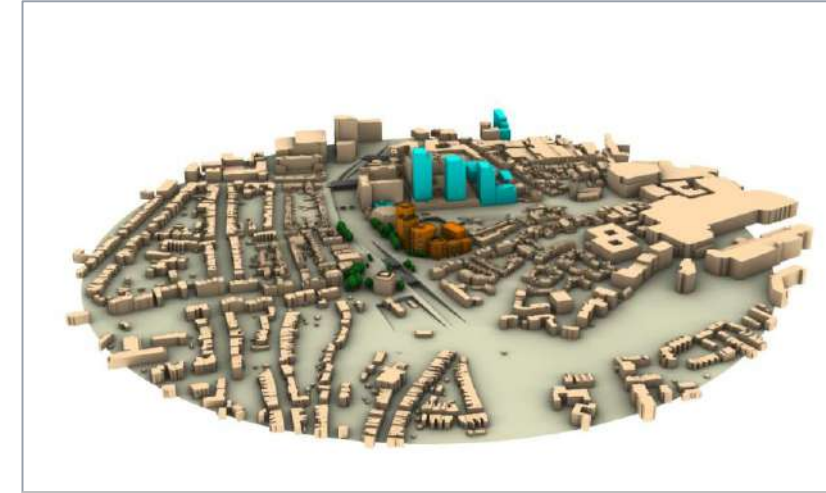


Figure 4.6.2:PinC Surrounds looking north



Figure 4.6.3:PinC Closeup looking south

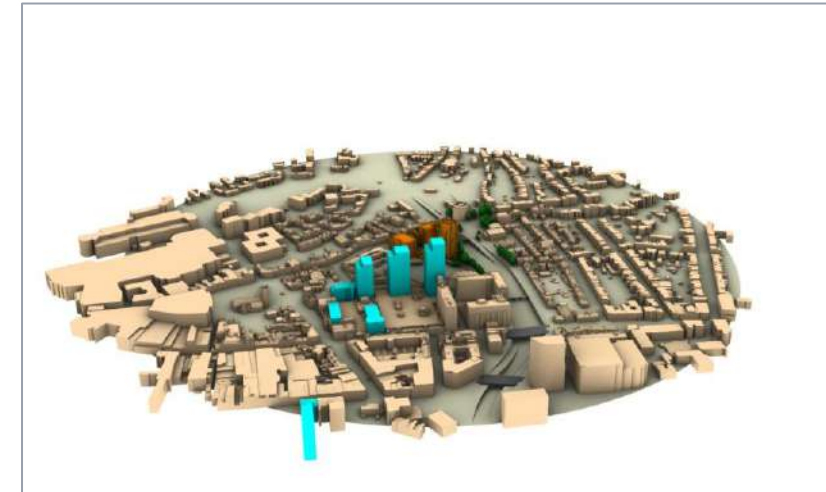


Figure 4.6.4:PinC Surrounds looking south

Scenario Figures - Buildings Key	
Building Colour	Category
Dark Red	Existing site
Orange	Proposed Development
Light Beige	Surrounding Buildings: Unchanged
Light Purple	Surrounding Buildings: To be removed
Cyan	Surrounding Buildings: Cumulative Developments

The following scenarios have been modelled:

- Existing site conditions, Existing surrounding context (EinE)
- Proposed development, Existing surrounding context (PinE)
- Proposed development, Cumulative surrounding context (PinC)
- Proposed development, Existing surrounding context with Mitigation (PinE Mit) - shown in Figures 4.7.1 to 4.7.4
- Proposed development, Cumulative surrounding context with Mitigation (PinC Mit)

Scenario Figures - Buildings Key	
Building Colour	Category
Red	Existing site
Orange	Proposed Development
Light Orange	Surrounding Buildings: Unchanged
Light Blue	Surrounding Buildings: To be removed
Cyan	Surrounding Buildings: Cumulative Developments



Figure 4.7.1:PinE Mit Closeup looking north

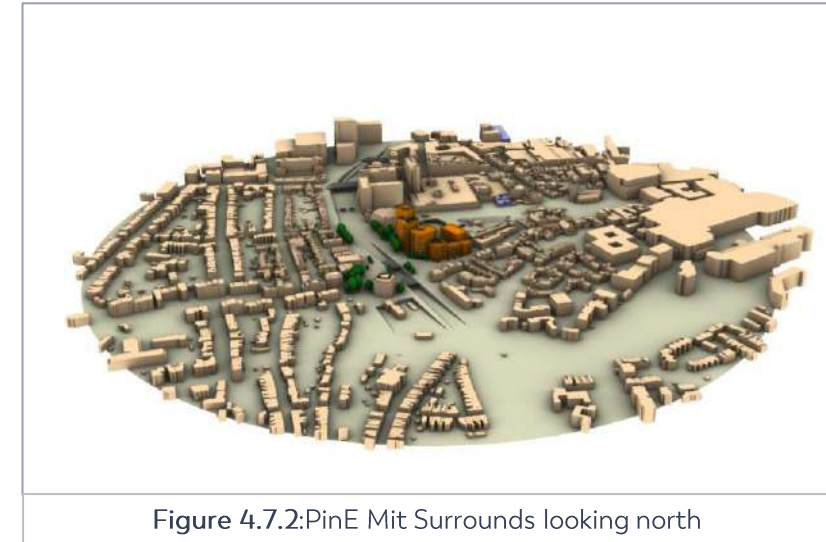


Figure 4.7.2:PinE Mit Surrounds looking north



Figure 4.7.3:PinE Mit Closeup looking south

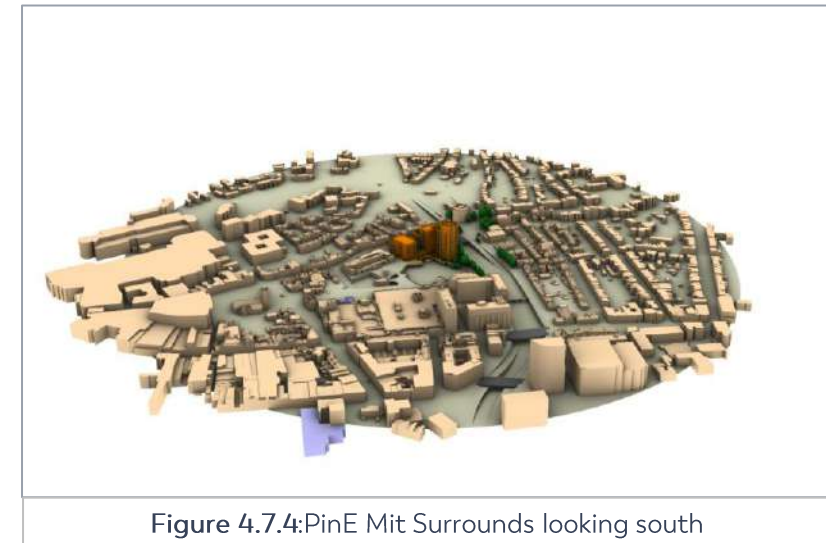


Figure 4.7.4:PinE Mit Surrounds looking south

The following scenarios have been modelled:

- Existing site conditions, Existing surrounding context (EinE)
- Proposed development, Existing surrounding context (PinE)
- Proposed development, Cumulative surrounding context (PinC)
- Proposed development, Existing surrounding context with Mitigation (PinE Mit)
- Proposed development, Cumulative surrounding context with Mitigation (PinC Mit) - shown in Figures 4.8.1 to 4.8.2

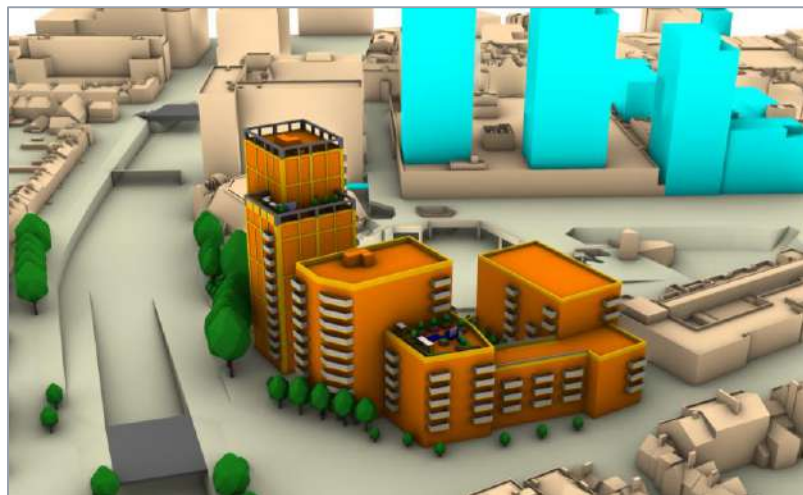


Figure 4.8.1:PinC Mit Closeup looking north



Figure 4.8.2:PinC Mit Surrounds looking north



Figure 4.8.3:PinC Mit Closeup looking south

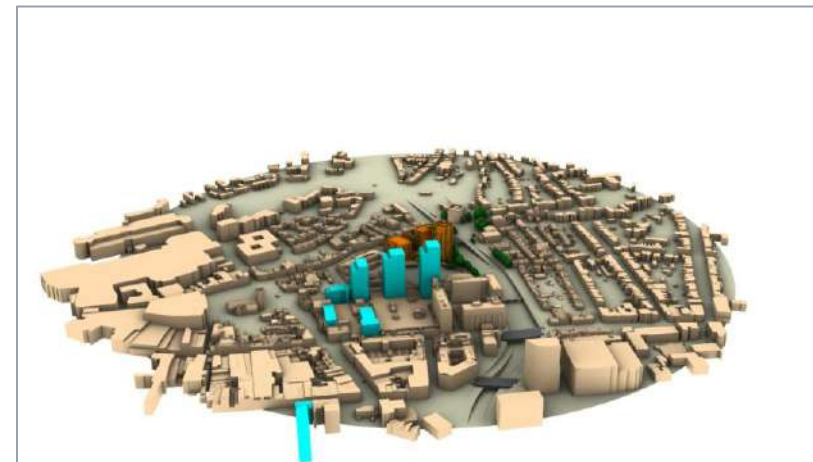


Figure 4.8.4:PinC Mit Surrounds looking south

Scenario Figures - Buildings Key	
Building Colour	Category
Red	Existing site
Orange	Proposed Development
Tan	Surrounding Buildings: Unchanged
Light Blue	Surrounding Buildings: To be removed
Cyan	Surrounding Buildings: Cumulative Developments

Modelling of Nearby Developments With Planning Consent

Several cumulative schemes have been included in the assessment. These are presented visually in Figure 6 and in tabular format in Table 2.

Developments with planning consent that are substantially under construction have been treated as existing and included within the existing surrounds scenario. These are detailed in Table 3.

Cumulative schemes that fall outside the study radius and are therefore excluded from all modelled scenarios are listed in Table 4.

Table 2: Cumulative developments		
Number	Development Name	Planning Reference
1	52-55 Friar Street Reading and 12 Greyfriars Road RG1 1DX	PL/16/2210
2	Hexagon Theatre	PL/24/1392
3	Broad Street Mall, Reading	PL/18/2137
4	20 Hosier Street	PL/18/2054

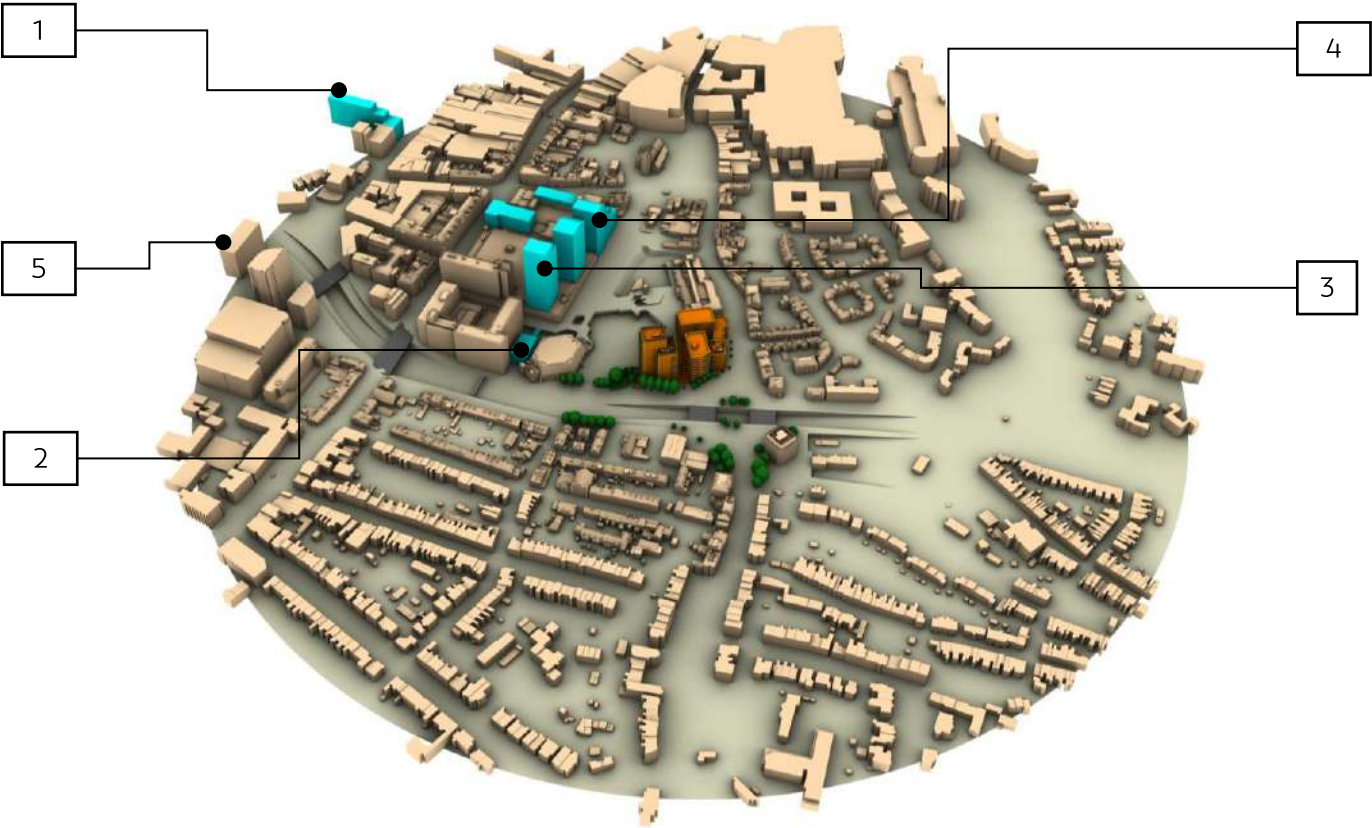


Figure 6: Cumulative developments

Table 3: Built or under-construction cumulative sites treated as existing buildings

Number	Development Name	Planning Reference
5	Land between Weldale Street and Chatham Street Reading	PL/17/0326

Table 4: Cumulative schemes beyond the modelling extent

Number	Development Name	Planning Reference
6	Station Hill	PL/20/1536
7	Plot E Friar Street & Garrard Street	PL/20/1537
8	35-39 Friar Street	PL/22/0933
9	Former Debenhams Department Store, west of Yield Hall Place	PL/22/1916
10	Existing Vue cinema complex west of Yield Hall Place/London Road	PL/22/1917

5. Landscaping & Mitigation: Ground Level Landscaping

Landscaping Proposals

The wind microclimate for the Proposed Development has been assessed with current soft landscaping proposals and surrounding landscaping. Figures 7, 8, 9, and 10 summarise the landscaping modelled at ground level, Level 1, Level 6, and Level 12, respectively.

Modelling of the soft landscaping has been based on drawings provided by Exterior Architecture, with all referenced drawing information listed in Appendix A.

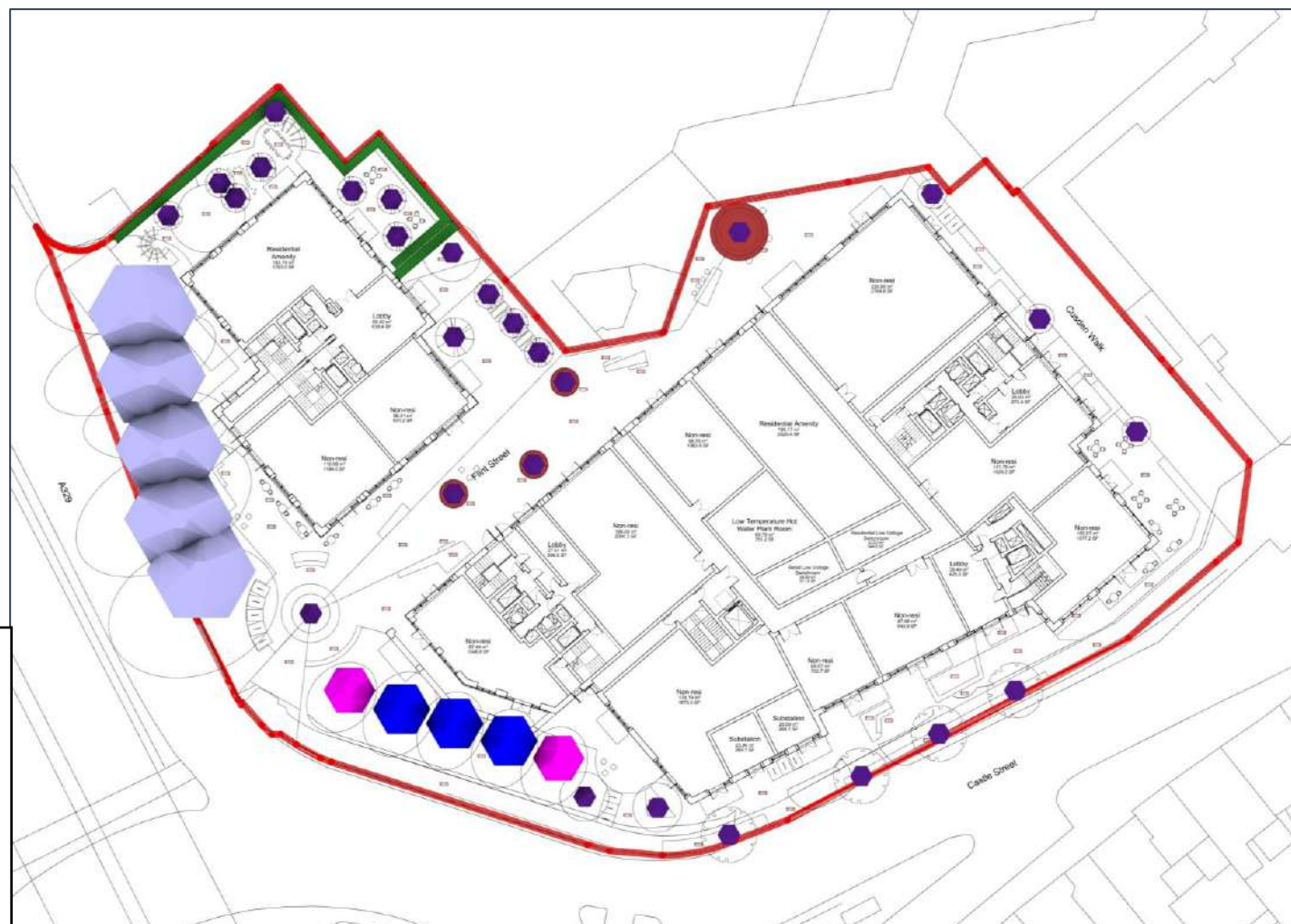
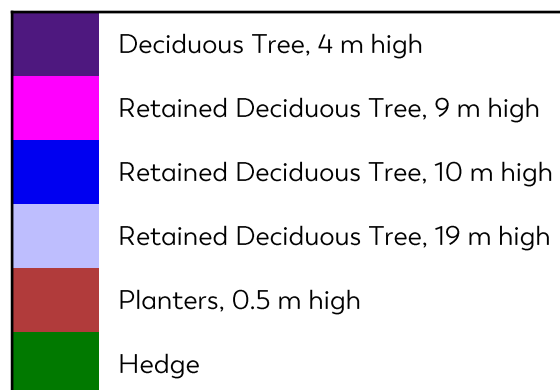


Figure 7: Soft landscaping proposals at ground and podium level

5. Landscaping & Mitigation: Raised Levels Landscaping

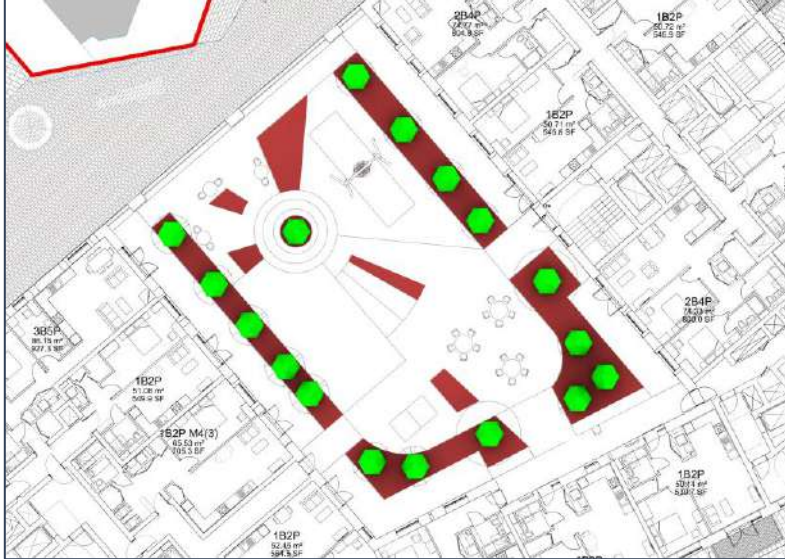


Figure 8: Landscaping proposals at Level 1



Figure 9: Landscaping proposals at Level 6



Figure 10: Landscaping proposals at Level 12

	Deciduous Tree, 2.5 m high
	Deciduous Tree, 3 m high
	Planters, 1 m high
	Planters, 0.5 m high
	Pergola

5. Landscaping & Mitigation: Ground Level Wind Mitigation Measures

The proposed development has been assessed both with and without wind mitigation measures. Figure 11 illustrates the mitigation measures incorporated at ground level:

- Ground and Podium level measures
 - Three 4 m high deciduous trees
 - Eleven 1 m high planters with shrub planting at entrances to Block A
 - Eight 0.5 m high planters
 - Relocation of outdoor seating from the southeast to the southwest of Block B

	Deciduous Tree, 4 m high
	Potted Plants, 2 m high
	Porous Screen, 2 m high
	Planters, 0.5 m high
	Relocation



Figure 11: Wind mitigation measures at ground and podium level

5. Landscaping & Mitigation: Raised Levels Wind Mitigation Measures

Figures 12 and 13 present the mitigation measures implemented at Level 6, Level 12, and the balconies above Level 12.:

- Level 6
 - Two 2 m high porous screens integrated within planters
 - Relocation of planters
- Level 12
 - One 2 m high porous screen within planters
 - One 2m high porous screen at southern corner
 - Two 0.5 m high planters
 - Full-height solid infill along columns on the southwest façade
- Balconies above Level 12
 - Relocation of the balconies to the northeast façade

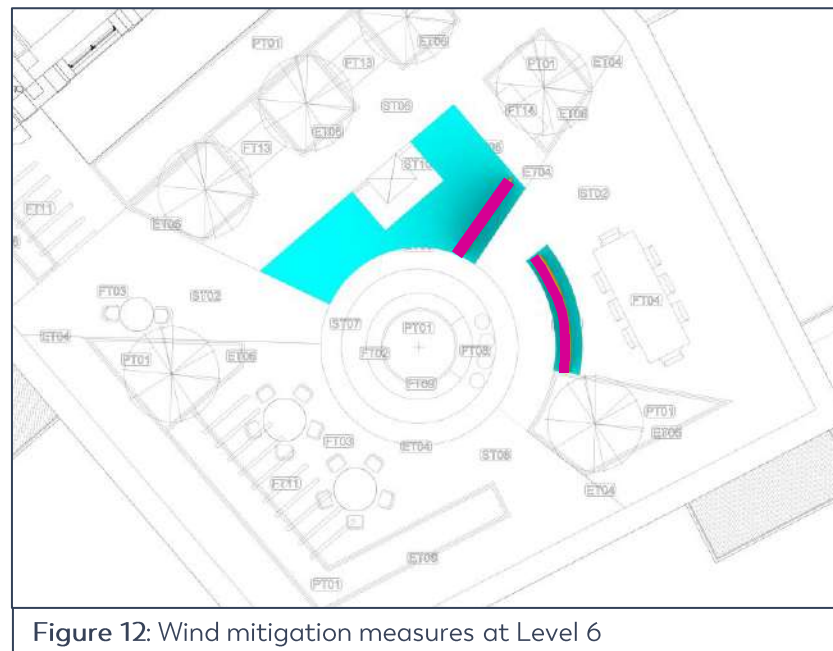


Figure 12: Wind mitigation measures at Level 6

	Porous Screen, 2 m high
	Planters, 0.5 m high
	Solid Infill
	Relocation

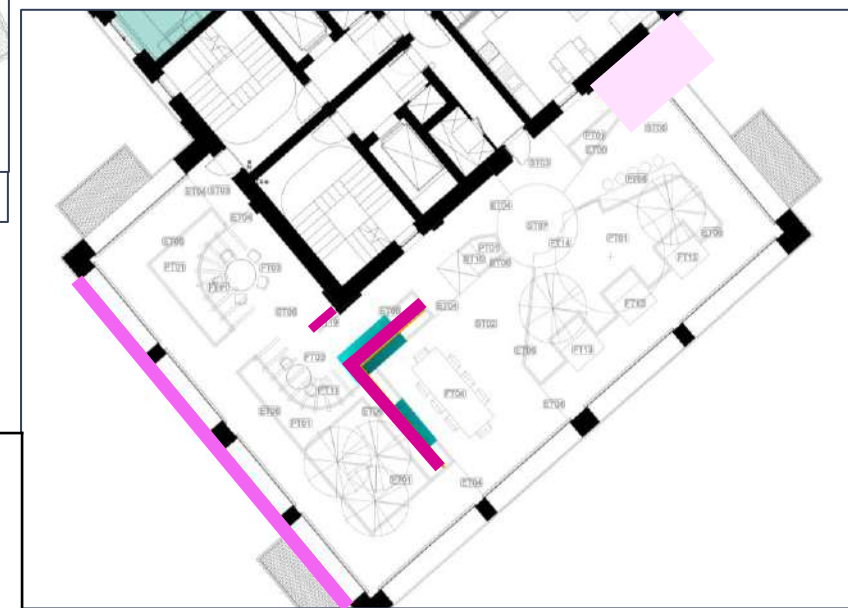


Figure 13: Wind mitigation measures at Level 12

6. Results

Pedestrian Uses

Assessments of this nature predict the proportion of time an area will experience wind speeds greater than threshold values associated with comfortable use once the development is introduced. It is therefore important to have an adequate understanding of the expected uses of the various areas in and around the site.

For the current study, anticipated pedestrian uses are presented graphically in Figures 14, 15, 16 and 17.

Results

Results are presented as follows, for safety, worst-seasonal comfort and summertime comfort respectively, at ground level, plus summertime comfort above ground:

- Existing site conditions , existing surrounding context (EinE) – Figures 18-20
- Proposed development, existing surrounding context (PinE) – Figures 21-27
- Proposed development, cumulative surrounding context (PinC) – Figures 28-34
- Proposed development, existing surrounding context with mitigation (PinE Mit) – Figures 35-41
- Proposed development, cumulative surrounding context with mitigation (PinC Mit) – Figures 42-48

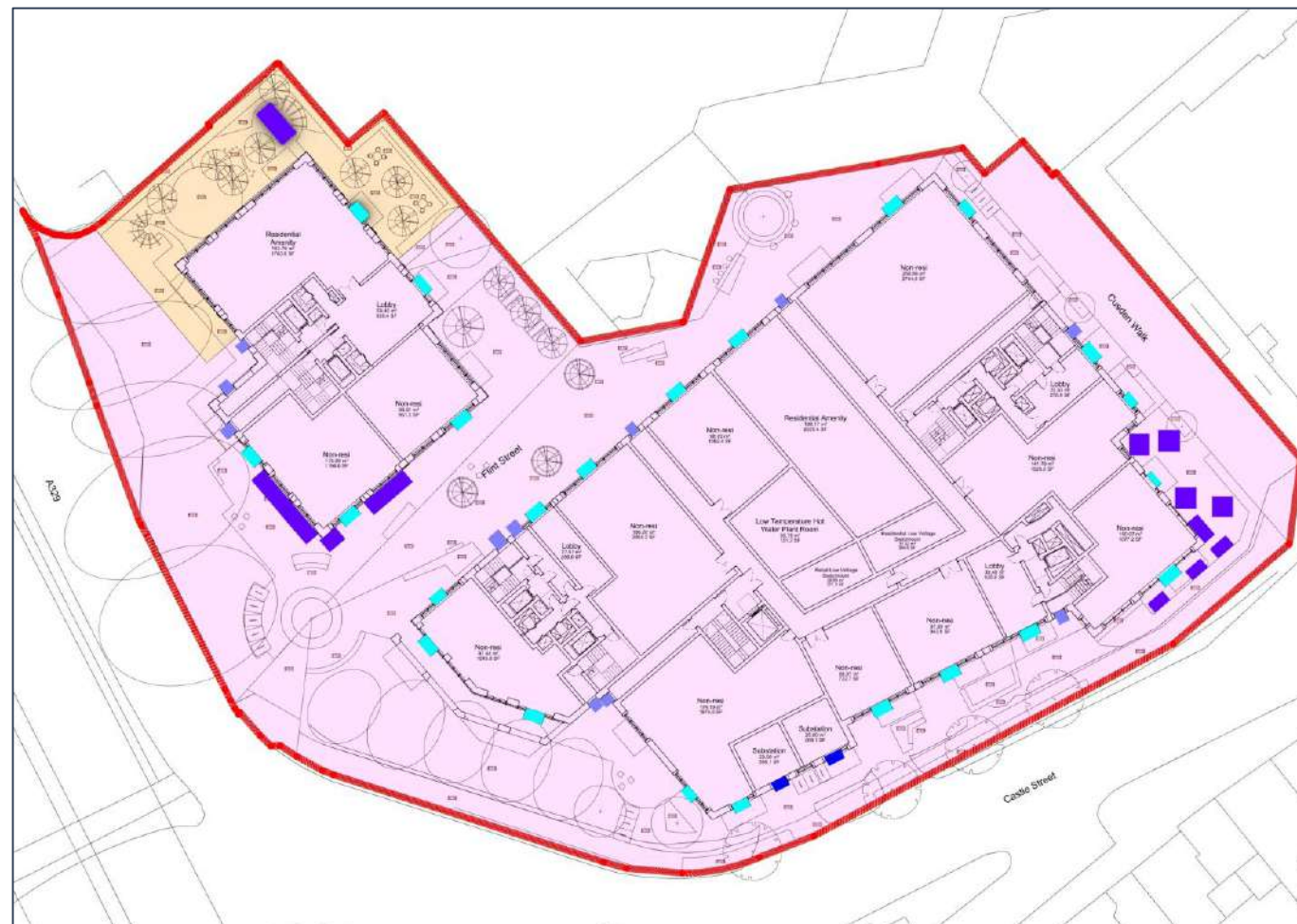


Figure 14: Site wide pedestrian uses

General Movement	Primary Entrances	Maintenance Entrances
General Recreational	Secondary Entrances	Outdoor Seating

6. Results

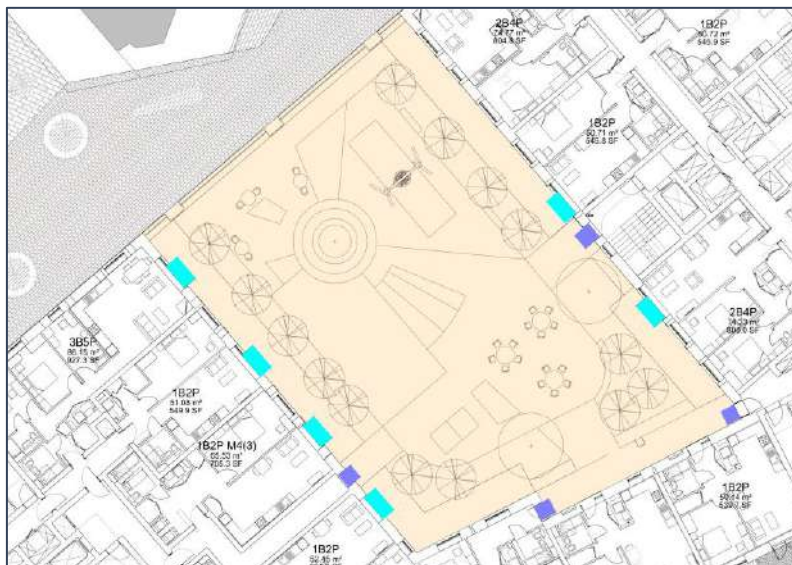


Figure 15: Proposed uses at Level 1

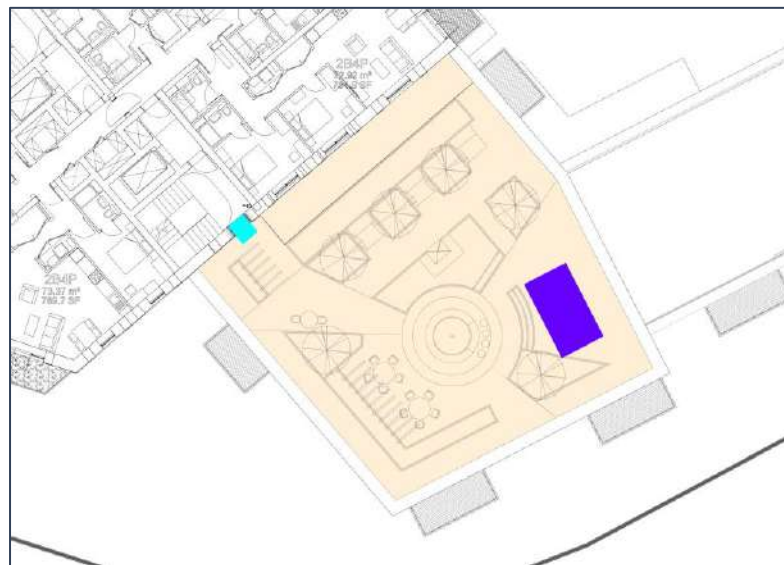


Figure 16: Proposed uses at Level 6

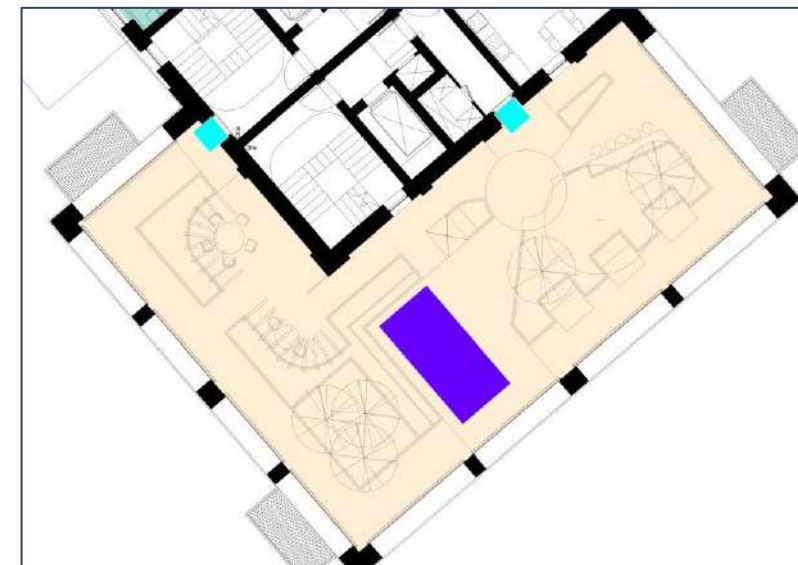
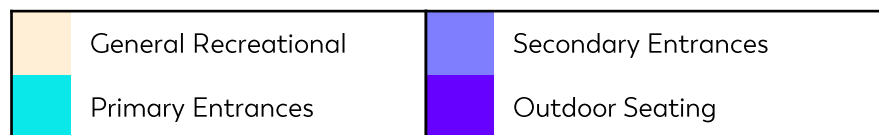


Figure 17: Proposed uses at Level 12



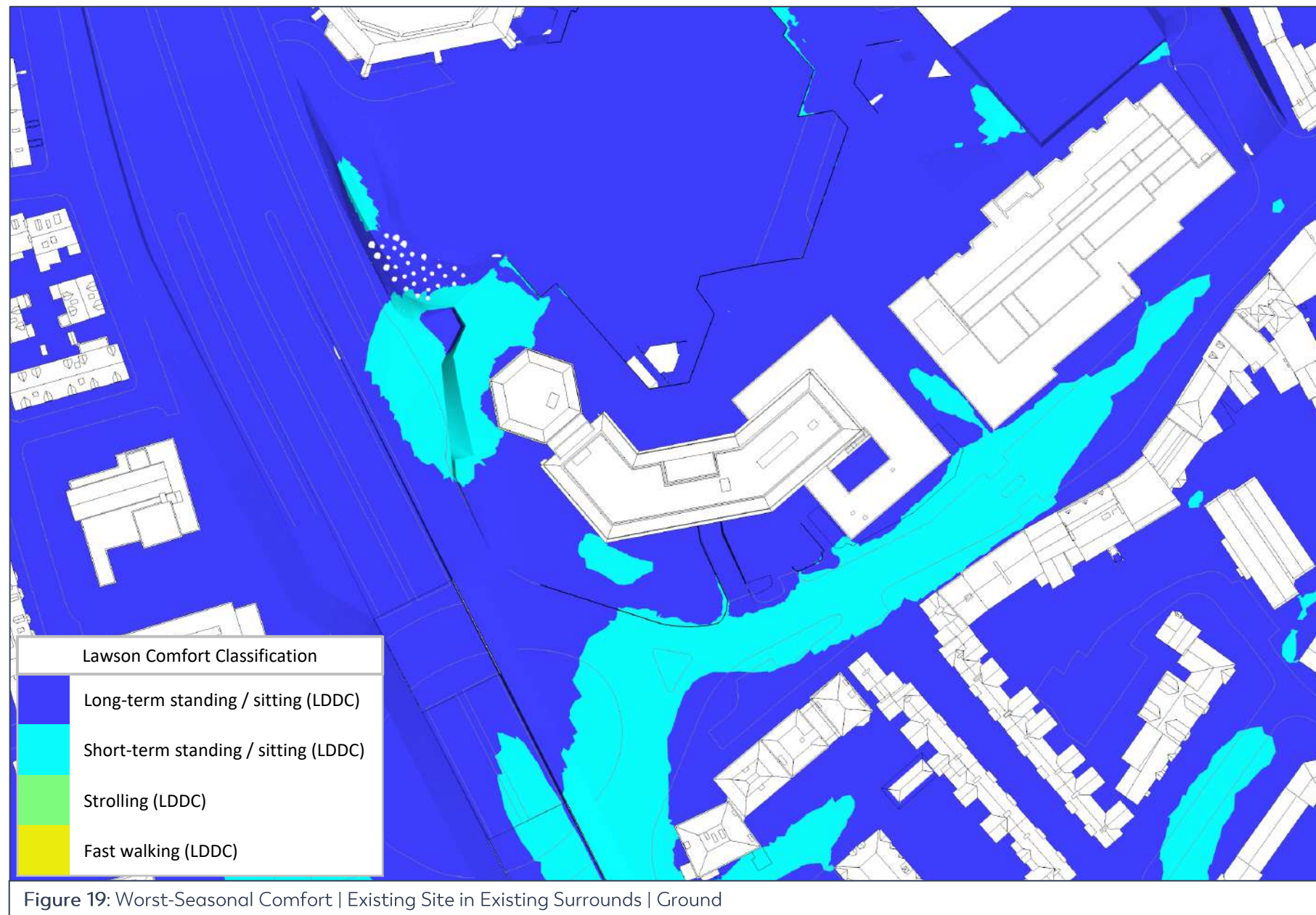
Safety | EinE | Ground

- Wind conditions within the existing site and surrounding areas comply with the Lawson safety criterion for pedestrian safety.



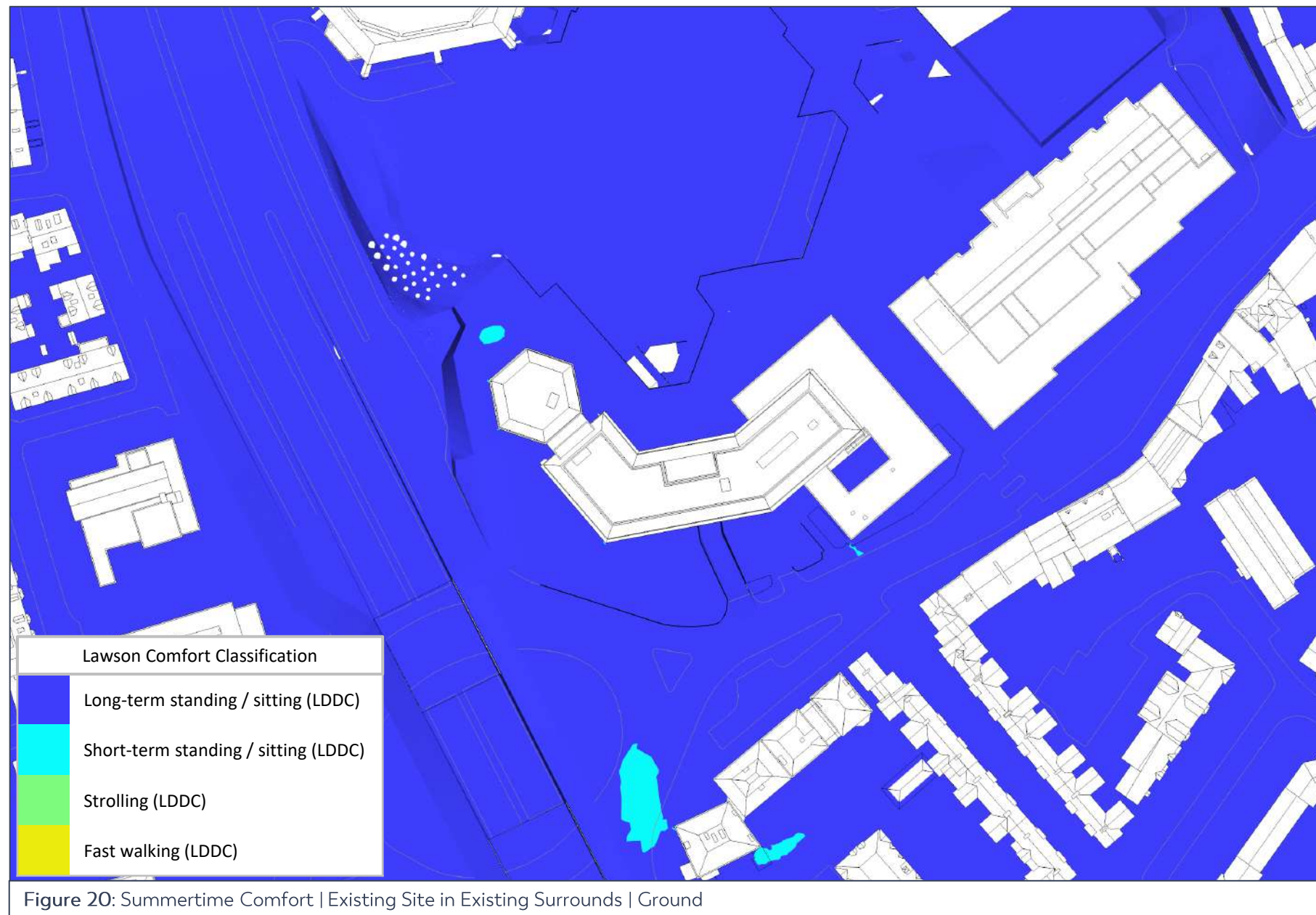
Worst-Seasonal Comfort | EinE | Ground

- Wind conditions across the site and immediate surroundings are at least suitable for short-term standing or sitting.
- Accordingly, wind conditions are considered suitable for their intended uses, including at entrances and along pedestrian routes.



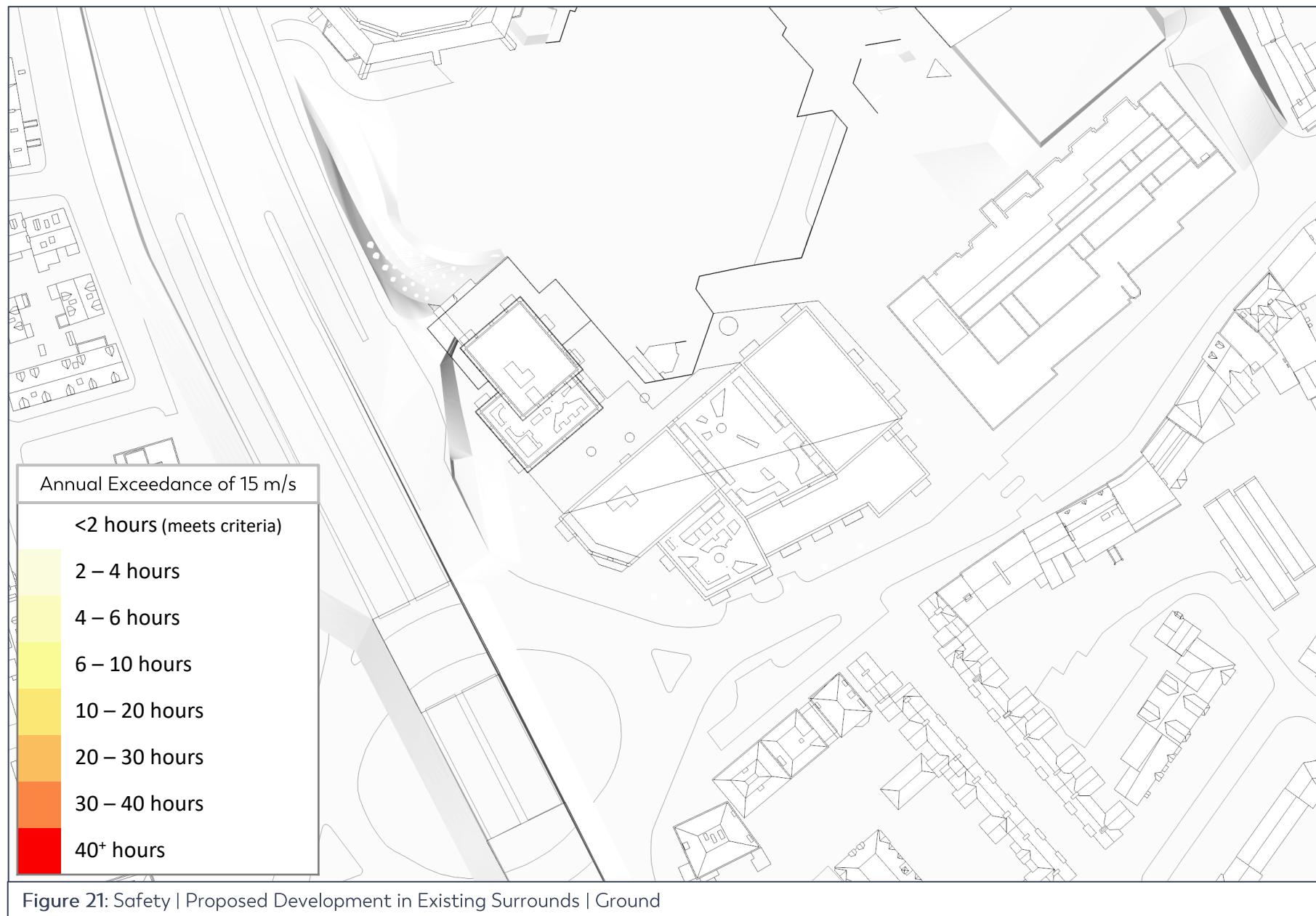
Summertime Comfort | EinE | Ground

- Wind conditions within the site and the immediate surrounding areas are predominantly suitable for long-term standing or sitting during summer.



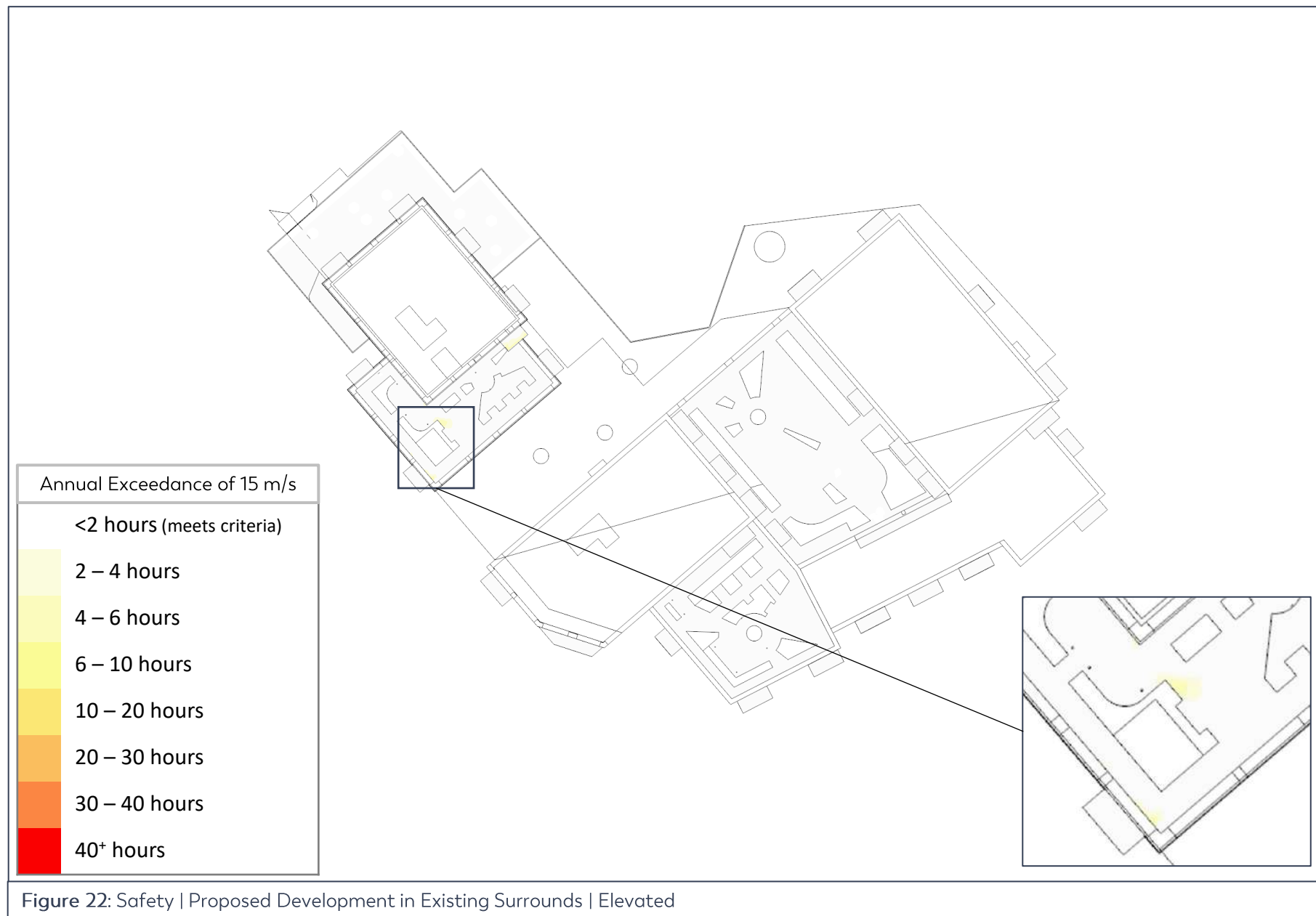
Safety | PinE | Ground

- Following the introduction of the proposed development, wind conditions at ground level within the site and surrounding areas continue to satisfy the Lawson safety criterion.



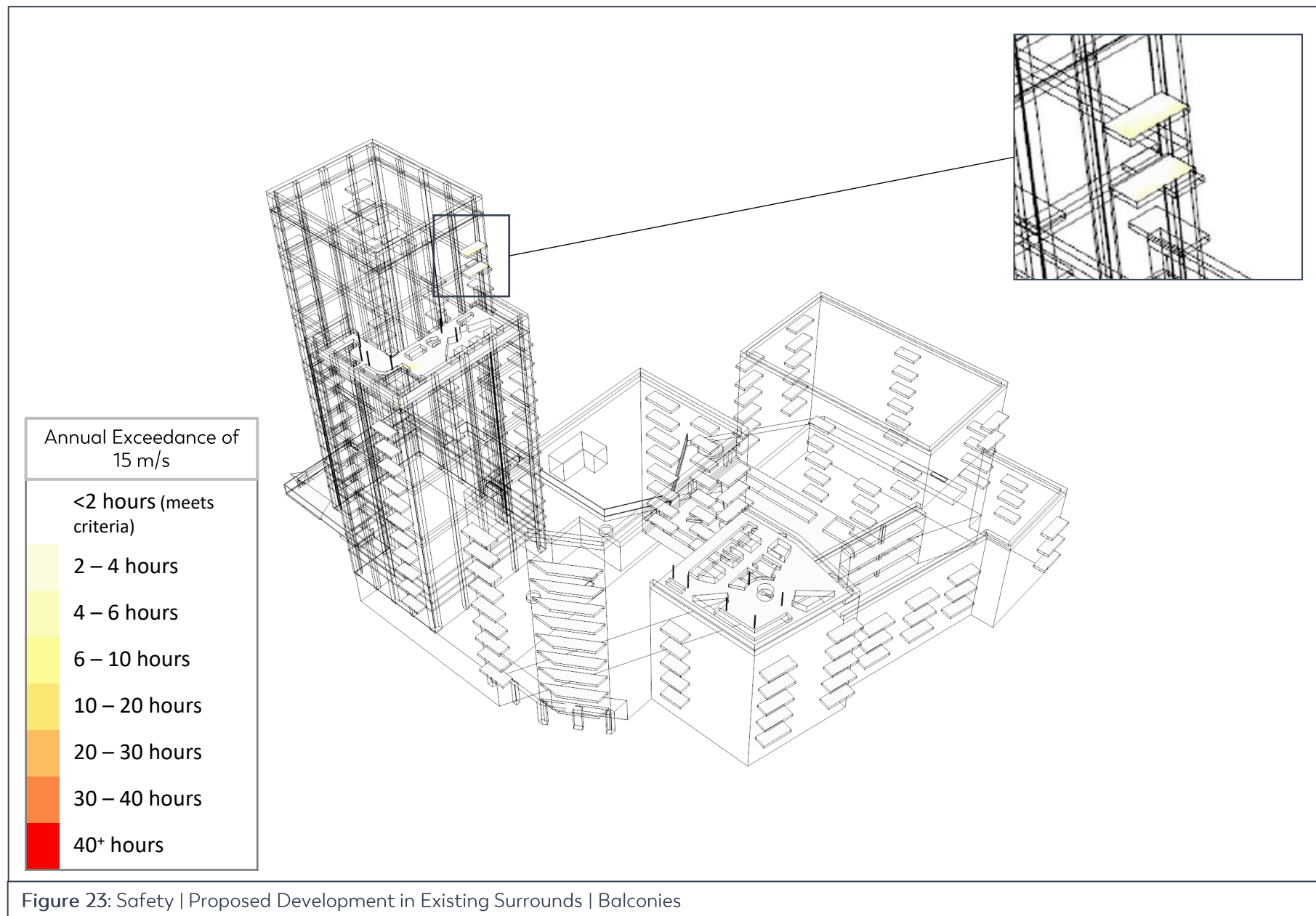
Safety | PinE | Elevated

- Wind conditions at majority of the elevated communal terrace levels are predicted to comply with the Lawson safety criteria.
- However, marginal exceedances are anticipated at localised areas on the Level 12 communal terrace.
- These exceedances are limited in extent and do not affect the terrace as a whole.



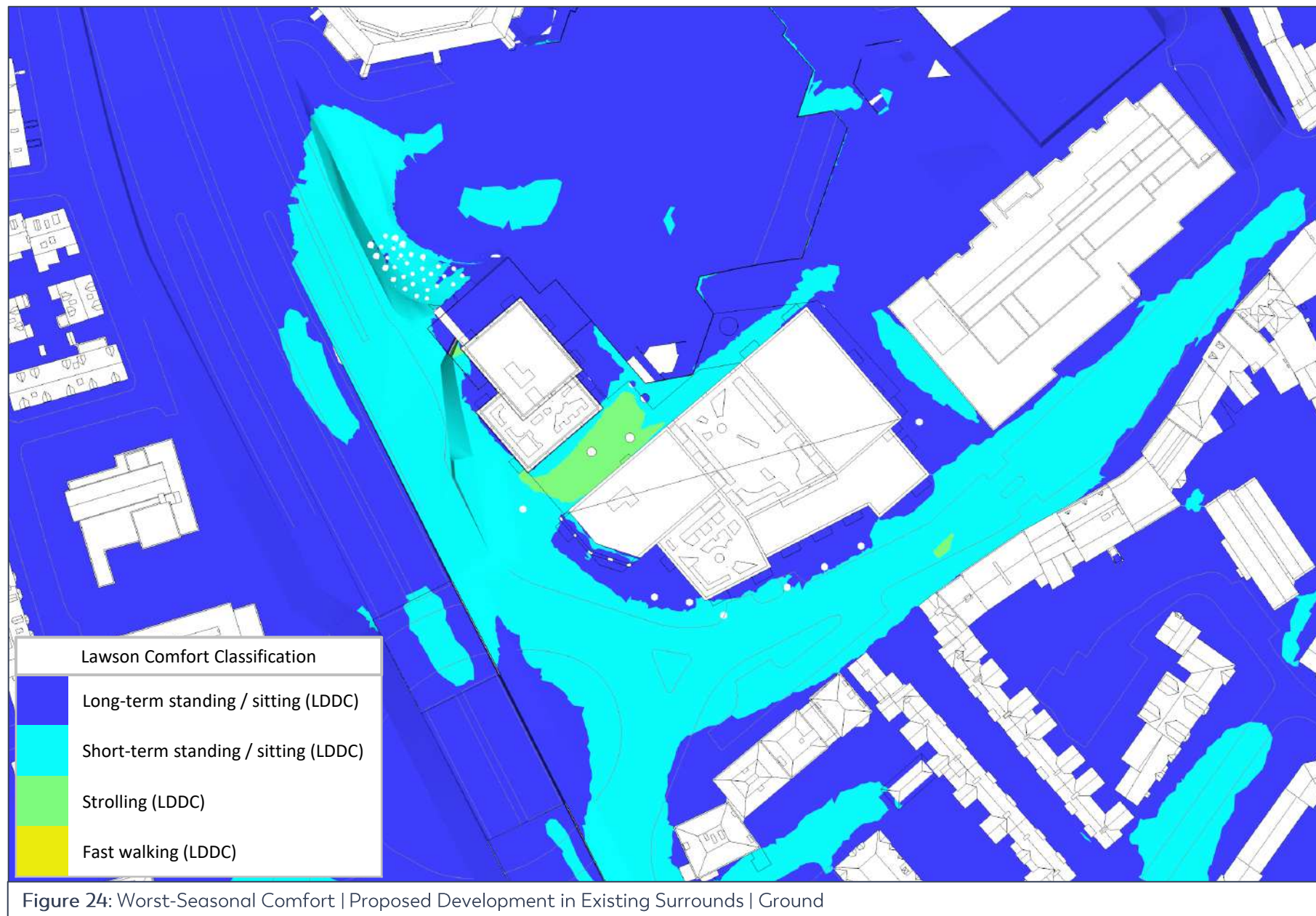
Safety | PinE | Balconies

- Wind conditions across the majority of balconies on Blocks A and B comply with the Lawson safety criterion.
- However, two balconies on the south-eastern façade of Block B, located above the Level 12 terrace, are predicted to exceed the safety criterion.



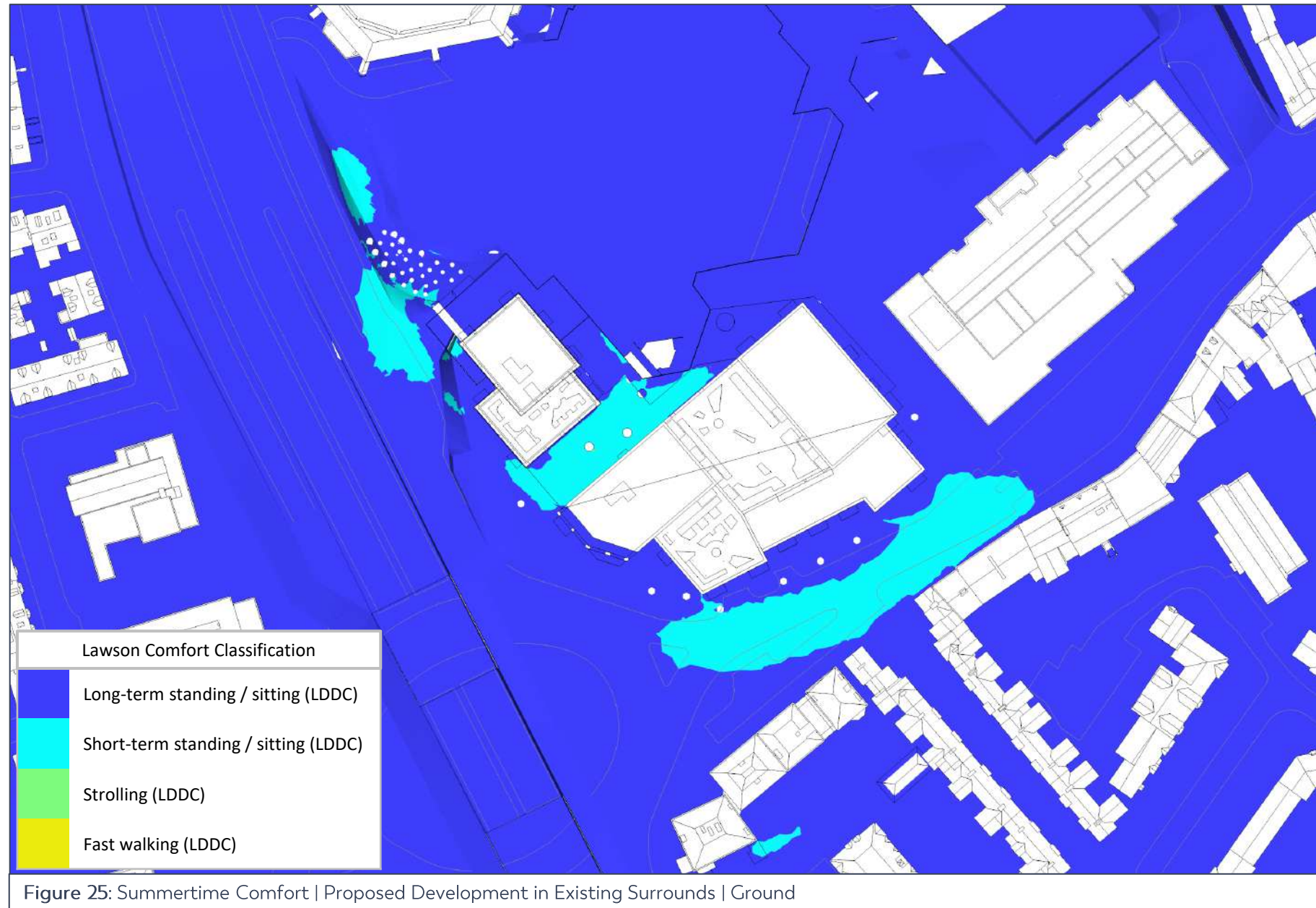
Worst-Seasonal Comfort | PinE | Ground

- Wind conditions at thoroughfares within the site are suitable for at least short-term standing or better, with only a pocket of strolling conditions present along Flint Street between Block A and B. These conditions meet the comfort criteria for leisure thoroughfare and are thus suitable.
- Wind conditions at the majority of the entrances are predominantly suitable for short-term standing, providing acceptable conditions for pedestrian access.
- However, wind conditions at the entrances to Block A along Flint Street are limited to strolling, indicating reduced comfort for pedestrian ingress and egress.
- In surrounding areas, wind conditions are generally suitable for short-term standing or better and remain suitable for pedestrian activity.



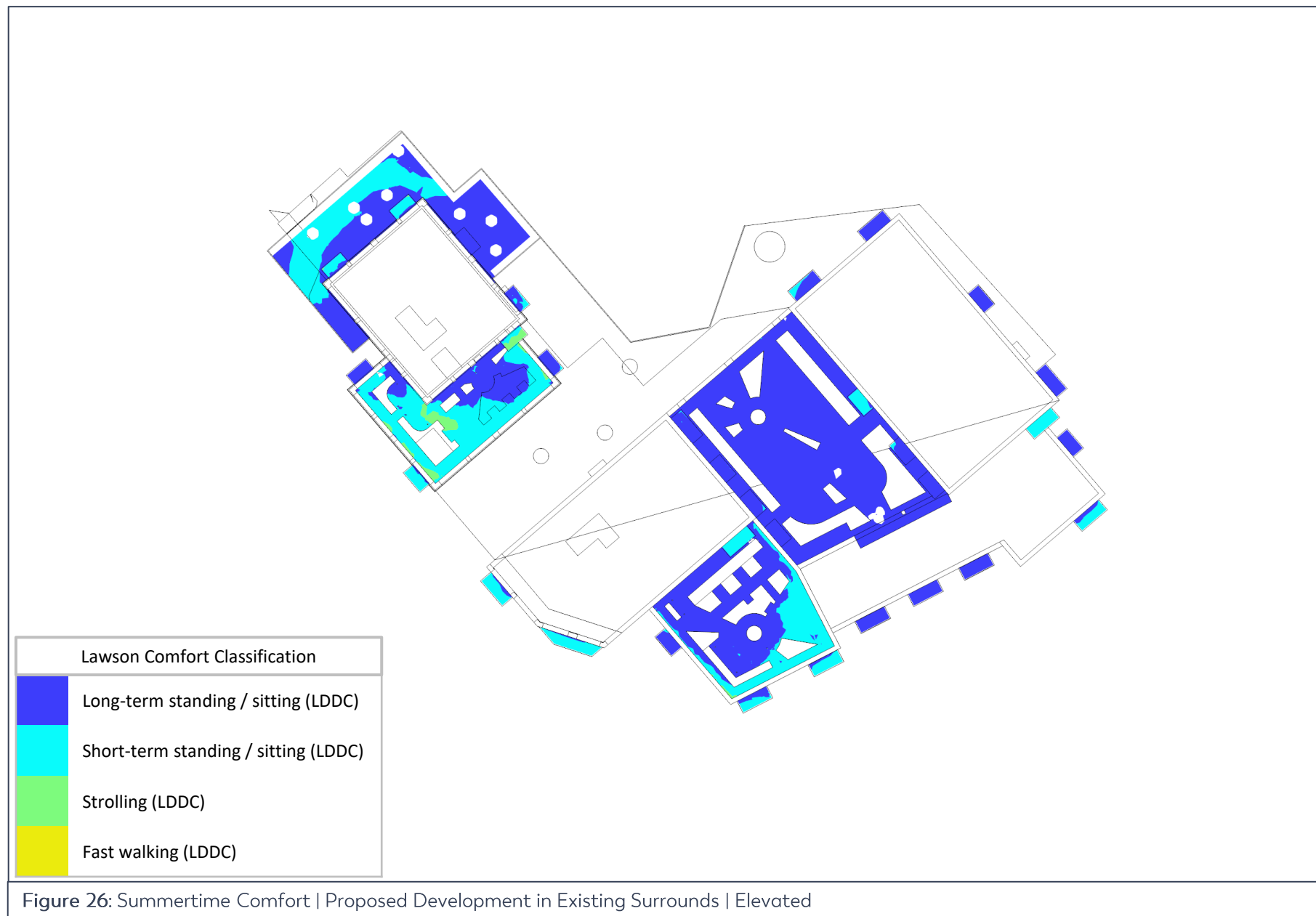
Summertime Comfort | PinE | Ground

- Wind conditions across the site and immediate surroundings are generally suitable for short-term standing or sitting and are therefore appropriate for summer use.
- However, wind conditions at ground-level outdoor seating areas to the southeast of Block B along Flint Street are limited to short-term standing or sitting, indicating that they are too windy for comfortable use.



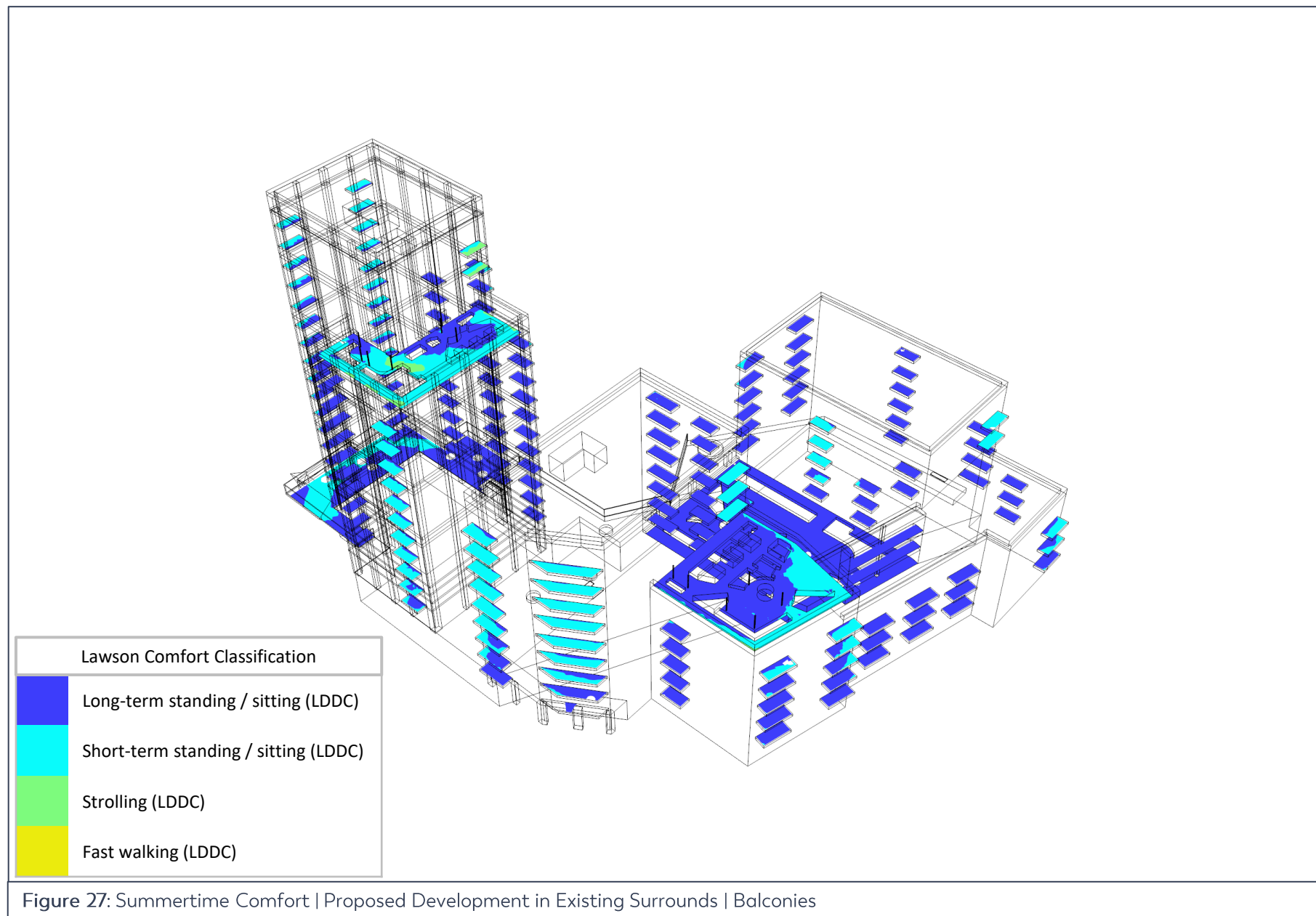
Summertime Comfort | PinE | Elevated

- Wind conditions at the podium amenity space to the north of Block B and at the Level 6 terrace are suitable for a mix of short-term and long-term sitting. While suitable for general recreational use, the outdoor seating area is unsuitable for proposed use.
- Wind conditions at the Level 1 terrace at Block A is largely suitable for long-term sitting and is therefore appropriate for its intended use.
- At the Level 12 terrace of Block B, wind conditions are generally suitable for short-term sitting. Minor exception to this is at the southern corner region, where the wind conditions are only suitable for strolling. These conditions could be improved through the use of landscaping or wind mitigation measures.



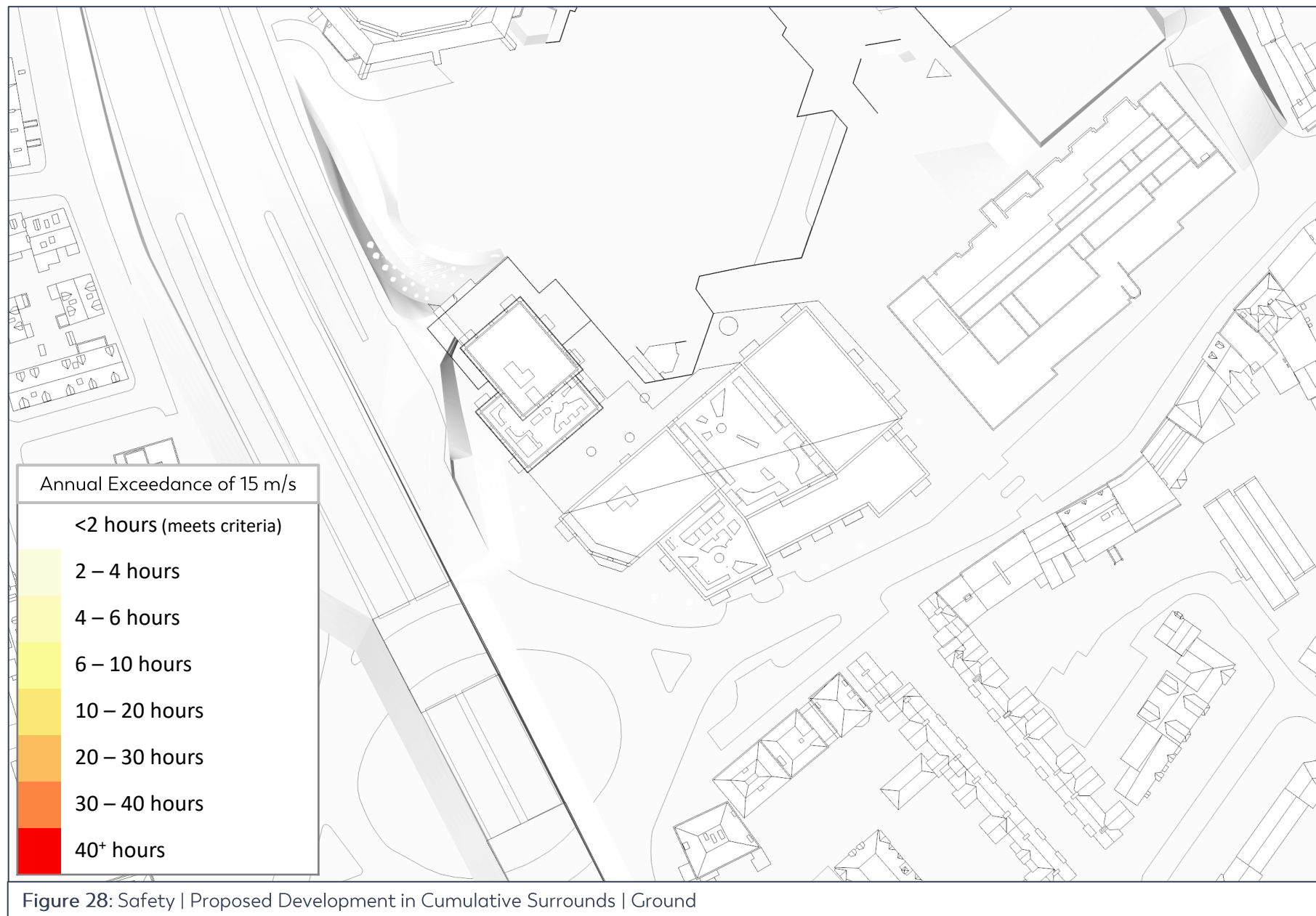
Summertime Comfort | PinE | Balconies

- Wind conditions across the majority of balconies are suitable for at least short-term standing or sitting and are therefore appropriate for their intended use.
- However, wind conditions at two balconies on the southeastern façade of Block B, above the Level 12 terrace, are limited to strolling, and are therefore unsuitable for their intended use.



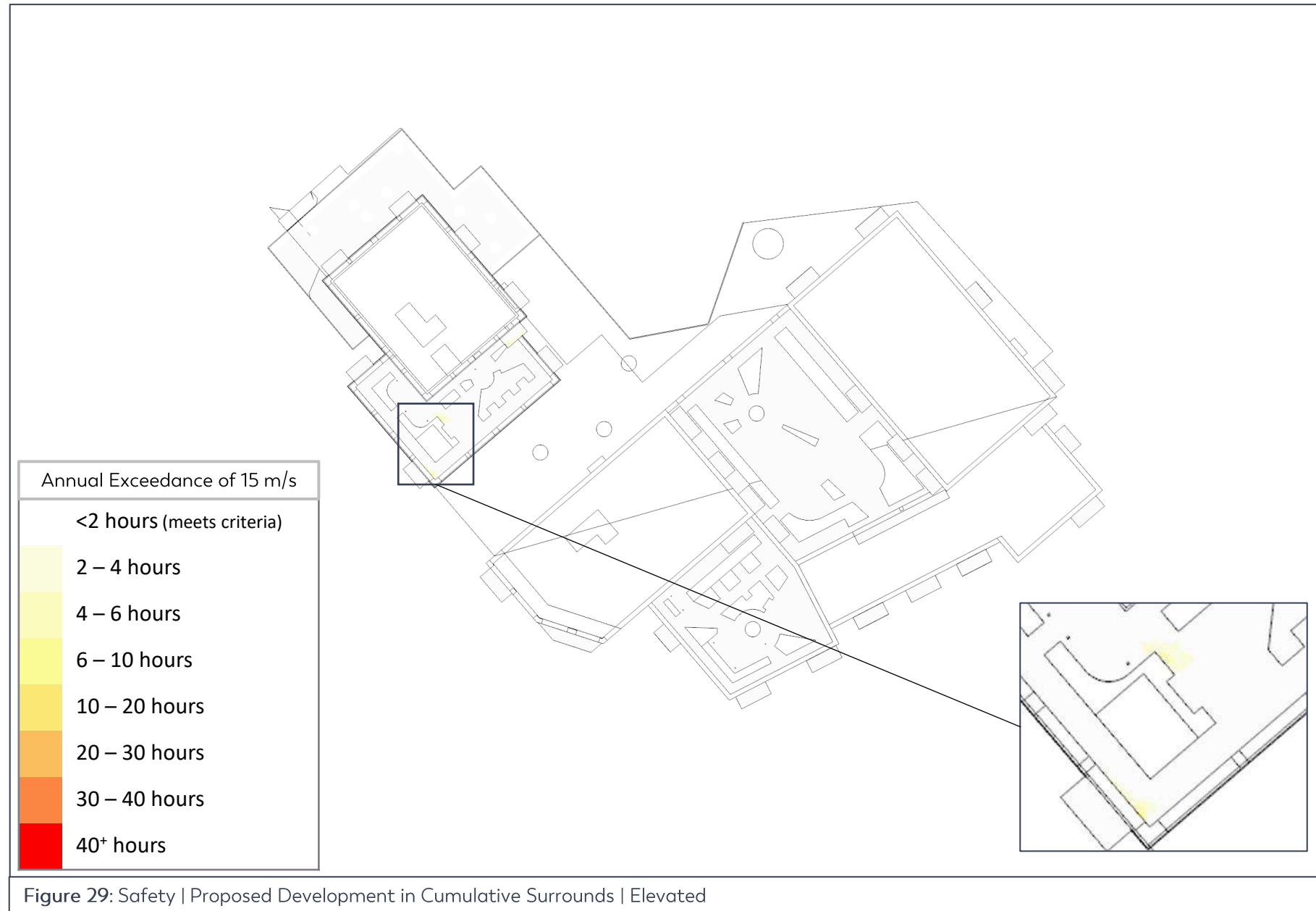
Safety | PinC | Ground

- With the inclusion of cumulative surrounding developments, wind conditions at ground level within the site and surrounding areas continue to satisfy the Lawson safety criterion.



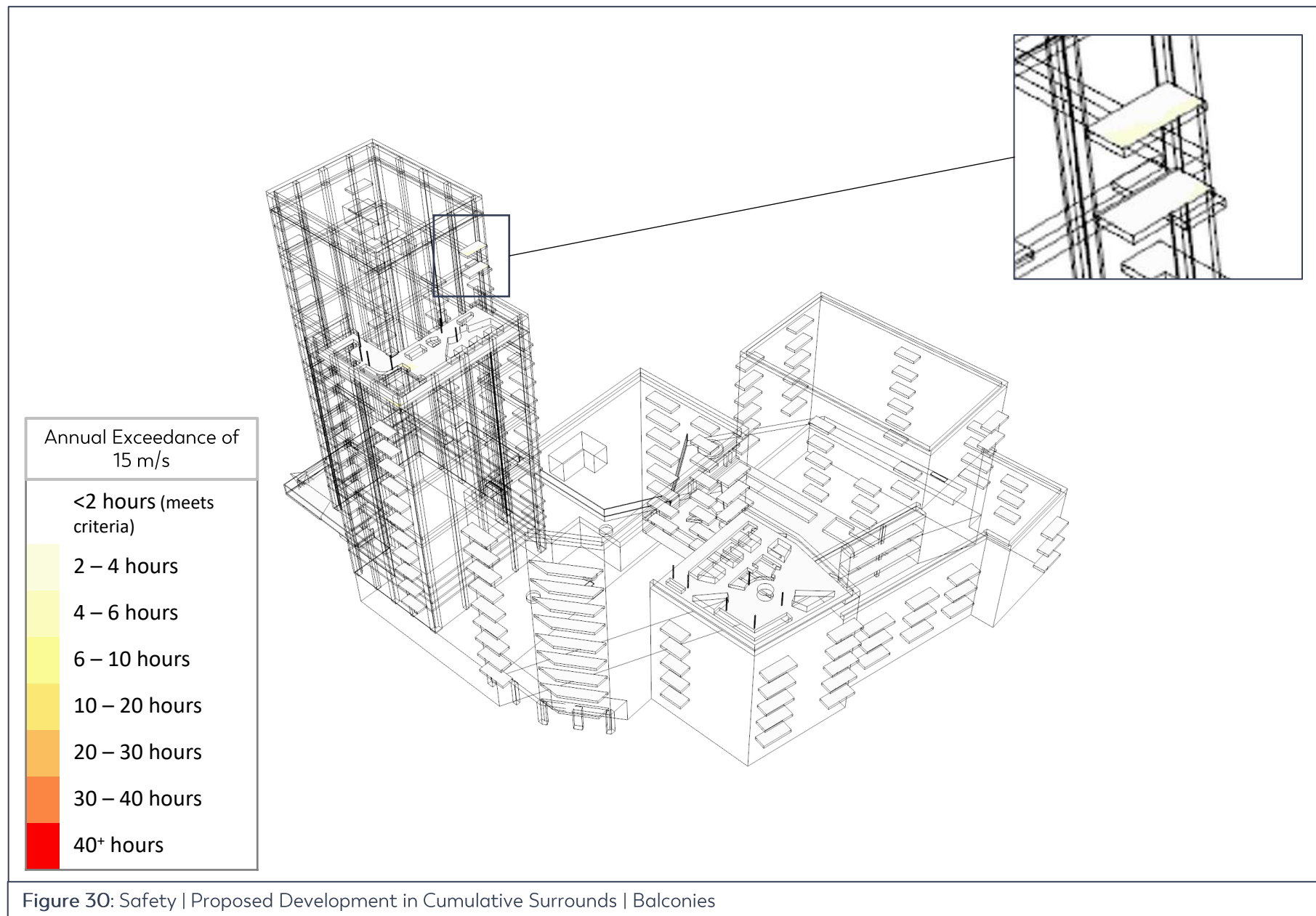
Safety | PinC | Elevated

- Wind conditions remain broadly consistent with the existing surroundings scenario, with a localised exceedance of the Lawson safety criterion at the Level 12 terrace.



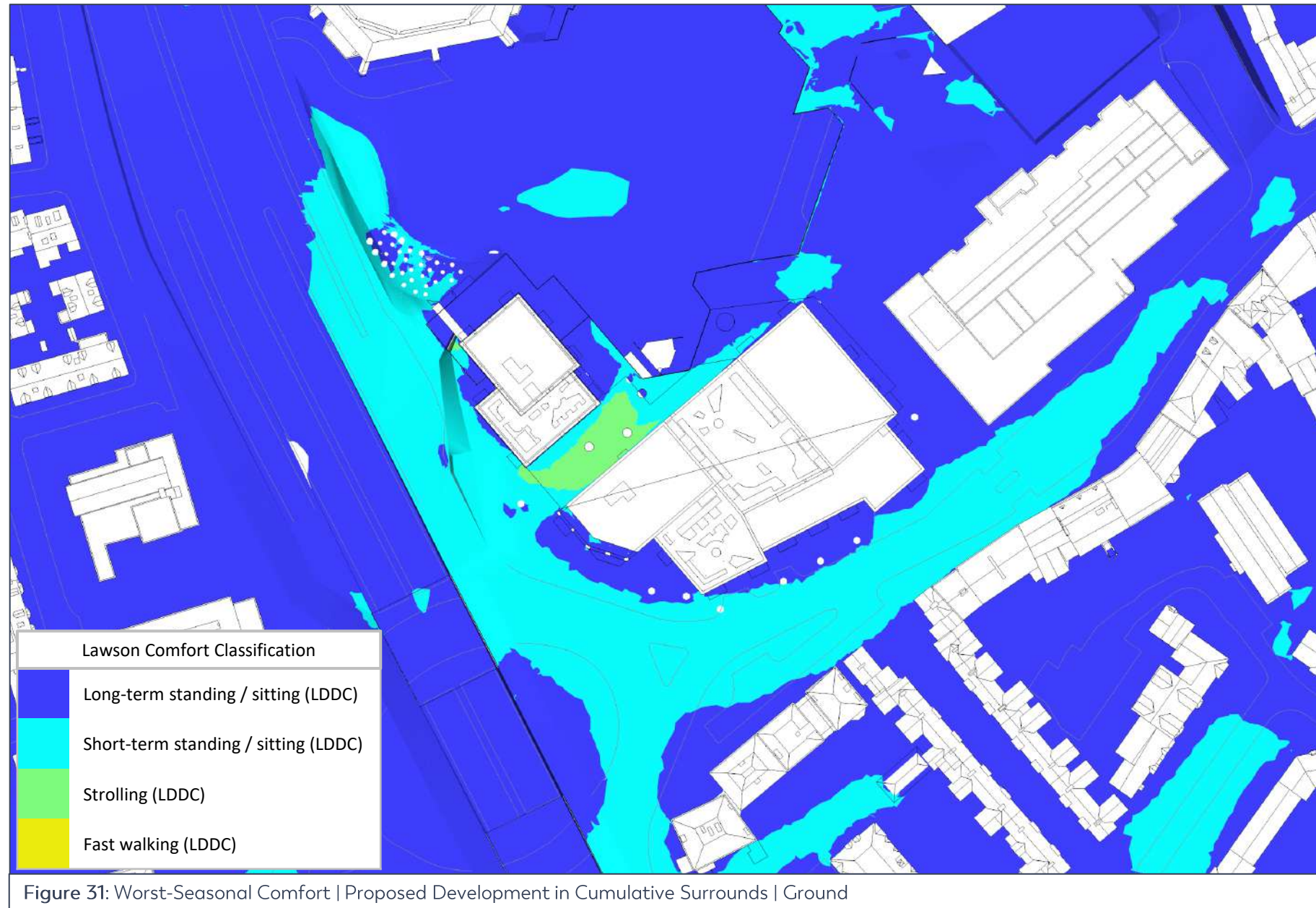
Safety | PinC | Balconies

- Wind conditions remain broadly consistent with the existing surroundings scenario, with exceedances of the Lawson safety criterion persisting on the south-eastern façade of Block B, located above the Level 12 terrace.



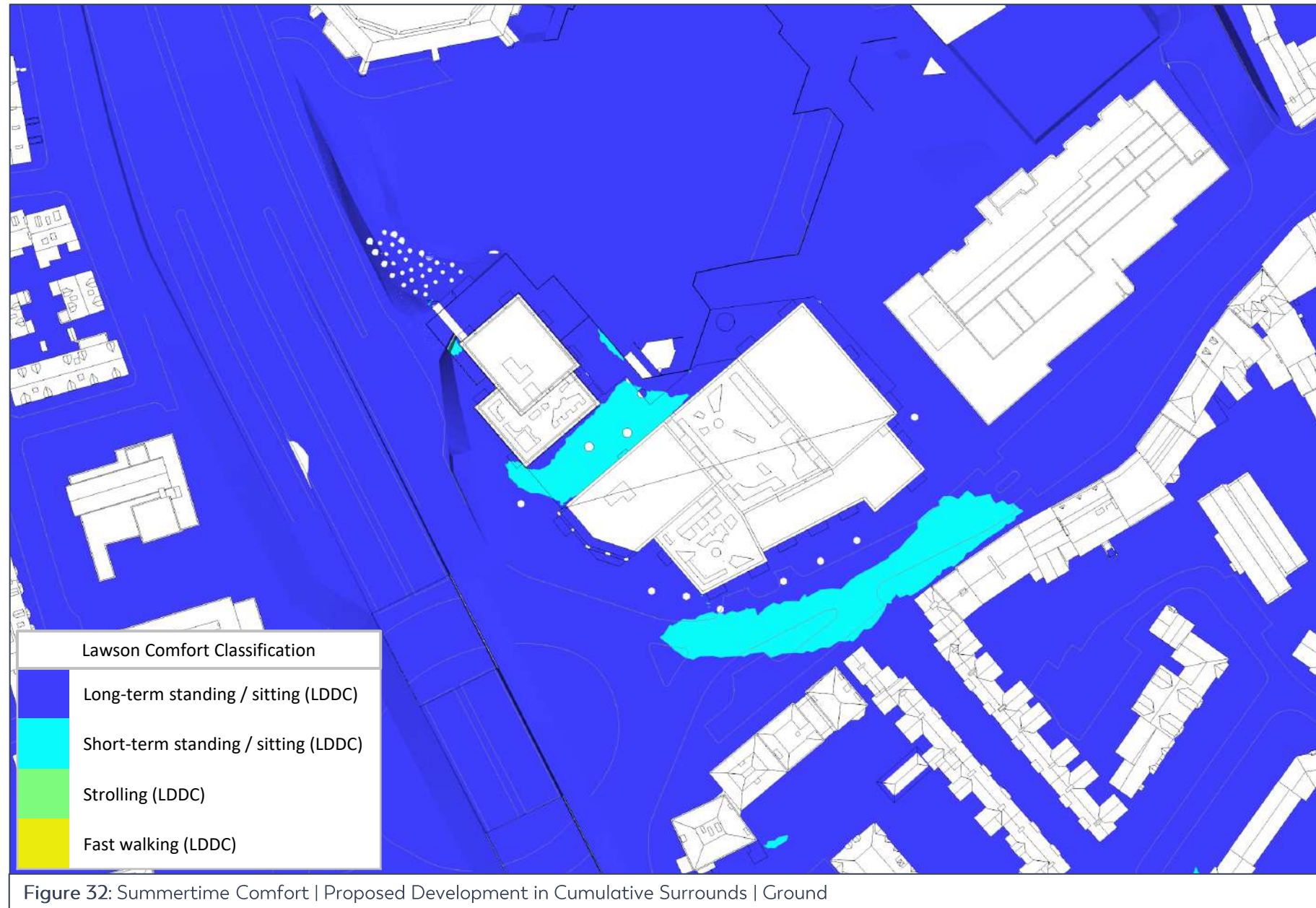
Worst-Seasonal Comfort | PinC | Ground

- Wind conditions are materially similar to those of the existing surroundings scenario.
- Conditions remain suitable for intended pedestrian uses throughout the year, with the exception of entrances to Block A along Flint Street, where comfort is reduced.



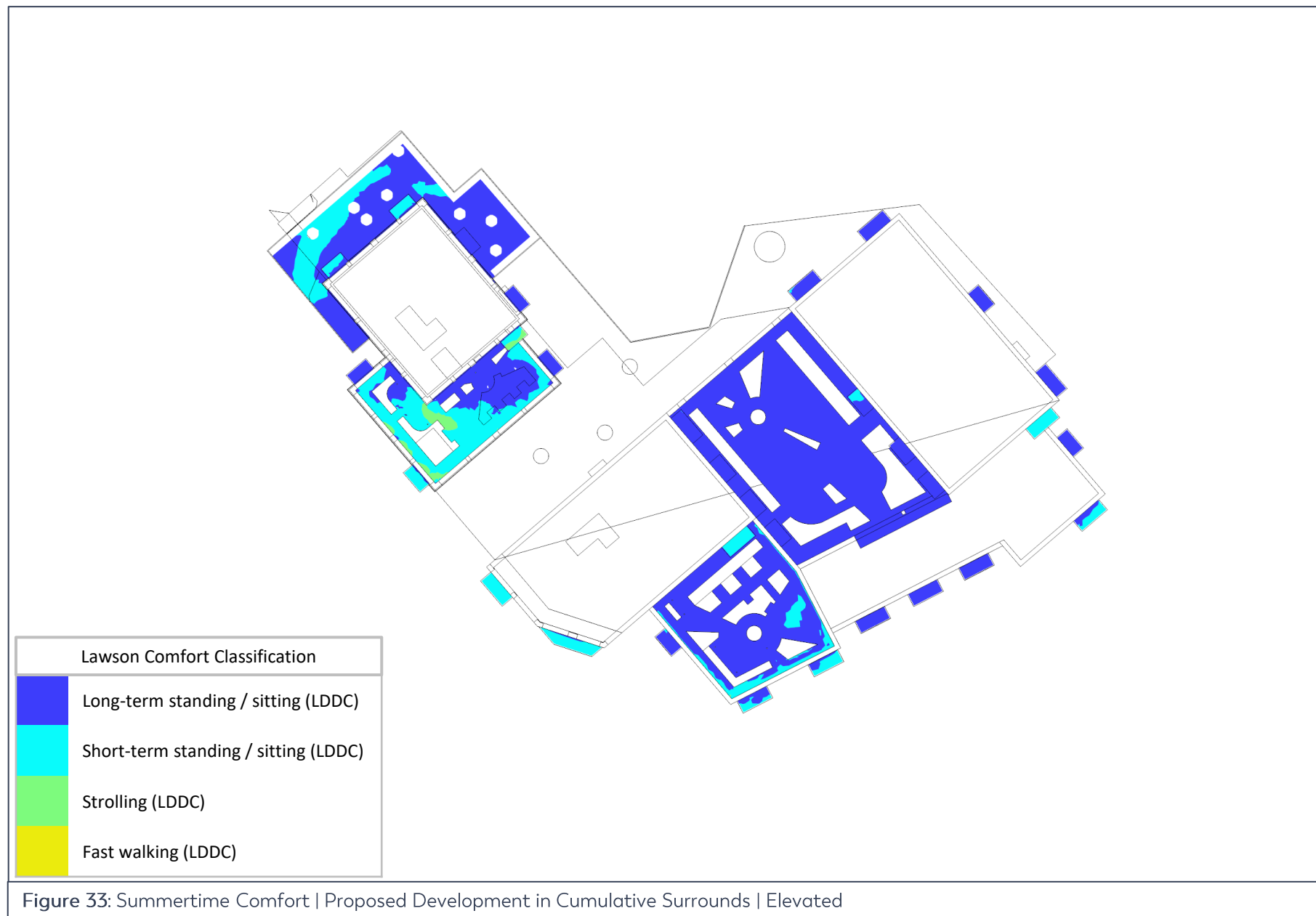
Summertime Comfort | PinC | Ground

- With the introduction of cumulative surrounds, wind conditions are suitable for short-term standing or better.
- Wind conditions are suitable for the intended uses during the summer period, including at the seating areas located to the southeast of Block B at ground level.



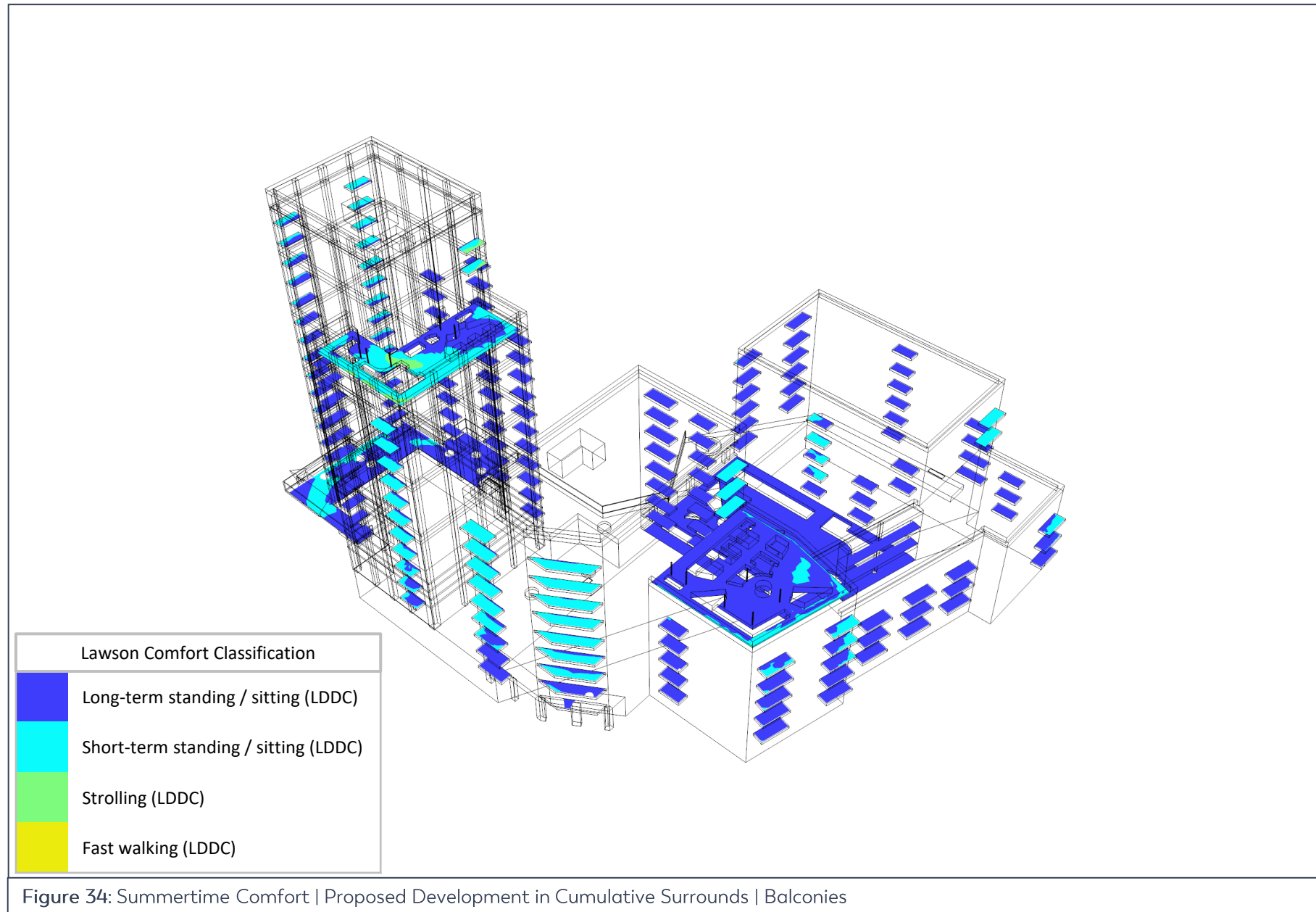
Summertime Comfort | PinC | Elevated

- With the introduction of cumulative surrounds, wind conditions at Level 1 terrace remain materially consistent with those predicted for the existing surroundings scenario.
- Wind conditions at the raised ground level and Level 6 communal terrace have improved, with conditions now suitable for long-term sitting at the outdoor seating areas, while general recreational areas remain comfortable.
- At the Level 12 communal terrace, wind conditions are too windy for the comfortable use, where wind conditions is only suitable for strolling in summer.



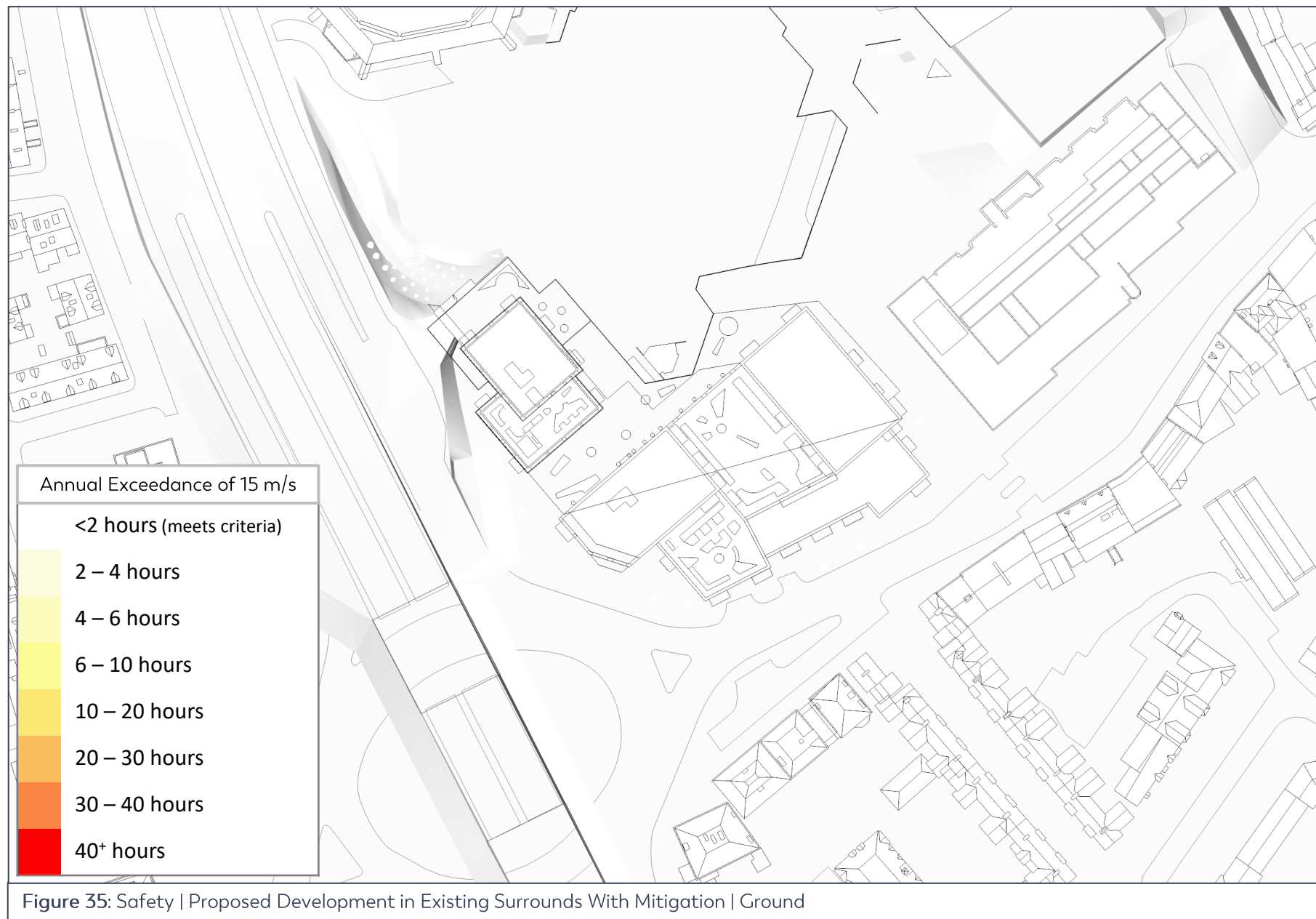
Summertime Comfort | PinC | Balconies

- Wind conditions at balconies remain materially consistent with those predicted under the existing surroundings scenario.



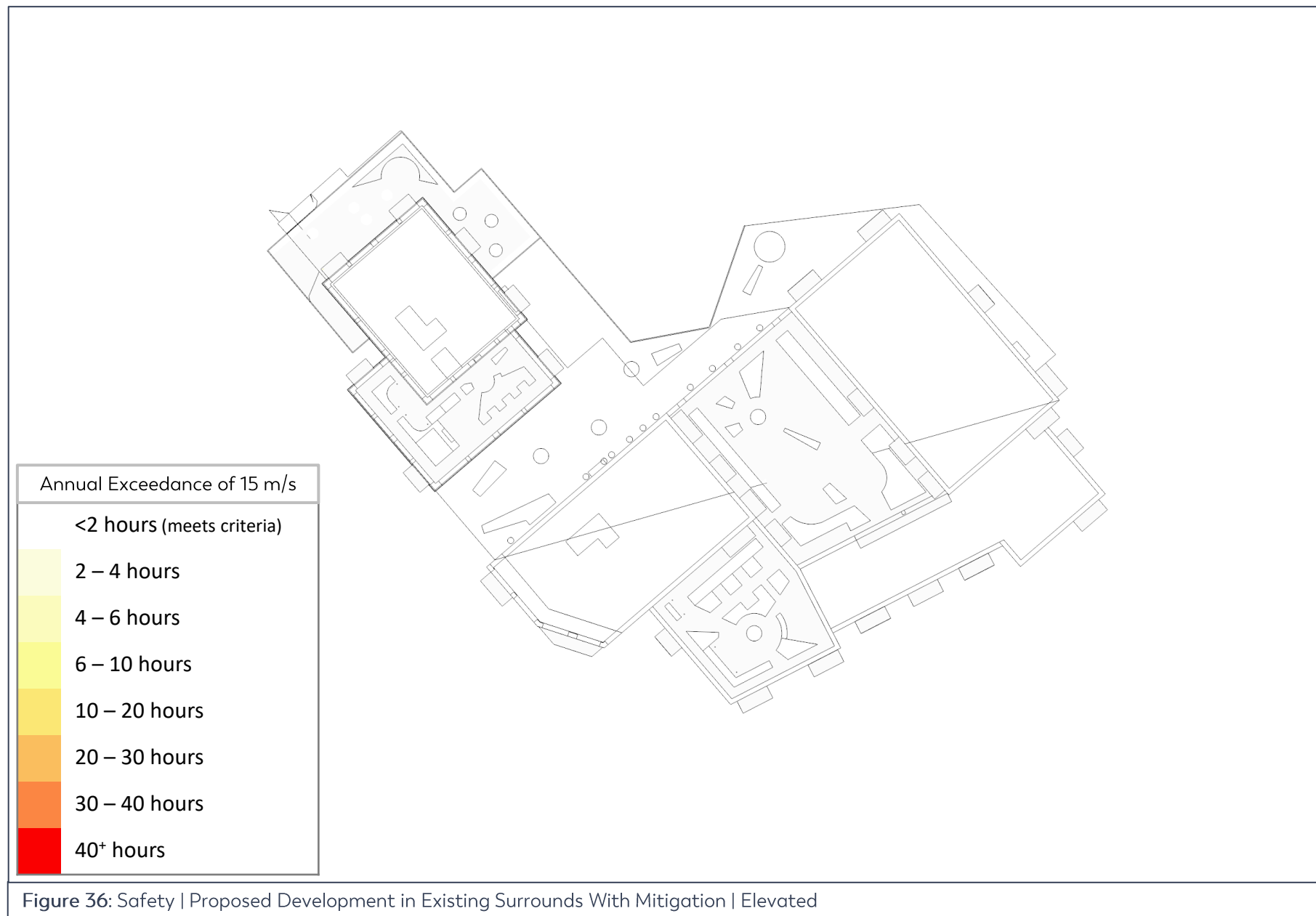
Safety | PinE Mit | Ground

- Following the introduction of mitigation measures, wind conditions at ground level within the site and surrounding areas continue to satisfy the Lawson safety criterion.



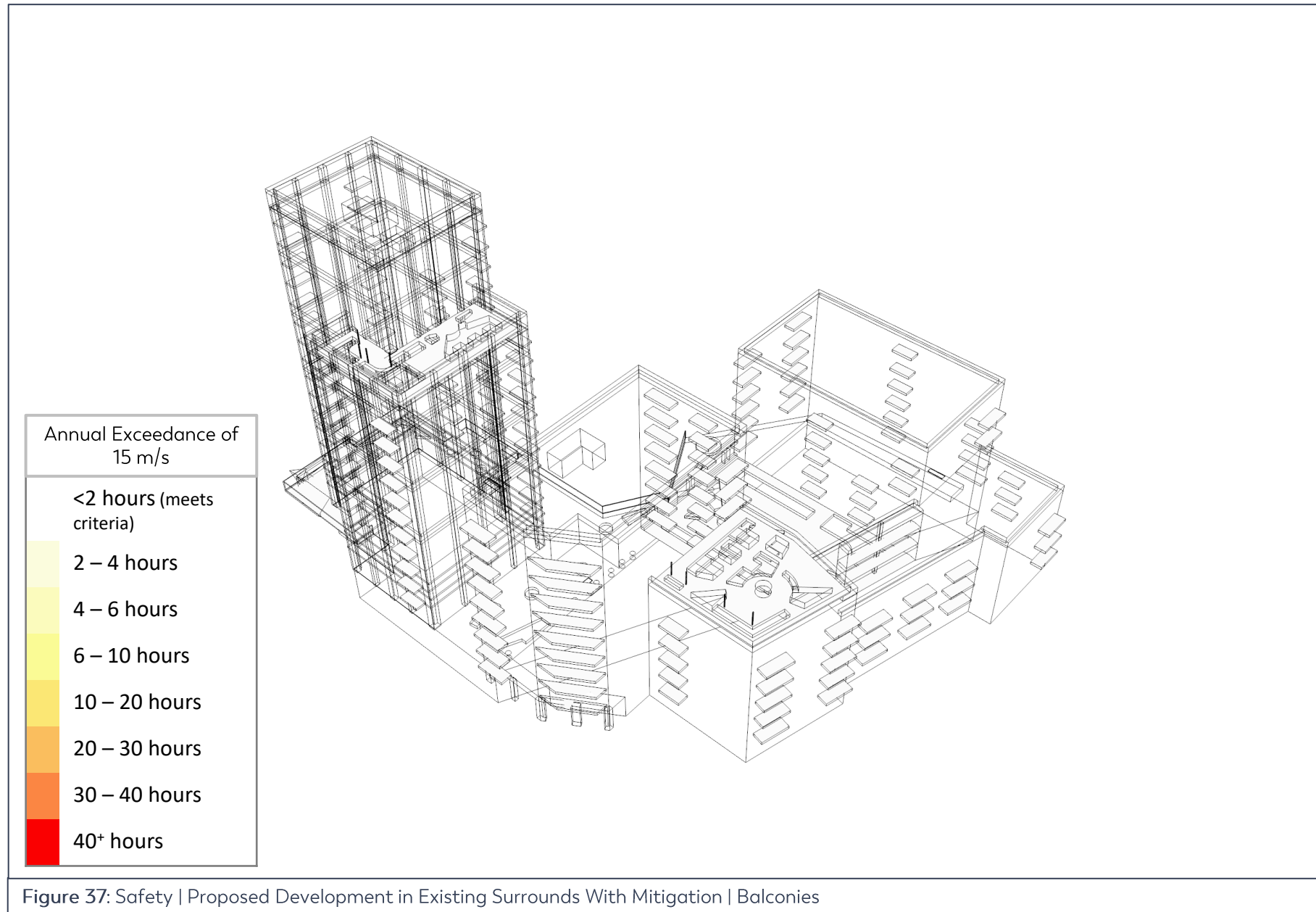
Safety | PinE Mit | Elevated

- Mitigation measures result in a notable improvement in wind conditions at the Level 12 terrace.
- With the mitigation measures in place, wind conditions now satisfy the Lawson safety criteria at all terraces.



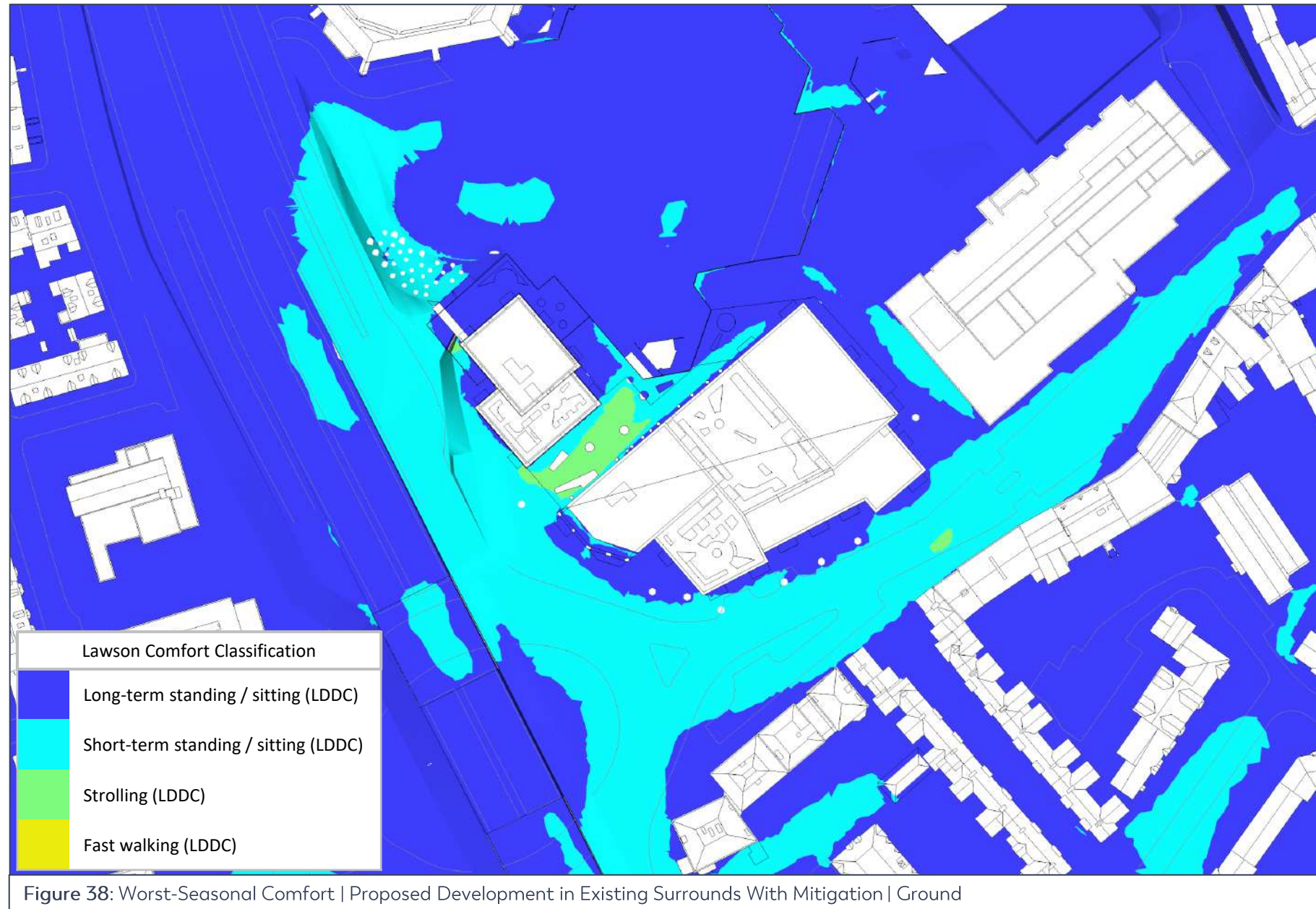
Safety | PinE Mit | Balconies

- With the relocation of the balconies above Level 12 terrace to the northeast façade of Block B, wind conditions satisfy the Lawson safety criteria at all balconies.



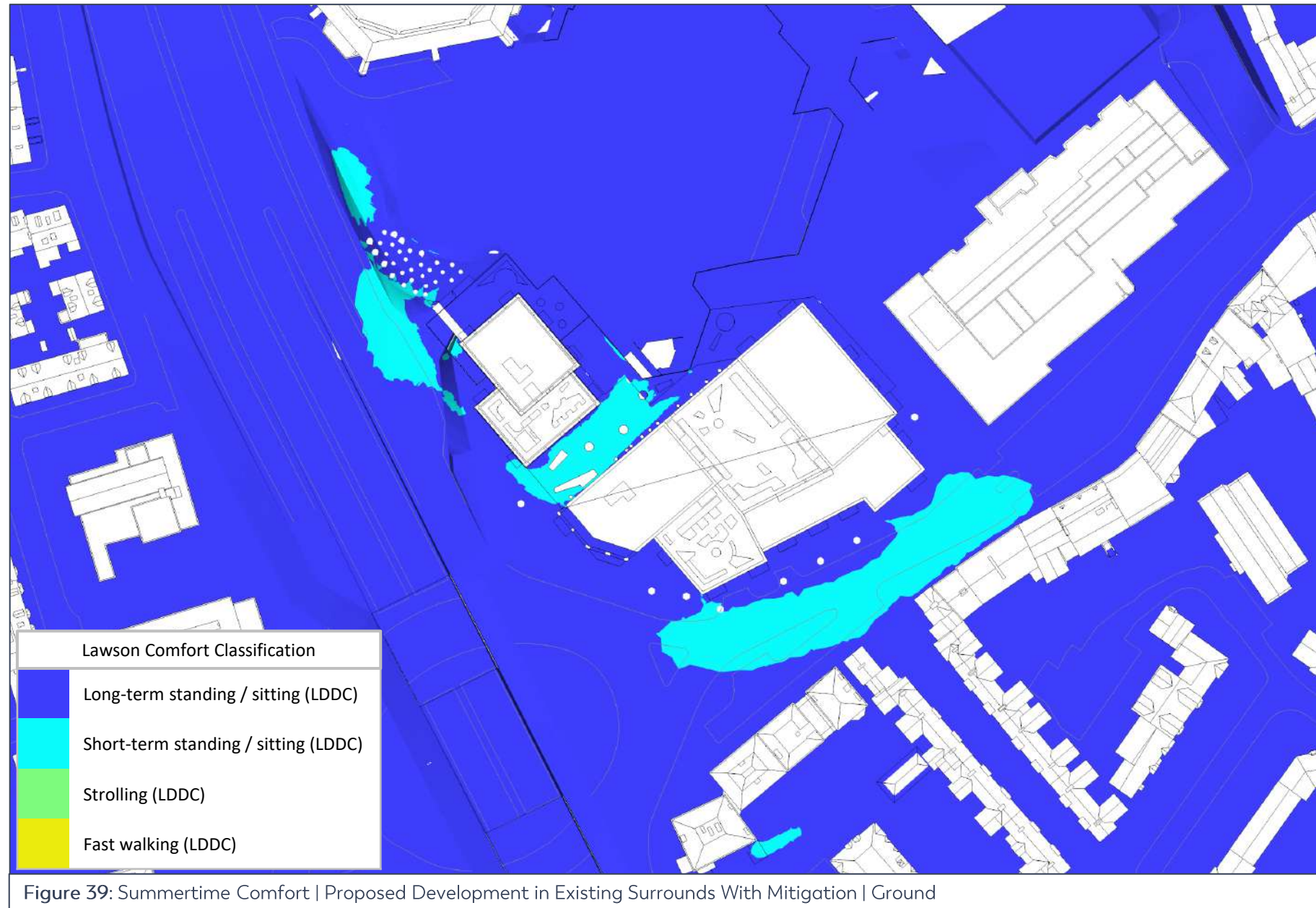
Worst-Seasonal Comfort | PinE Mit | Ground

- Mitigation measures have led to improved wind conditions at ground level, with wind conditions at entrances now meeting short-term standing criteria.
- Wind conditions across all areas are therefore suitable for their intended uses throughout the year.



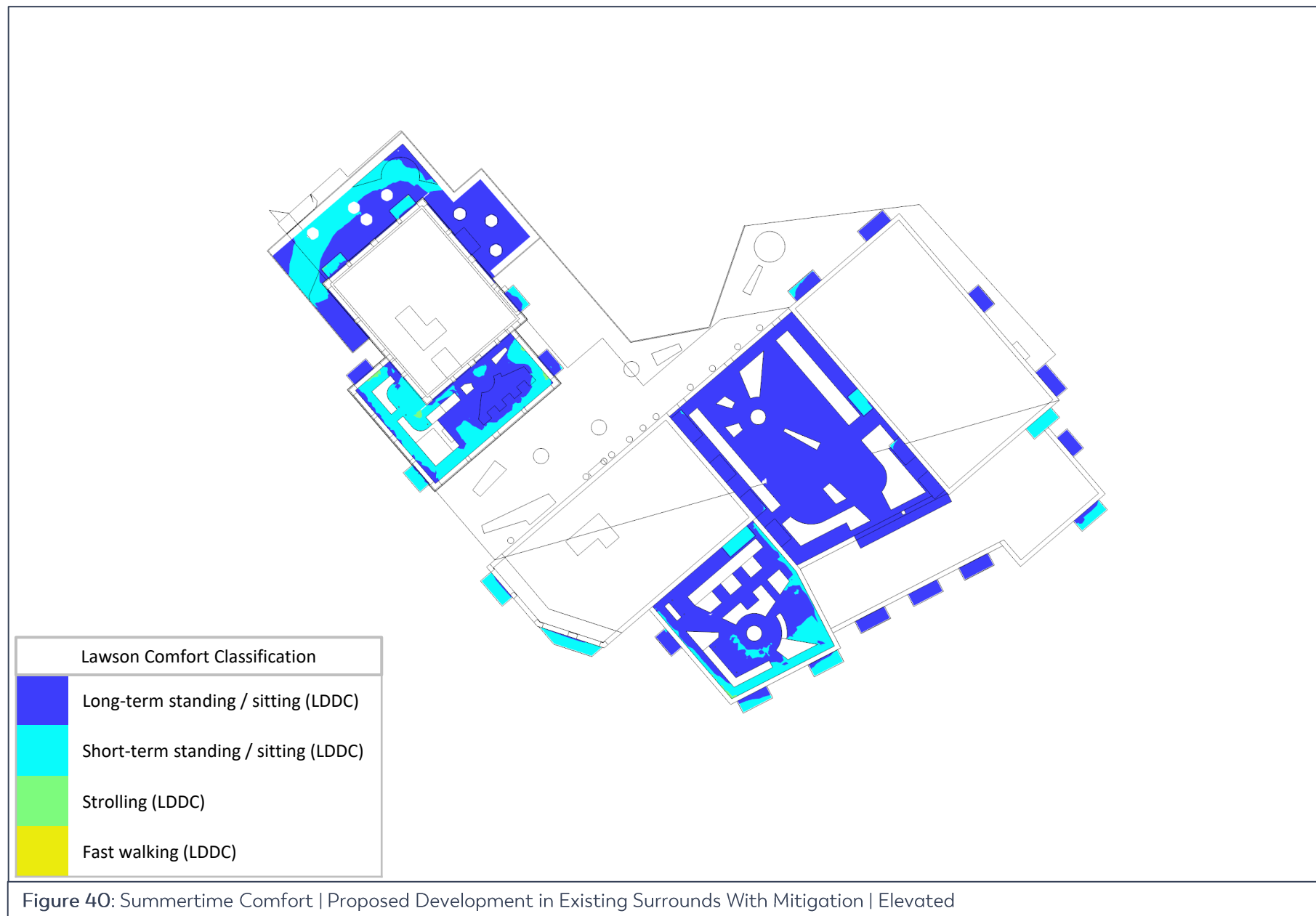
Summertime Comfort | PinE Mit | Ground

- Following the introduction of mitigation measures, wind conditions at ground level during the summer period remain broadly consistent with the existing scenario without mitigation, where the wind conditions remain suitable for proposed use.
- The decision has been taken to relocate the outdoor seating area to the southwest of Block B, where wind conditions in this area are suitable for long-term sitting and are therefore comfortable for the intended use.



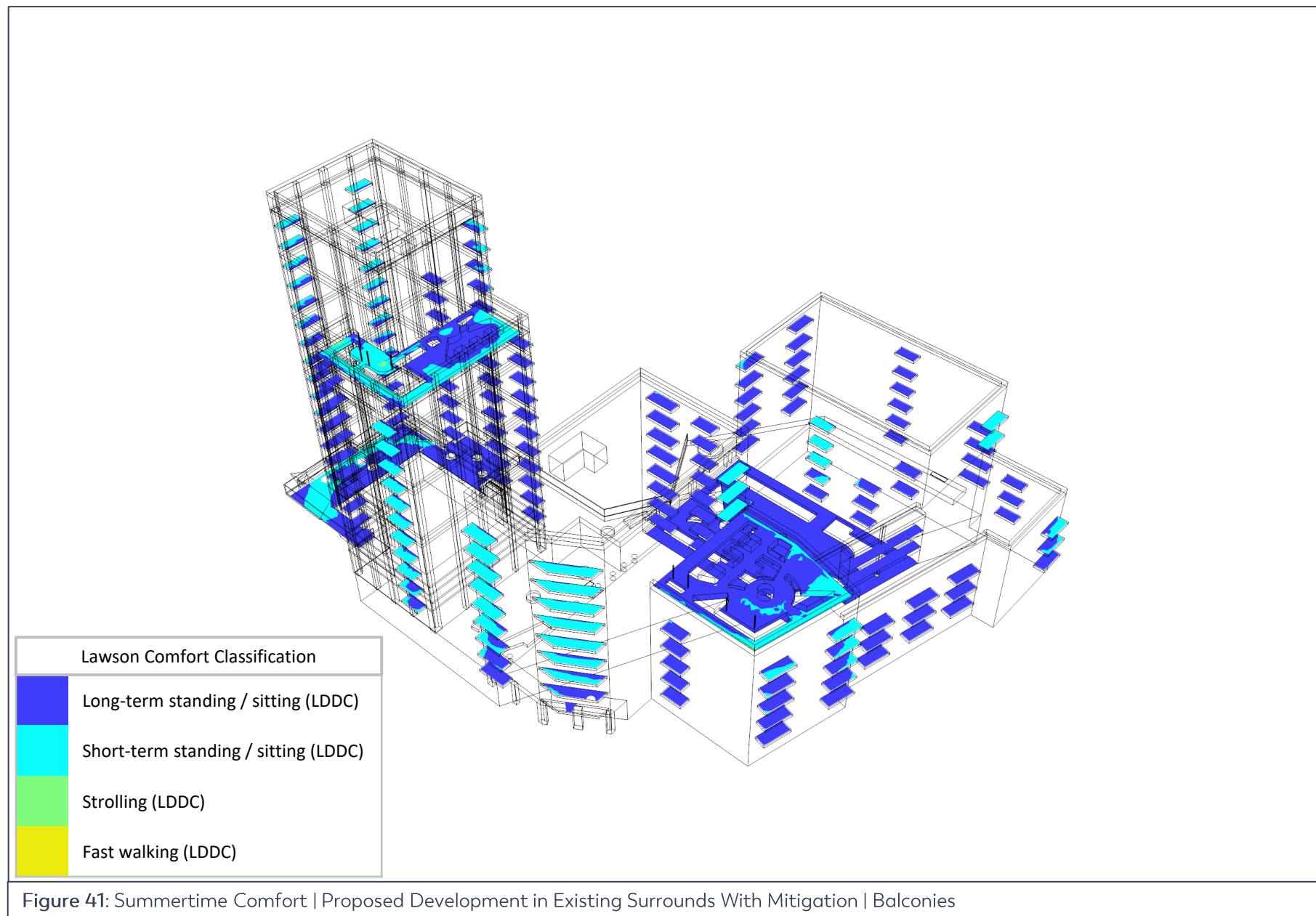
Summertime Comfort | PinE Mit | Elevated

- Wind conditions at elevated levels show improvements following the introduction of mitigation measures, particularly at Level 6 and Level 12, where wind conditions now meet the long-term sitting criteria for the designated outdoor seating area.
- Wind conditions at the outdoor seating locations to the north of block B are similarly suitable for their intended uses.
- The recreational spaces on the Level 12 terrace are substantially suitable for a mixture of long and short-term sitting in summer and thus suitable for general recreation.



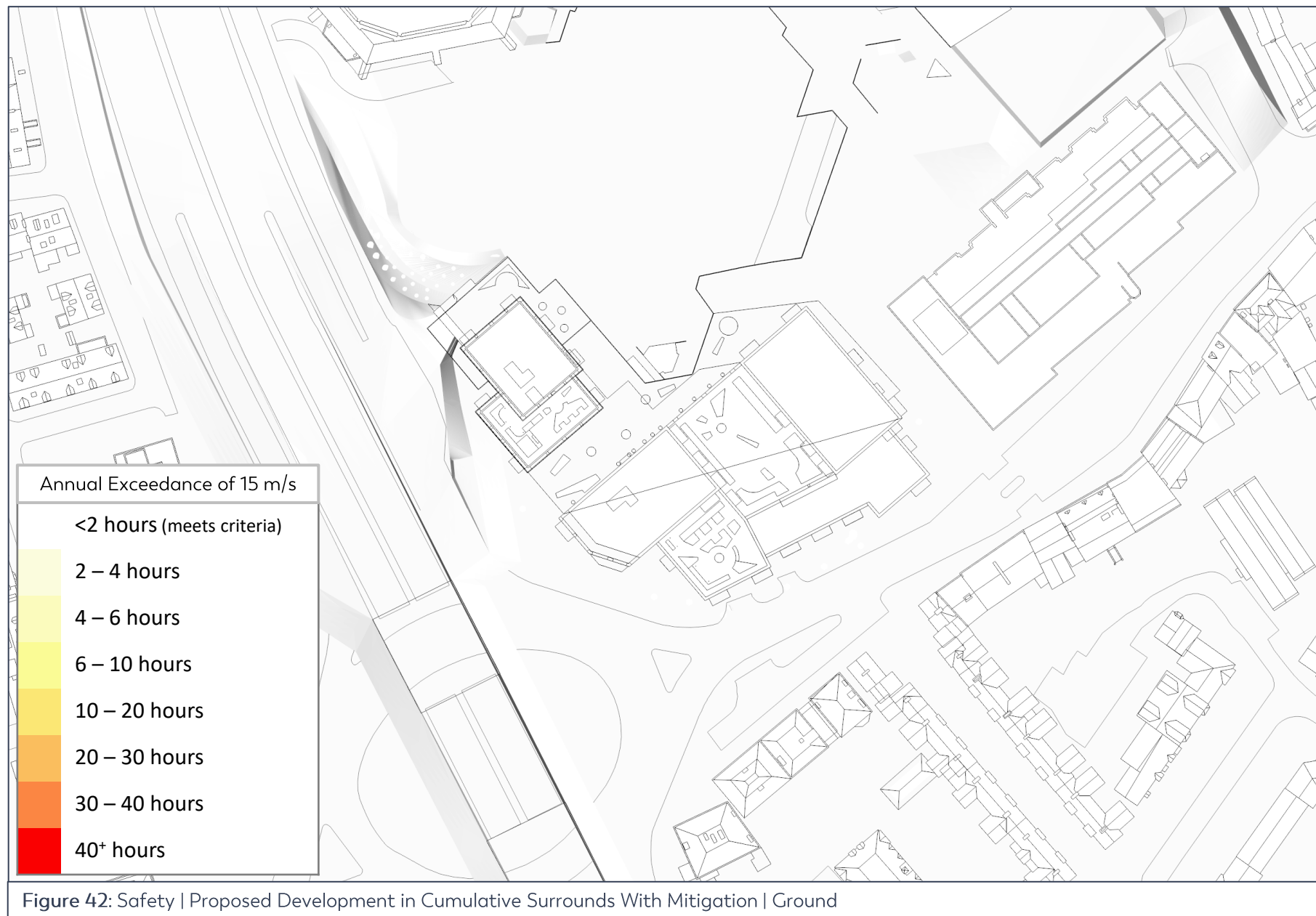
Summertime Comfort | PinE Mit | Balconies

- Following the relocation of the balconies to the northeast façade of Block B, wind conditions across all balconies are suitable for at least short-term standing and are therefore considered comfortable for the intended use.



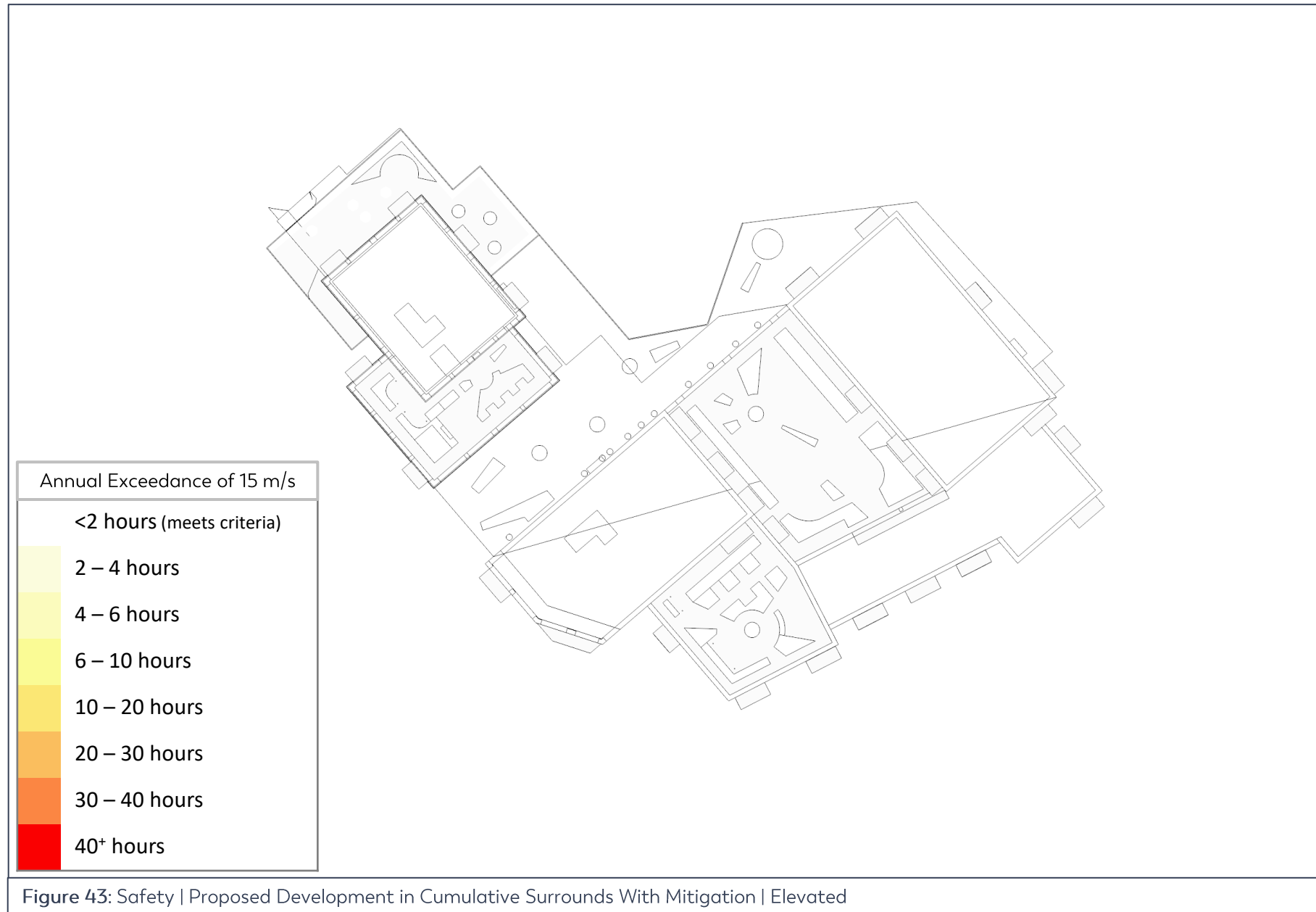
Safety | PinC Mit | Ground

- Following the introduction of mitigation measures in the cumulative surrounds, wind conditions at ground level within the site and immediate surrounds continue to satisfy the Lawson safety criteria.



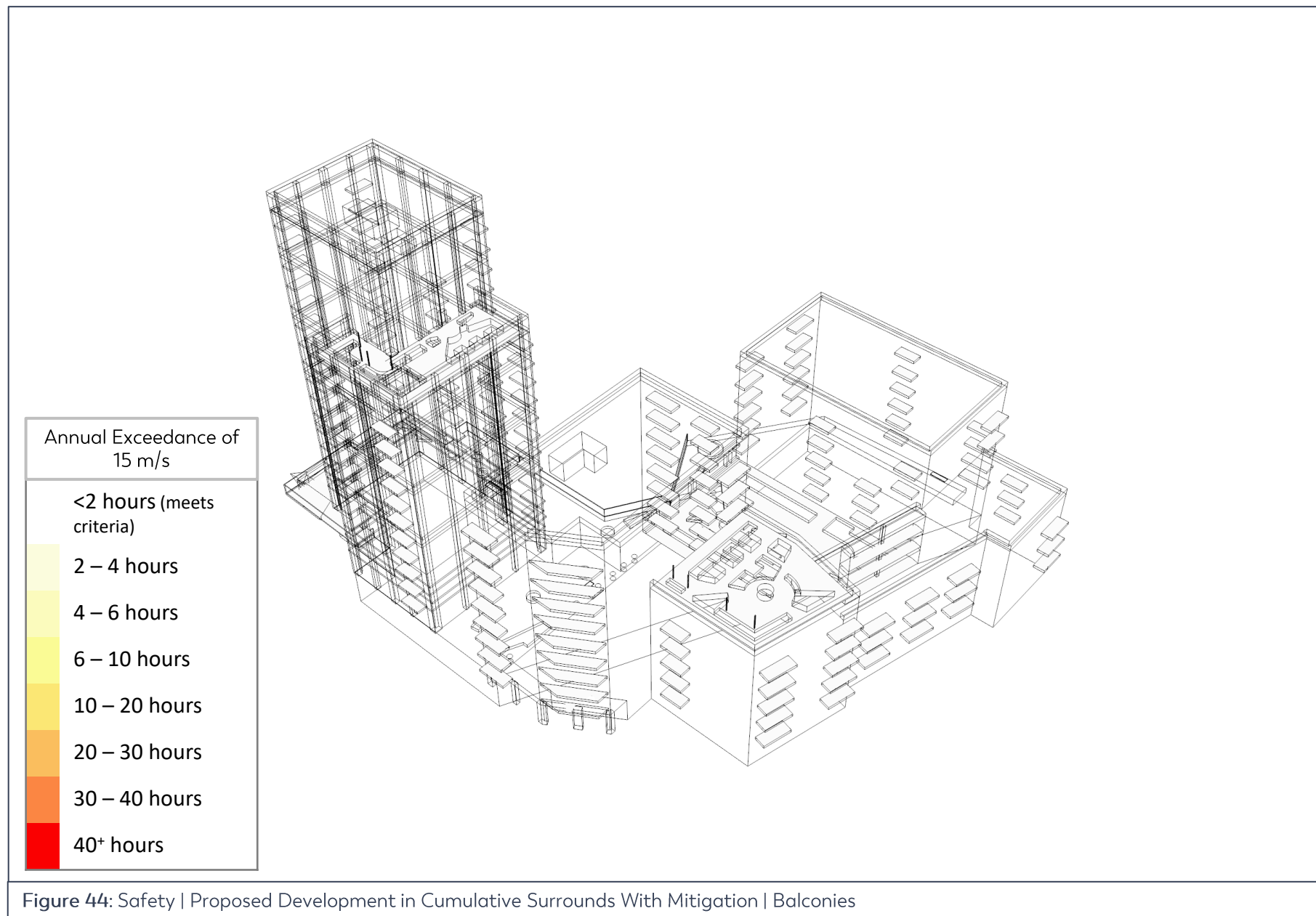
Safety | PinC Mit | Elevated

- Following the introduction of mitigation measures in the cumulative surrounds, wind conditions continue to comply with the Lawson safety criteria.



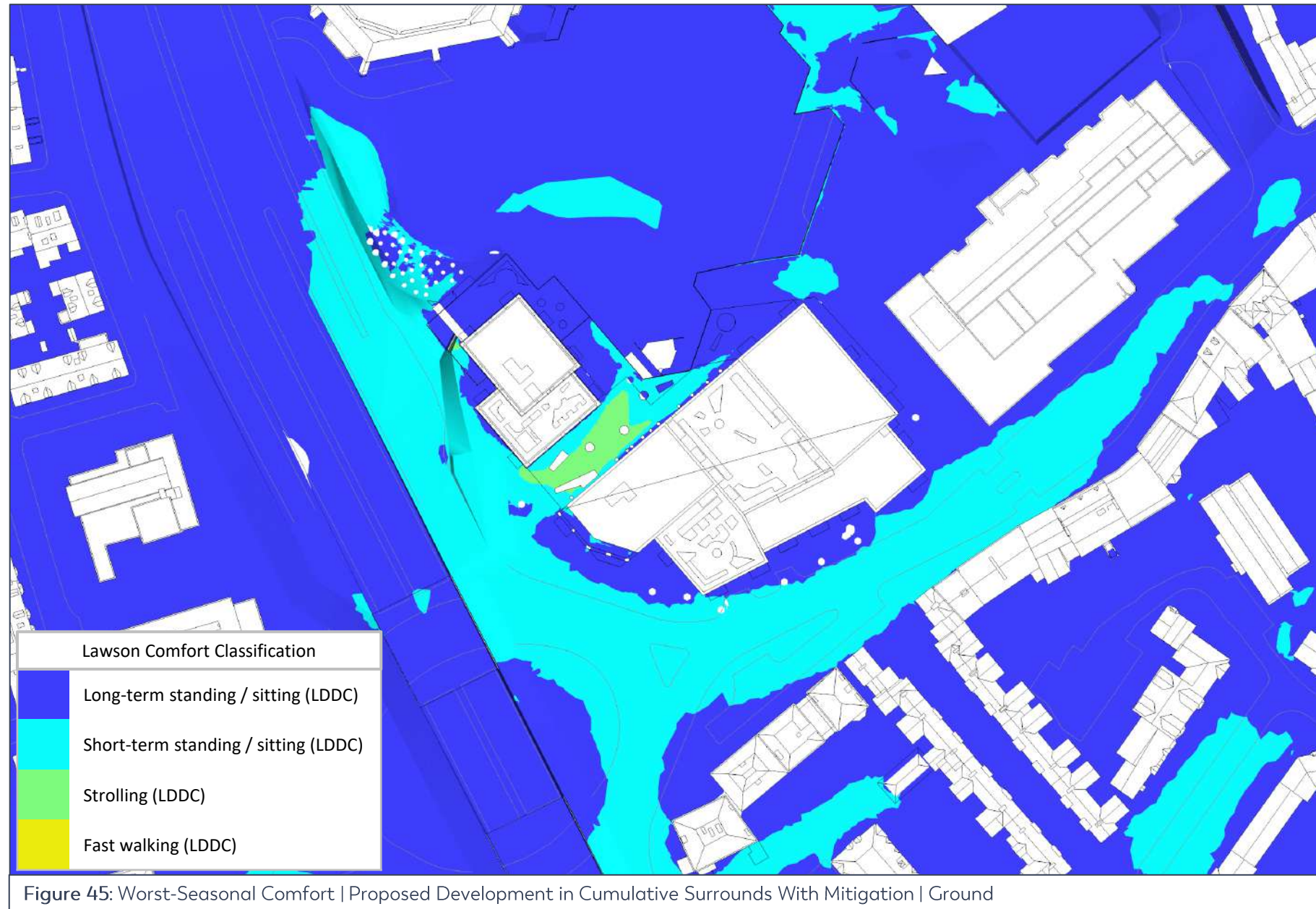
Safety | PinC Mit | Balconies

- With the relocation of the balconies above Level 12 terrace to the northeast façade of Block B, wind conditions continue to satisfy the Lawson safety criteria at all balconies.



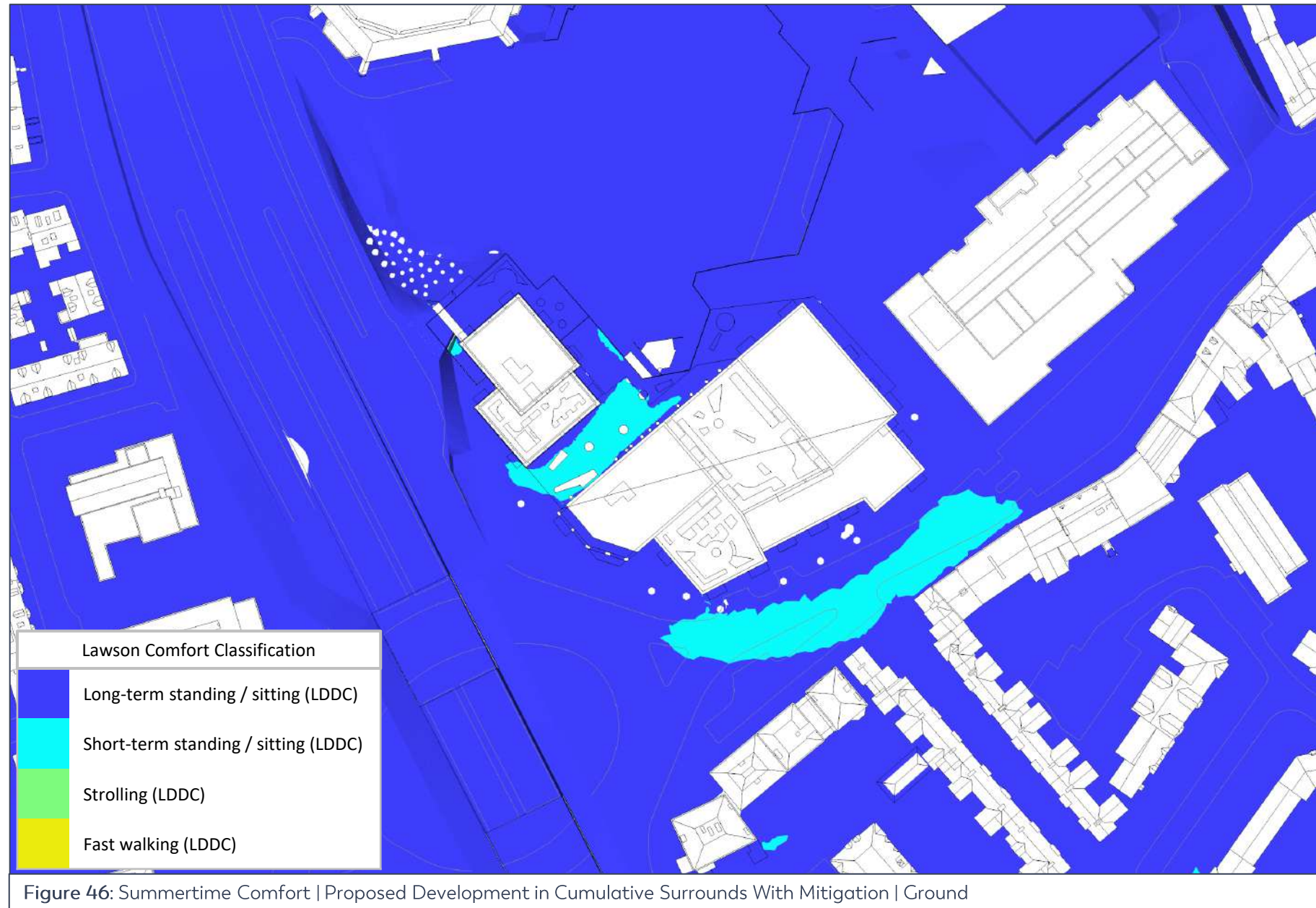
Worst-Seasonal Comfort | PinC Mit | Ground

- Following the introduction of mitigation measures in the cumulative surrounds, wind conditions at ground level remain materially similar to those observed in the existing surrounds with mitigation scenario.
- As such, conditions across all areas are suitable for comfortable use throughout the year.



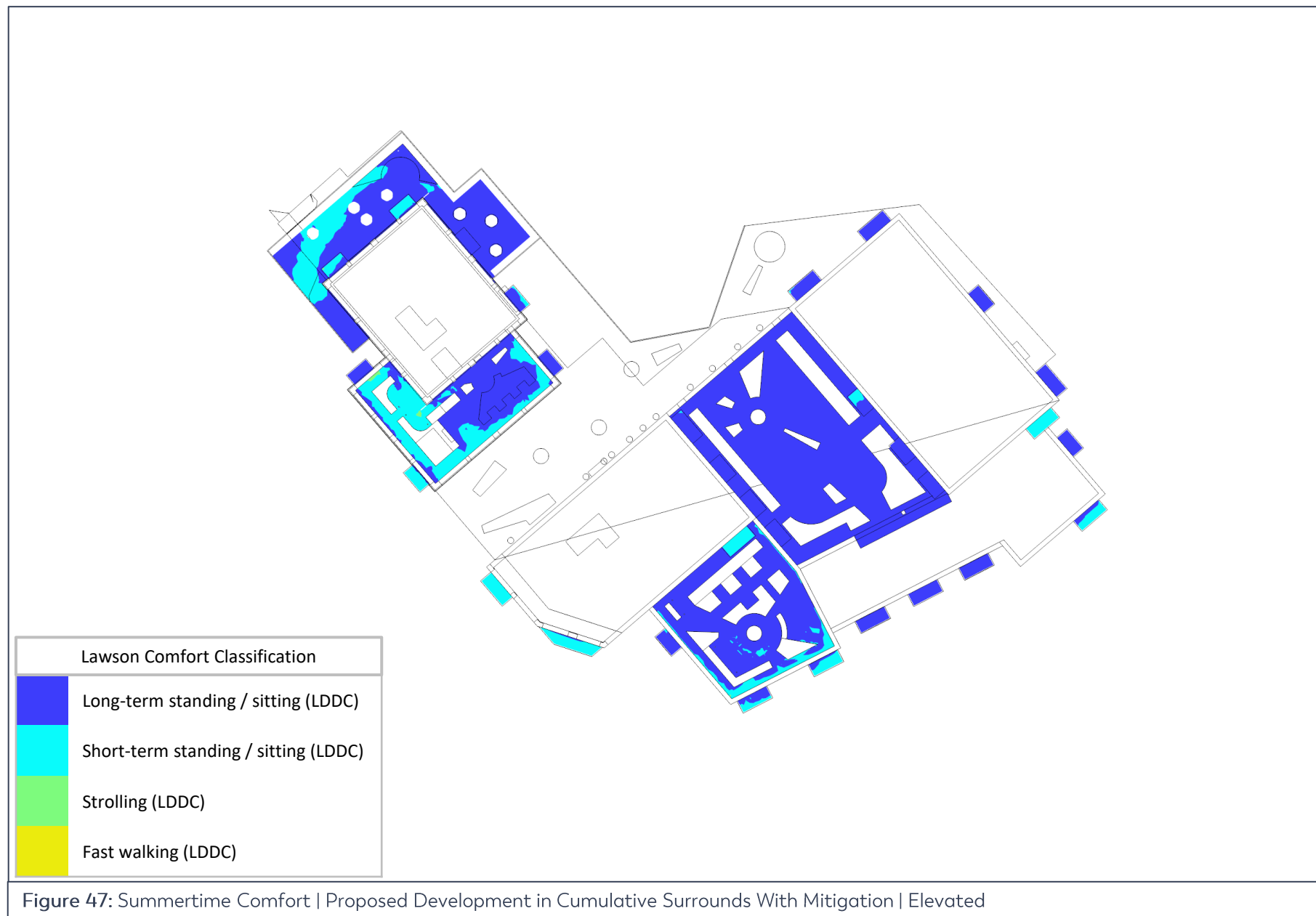
Summertime Comfort | PinC Mit | Ground

- Wind conditions at ground level are materially similar to those observed in the existing surrounds with mitigation scenario.
- As such, conditions across all areas remain suitable for comfortable use throughout the summer months.



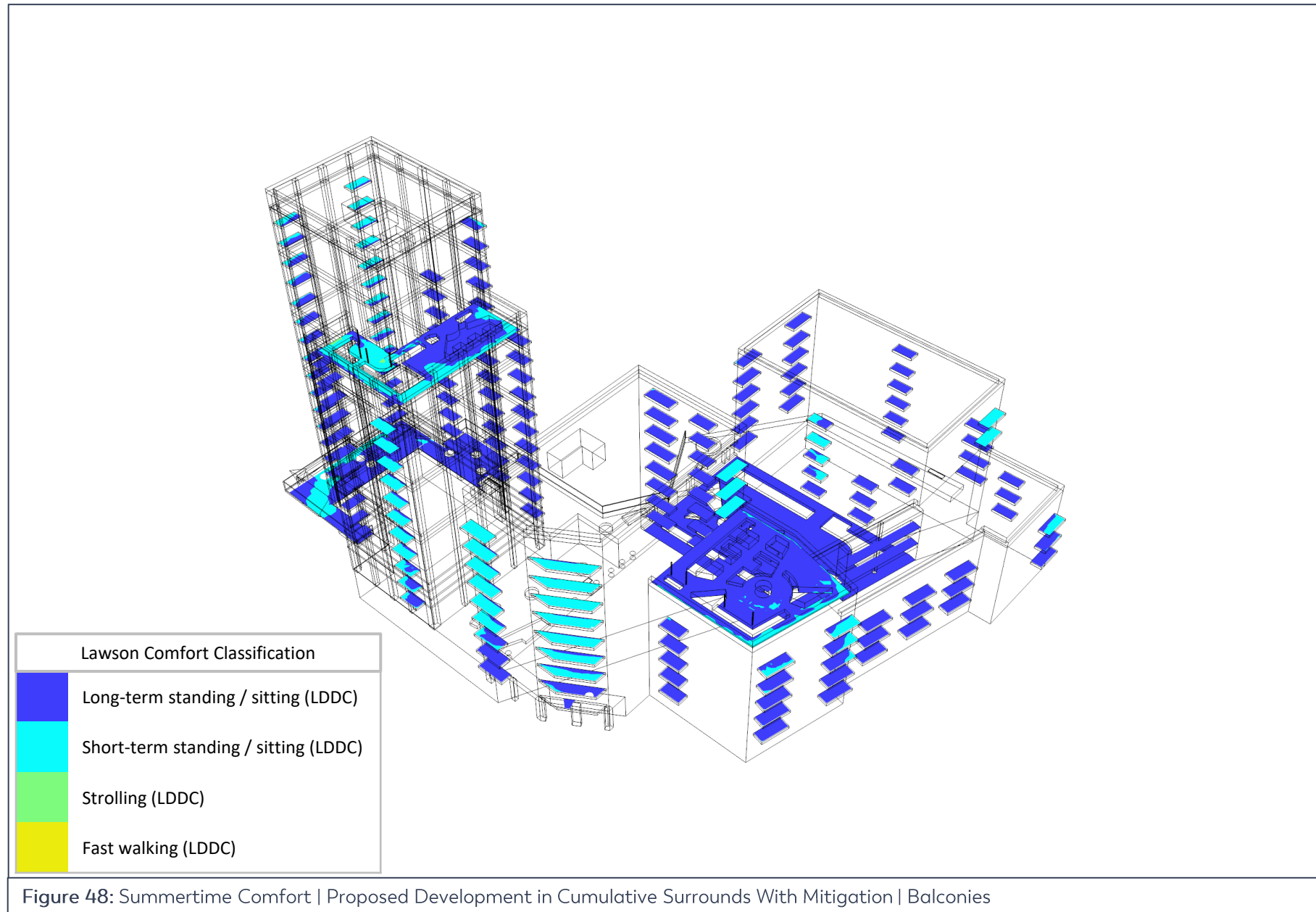
Summertime Comfort | PinC Mit | Elevated

- Following the introduction of mitigation measures under the cumulative surrounds, the overall wind conditions have improved when compared to the existing surrounds scenario with mitigation measures during summer months.
- Wind conditions at the Level 6 and Level 12 outdoor seating areas remain suitable for comfortable use. Conditions at the podium level outdoor seating area have improved and are now suitable for long-term sitting and are therefore comfortable for their proposed use throughout the summer months.
- The recreational spaces on the Level 12 terrace are substantially suitable for a mixture of long and short-term sitting in summer and thus suitable for general recreation.



Summertime Comfort | PinC Mit | Balconies

- Following the relocation of the balconies to the northeast façade of Block B, wind conditions across all balconies are suitable for at least short-term standing and are therefore considered comfortable for the intended use.



7. Conclusions

Wind microclimate studies assess how new developments alter local wind conditions. They estimate how often wind speeds at pedestrian level exceed thresholds for safety and comfort, helping to determine whether areas are suitable for their intended use, or if design changes are needed.

The Reading Police Station development was assessed by ArcAero Computational Fluid Dynamics (CFD) and the London Docklands Development Corporation (LDDC) variant of the Lawson criteria. The study predicts pedestrian wind conditions following the introduction of the proposed buildings and evaluates their suitability for public comfort and safety.

The findings of the assessment are as follows:

- Wind conditions across the existing site comply with Lawson safety and comfort criteria for anticipated pedestrian activities.
- Following the introduction of the proposed development within the existing surroundings, without mitigation in place, wind conditions at ground level and elevated terraces are predicted to generally comply with Lawson safety criteria. Minor exceptions are noted at the Level 12 terrace and two balconies above Level 12. Wind conditions are generally suitable for their intended uses meeting the comfort criteria, with localised comfort exceedances at a few outdoor seating areas and entrances along Flint Street.
- With the inclusion of cumulative surrounding developments, wind conditions remain broadly comparable to those predicted for the proposed development within the existing surroundings with some improvements.
- Following the introduction of mitigation measures (including the movement of raised balconies) wind conditions satisfy the safety criteria and are suitable for the intended uses within both the existing and cumulative surrounding contexts.

8. References

- [1] Lawson, T.V. The determination of the wind environment of a building complex before construction. Bristol : University of Bristol, Department of Aeronautical Engineering, 1990.
- [2] ESDU (Engineering Science Data Unit). Item 01008. Computer Program for wind speeds and turbulence properties: flat or hilly sites in terrain with roughness. 2001.
- [3] F, Menter. Zonal Two Equation $k-\omega$ Turbulence Models for Aerodynamic Flows. 1993. AIAA Paper 93-2906.
- [4] F, Menter. Turbulence Modelling for Engineering Flows. s.l. : ANSYS Inc., 2011.
- [5] Richards, P.J. and Hoxey, R.P. Appropriate boundary conditions for computational wind engineering models using the $k-\epsilon$ turbulence model. s.l. : Journal of Wind Engineering and Industrial Aerodynamics, 1993. vol. 46 & 47, pg. 145 - 153.
- [6] Blocken, B. and Carmeliet, J. Pedestrian wind environment around buildings: Literature review and practical examples. s.l. : Journal of Thermal Envelope and Building Science, 2004.

Appendix A: Preparation of Digital Models



Figure A.1: Proposed Development, close-up

Digital models used in this study were prepared using project-specific drawing information, provided by JTP Studios listed below.

- 01962-JTP-3D Model-Design Freeze Issue_260224.dwg

Drawings used for the modelling of landscaping proposals were:

- 25020_ExA_Linework_Ground Floor_WIP_Flint Street_260408.dwg
- 25020_ExA_Linework_Level 1_260227.dwg
- 25020_ExA_Linework_Level 6_WIP_260408.dwg
- 25020_ExA_Linework_Level 12_WIP_260408.dwg



Figure A.2: Proposed Development, close-up

Figures A.1 and A.2 present the Proposed Development in detail, as modelled.

Appendix B: CFD Modelling

Spatial Discretization

The computational domain was discretised using polyhedral cells for the core mesh and low aspect-ratio prism cells adjacent to solid boundaries, including building walls and the ground surface. Separate computational meshes were constructed for each of the three study configurations.

The domain includes the Proposed Development site along with surrounding buildings and topographical features, explicitly modelled within a 450 metre radius. The overall domain extends to 1400 metres in the along-wind direction, 1100 metres across-wind, and 450 metres vertically.

To resolve detailed architectural features and flow structures, the Proposed Development and its immediate surroundings were meshed with a minimum cell size of 0.2 m. Pedestrian-level surfaces were meshed with a five-layer prism mesh, which increases in thickness near buildings to reach a total height of 1.5 m above ground level.

Figure B.1 illustrates the computational domain.

Figures B.2 to B.4 provide examples of mesh resolution and distribution.

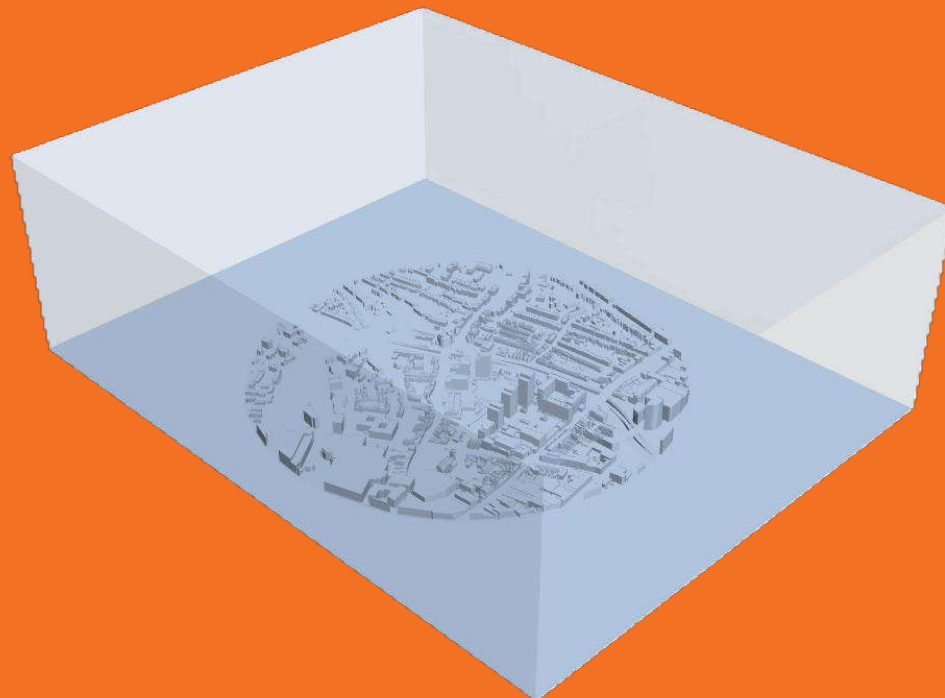
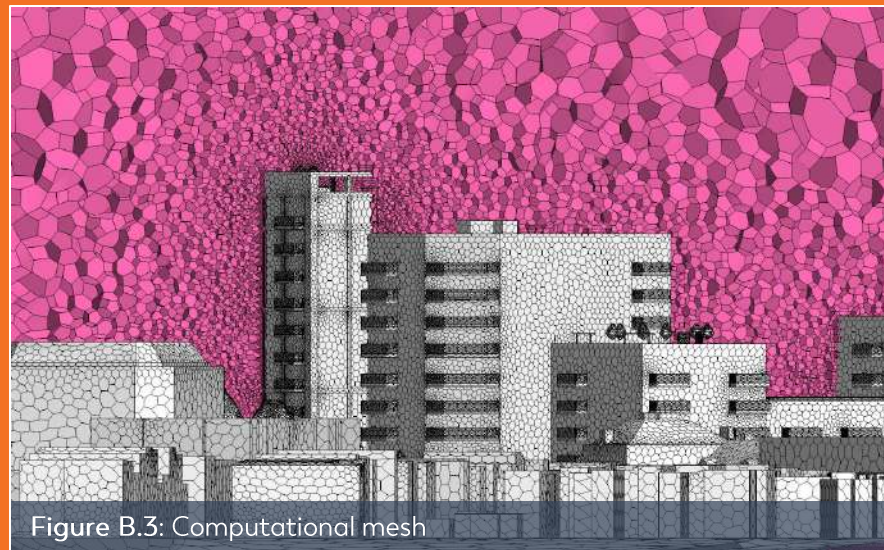


Figure B.1: Computational domain



Solution Method

The modelling of incompressible fluid flow was carried out using variants of the Semi-Implicit Method for Pressure-Linked Equations (SIMPLE) algorithm. Turbulent flow features were simulated using the Shear Stress Transport (SST) $k-\omega$ turbulence model.

Originally proposed by Menter^[3], the SST $k-\omega$ model is a two-equation eddy-viscosity model that blends the advantages of both the $k-\omega$ and $k-\varepsilon$ formulations. It applies the $k-\omega$ model near wall boundaries for accurate resolution of boundary layers, while transitioning to a $k-\varepsilon$ -like behaviour in the free-stream regions to improve robustness and accuracy in separated flows. Further detail on the formulation and application of the SST $k-\omega$ turbulence model can be found in the work of Menter^[3, 4].

Initial and Boundary Conditions

The atmospheric boundary layer flow was simulated by implementing a logarithmic velocity profile model presented by Richards and Hoxey^[5], with the following main assumptions:

- The vertical velocity component at the domain boundary is negligible
- The pressure gradient and shear stress are constant

The model implies the following equation for the mean inlet velocity at the CFD domain:

$$U(z) = \frac{U^*}{\kappa} \cdot \ln\left(\frac{z + z_0}{z_0}\right)$$

where:

- κ - is the von Karman's constant
- z - is the distance from the ground surface in vertical direction
- z_0 - is the ground surface roughness length in metres

The friction velocity U^* is calculated by the following equations:

$$U^* = \kappa \frac{U_{ref}}{\ln\left(\frac{z_{ref} + z_0}{z_0}\right)}$$

where:

- z_{ref} – is the reference height in metres
- U_{ref} - is the reference velocity in m/s measured at z_{ref}

The turbulent velocity fluctuations at the domain inlet are induced by constant shear stress with height, maintained by the turbulent kinetic energy k equation below:

$$k(z) = \frac{U_{ref}^2}{\sqrt{C_\mu}}$$

where:

- $C_\mu = 0.09$ - is a k - ϵ turbulence model constant

All surface boundary conditions were modelled as smooth walls with a no-slip condition. A no-slip wall boundary condition with a varying roughness length height based on the terrain analysis for the site was applied on the ground surface outside the explicit surrounds area of the domain.

Gust Equivalent Mean Calculation

The presence of gusts in the wind flow is a major component that may lead to additional instability and discomfort to that caused by the mean wind flow. Thus, the gust wind speed is accounted for by a calculation of the short-duration gust wind speed, considering the standard deviation of the mean wind speed, and in particular the turbulent kinetic energy, k :

$$\sigma = \sqrt{\frac{2}{3}k}$$

The Gust Equivalent Mean (GEM) is then calculated as:

$$U_{GEM} = \frac{U_{mean} + 3.5\sigma}{k_g}$$

where gust factor, $k_g = 1.85$

The final wind speed ratio (speed-up) used in the Lawson criteria assessment corresponds to the worst-case value derived from both the time-averaged mean wind speed and the gust equivalent mean wind speed. Once known, it is applied in conjunction with the the Weibull cumulative distribution function to calculate the probability of exceedance:

$$P(V > v) = \exp \left[- \left(\frac{v^k}{c} \right) \right]$$

Where v is the wind speed threshold, c is the scale (or dispersion) parameter, and k is the shape parameter. To this formulation, the directional probability of occurrence pp for each wind direction is incorporated. This allows the exceedance probability to be calculated for each wind direction and for each month of the year, providing a directional and temporal profile of wind comfort conditions in accordance with the Lawson criteria.

Reading Police Station – Wind Microclimate Assessment
Version 03 – Issued 30th April 2026

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