FINAL REPORT

BOLLO LANE (PLOT 3A)

LONDON, UK

PEDESTRIAN LEVEL WIND MICROCLIMATE ASSESSMENT

RWDI #2400056- REV B

DECEMBER 6TH, 2023

SUBMITTED TO

Barratt London

SUBMITTED BY

RWDI Anemos Ltd

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VERSION HISTORY

RWDI Project #2400056	Bollo Lane (Plot 3A) London, UK	
Report	**Releases**	**Dated**
Reports	Rev A Rev B	November 17th, 2023 December 6th, 2023
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1 EXECUTIVE SUMMARY

RWDI was retained by Barratt London to conduct a pedestrian level wind assessment of the proposed Plot 3A Bollo Lane development (referred to as the "Proposed Development" hereafter in this report) in London, UK. This report presents a description of the methodology used and the results of four configurations tested using Computational Fluid Dynamics (CFD) simulations, namely:

- Configuration 1: Existing Site with Existing Surrounding Buildings and Existing Landscaping;
- Configuration 2: Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping;
- Configuration 3: Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping; and
- Configuration 4: Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping, and Mitigation Measures.

RWDI have assessed the scheme previously, through wind tunnel testing, reference "*200609 RWDI Project 2001772 Bollo Lane Plot 3A - Pedestrian Winds Assessment Final Report RevE*", dated June 9th, 2020. Following the initial assessment, further amendments were made to the scheme. Overall, the Proposed Development geometry is largely similar compared to the original design with some small changes to building façade articulation and entrance/balcony placements. Similar to the previous assessment, results are presented in terms of the Lawson Comfort Criteria with the main focus on the windiest (generally winter) season and the summer season, when amenity spaces are expected to be most frequently used.

The meteorological data for the Site indicates prevailing winds blowing from the south-west throughout the year. There is a secondary wind from the north-east most common during the late spring season.

In the baseline scenario (Configuration 1), the majority of the Site and surrounding area has suitable wind conditions. Whilst windier walking conditions occur within Chiswick Business Park, there are trees which would help provide shelter that were not included in this assessment, which would also help reduce the occurrence of strong winds.

With the introduction of the Proposed Development (Configuration 2), there would be windier than suitable conditions introduced at the southern corner at ground level, and at terraces and balconies on the Proposed Development. These areas would also have strong wind exceedances, therefore would require mitigation measures.

The cumulative scenario (Configuration 3) would have similar conditions to those reported in Configuration 2, with mitigation measures required in the same areas.

Mitigation measures were developed and tested for the balconies and terraces (Configuration 4). With the implementation of this mitigation, wind conditions at these spaces would be suitable, on the basis seating shown on the terraces can be removed or relocated to calmer areas.

Overall, the results of the amended Proposed Development would be no worse than the approved scheme.

2 INTRODUCTION

RWDI was retained by Barratt London to conduct a pedestrian level wind microclimate assessment using CFD simulations for the Proposed Development in London, UK. This report presents the background and objectives from RWDI's assessment. A summary of the overall recommendations from the study are presented in Section 8 "Concluding Remarks".

RWDI have assessed the scheme previously, through wind tunnel testing, reference "*200609 RWDI Project 2001772 Bollo Lane Plot 3A - Pedestrian Winds Assessment Final Report RevE*", dated June 9th, 2020. Following the initial assessment, the following description for the non-material amendment (NMA) application is as follows:

Non-material amendments to planning permission Ref: 201379OUT to alter conditions to enable changes to the approved plans and elevations to respond to new fire safety requirements and an improved overheating strategy for Plot 3A. Alteration to various conditions for clarification purposes.

The following amendments have been made:

- Fire strategy:
  - Incorporate an additional residential stair to provide an alternate means of escape;
  - Amendments to the residential unit mix; and
  - Reconfiguration of the residential accommodation and apartment layouts.
- Plant and building servicing:
  - Amendments to the quantum and sizing of building plant and servicing; and
  - Amendments to the provision of cycle parking.
- Workspace accommodation and residential amenity:
  - Amendments to the communal amenity; and
  - Amendments to the landscape and public realm.
- Façade:
  - Achieving the thermal performance of the external walls;
  - Responding to the Overheating Assessment for the building; and
  - Reconfiguration of the residential accommodation and apartment layouts.
- Corrections and clarity of dawn information:
  - Separation of floor plan drawings;
  - Drawing number changes; and
  - Elevation drawings.
- Landscape:
  - Parking, servicing and access;
  - Urban greening factor;
  - Wind mitigation;
  - Tree planting;
  - Hard landscaping; and
  - Play space.

3 BACKGROUND AND APPROACH

Computational Fluid Dynamics (CFD) simulations were conducted on the Proposed Development in London, UK. The assessment quantifies the wind conditions within and around the Site by comparing the measured wind speed and frequency of occurrence with the Lawson Comfort Criteria. Meteorological data for London has been analysed and adjusted to the Site conditions by modelling the effect of terrain roughness in the computational domain.

Four configurations were assessed, as follows:

- Configuration 1: Existing Site with Existing Surrounding Buildings and Existing Landscaping;
- Configuration 2: Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping;
- Configuration 3: Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping; and
- Configuration 4: Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping, and Mitigation Measures.

3.1 Site Description and Surroundings

The development Site is situated in the London Borough of Ealing. The Plot 3A Site is bounded by Bollo Lane to the north-east, Network Rail tracks and 100 Bollo Lane to the south-east, London Underground tracks on an embankment to the south-west, and an access road to the LU Acton Works and the Plot 2 Site to the north-west. The OS Landranger grid reference is TQ197792.

The terrain surrounding the Site is predominantly suburban in nature, with the low-rise Acton Works industrial units and the open terrain of Gunnersbury Park to the west. The surrounding area comprises low-rise buildings, with industrial units situated to the east, and residential housing situated further afield around the Site. Due to the nature of the surrounding development, winds approaching the Site would have a relatively high mean wind speed with low turbulence, compared to a Site which is surrounded by a more urban terrain which would result in a lower mean wind speed and higher turbulence.

Figure 1 below shows an aerial view of the Site and surroundings, with the approximate Site location highlighted in yellow.

Figure 1: Aerial view of the Existing Site (Approximate extent of Plot 3A highlighted in yellow)

3.2 The Proposed Development

The Proposed Development comprises construction of a residential led masterplan, comprising Plot 1A to the north, Outline Plots 2B-2F within the middle, and Plot 3A (the subject Site of this report) to the south. Plot 3A is a 25-storey residential-led tower with ground level public realm improvements, situated at the southern end of the masterplan site. In terms of elevated spaces for Plot 3A, balconies are situated on the corners of the tower, and podium and terraces would be used for amenity use.

A 3D model of the Proposed Development used in the assessment is shown in Figure 2 below.

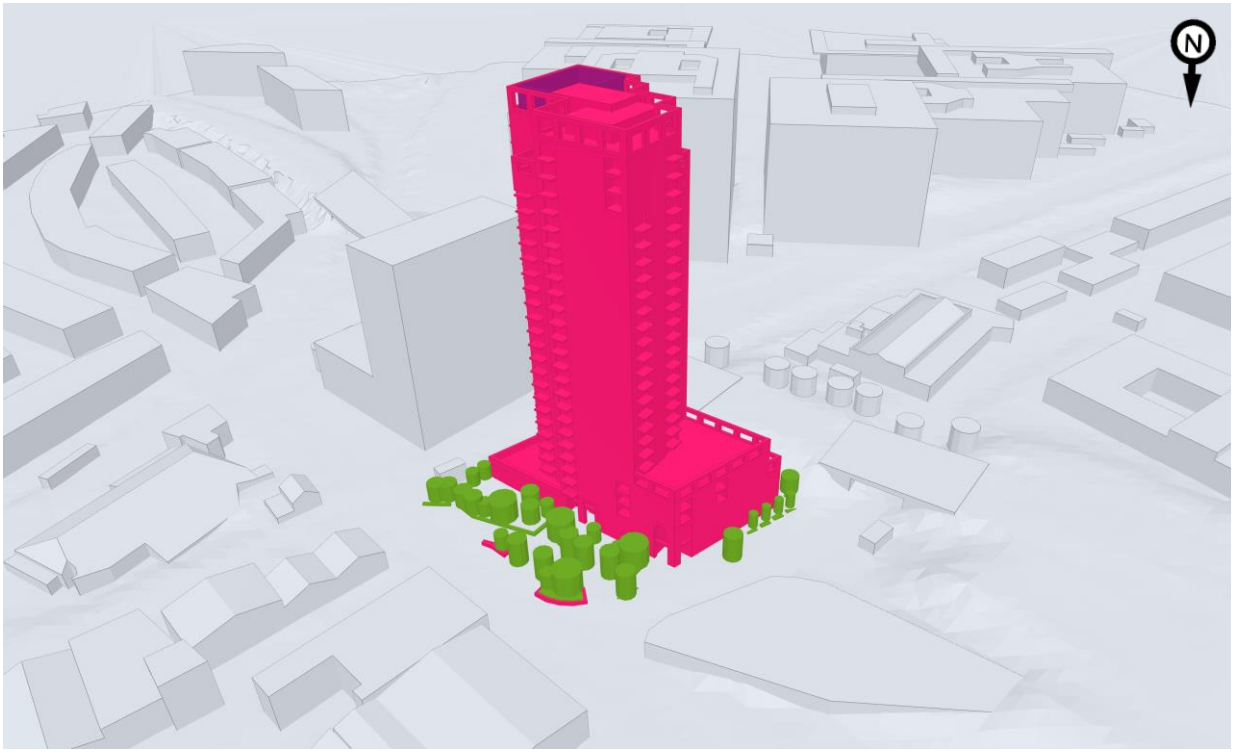


Figure 2: 3D model of the Proposed Development in the context of the existing surrounding buildings, existing and proposed landscaping, used for CFD simulations (view from the north)

4 METHODOLOGY AND ASSESSMENT CRITERIA

The 3D model of the Proposed Development in the context of the existing surrounding buildings used for CFD simulations of Configuration 2 is shown in Figure 2. Additional images of the 3D model for all configurations are presented in Appendix A. In each of the assessed scenarios surrounding buildings within a 400m radius of the centre of the Site were included.

The 'Results' section, shows the windiest season (typically winter) and the summer season (June to August) comfort plots. The comfort results are assessed at a height of 1.5m above the ground or building surface to represent conditions around people. The colours correspond to the Lawson Criteria described below in Section 4.2 'Pedestrian Comfort'.

CFD is a computer modelling technique for numerically simulating wind flow in complex environments. For this study, computational modelling was undertaken using OpenFOAM version 4.1 with 18 wind angles tested for each scenario, equally spaced out around the compass (using 20-degree intervals). This quantity of wind angles will provide sufficient aerodynamic interactions from all wind directions to achieve convergence.

The individual cases of the Proposed Development were solved using a RANS approach with an RNG k-ε turbulence model. The steady state RANS type model with the RNG k- ε turbulence model is chosen over other turbulence models or transient type schemes for wind microclimate studies by RWDI for its ability to approximate highly complex flows within urban environments to a high level of accuracy against a practical computational time. The statistically steady solution obtained by RANS simulations does not have the ability to predict the fluctuating or gusty nature of wind. As comfort is a function of average conditions, this model is more suited to analyse this.

The potential for strong winds leading to potential safety issues is assessed using informed engineering judgement.

4.1 Meteorological Data

Figure 3 shows the seasonal wind roses (meteorological data) for London, which are based on data obtained from the meteorological station at London Heathrow airport. 0 Degrees represents wind blowing from the north and 90 degrees represents wind blowing from the east.

Approximately 30 years of meteorological data for London Heathrow was used in this report, presented in the seasonal wind roses with the wind speed divided into wind speed thresholds (Figure 3). The radial axis indicates the cumulative number of hours per season that the wind speed exceeds the wind speed threshold as a percentage. The seasons are defined as spring (March, April and May), summer (June, July and August), autumn (September, October and November) and winter (December, January and February).

The meteorological data indicate that the prevailing wind direction throughout the year is from the south-west. This is typical for many areas of southern England. There is a secondary peak from the north-westerly winds, especially during the spring; however, these tend to be colder winds.

The combination of meteorological data and velocity ratios permits the percentage of time that wind speeds are exceeded on the site to be evaluated. The locations can then be assessed using 'comfort criteria', as described below.

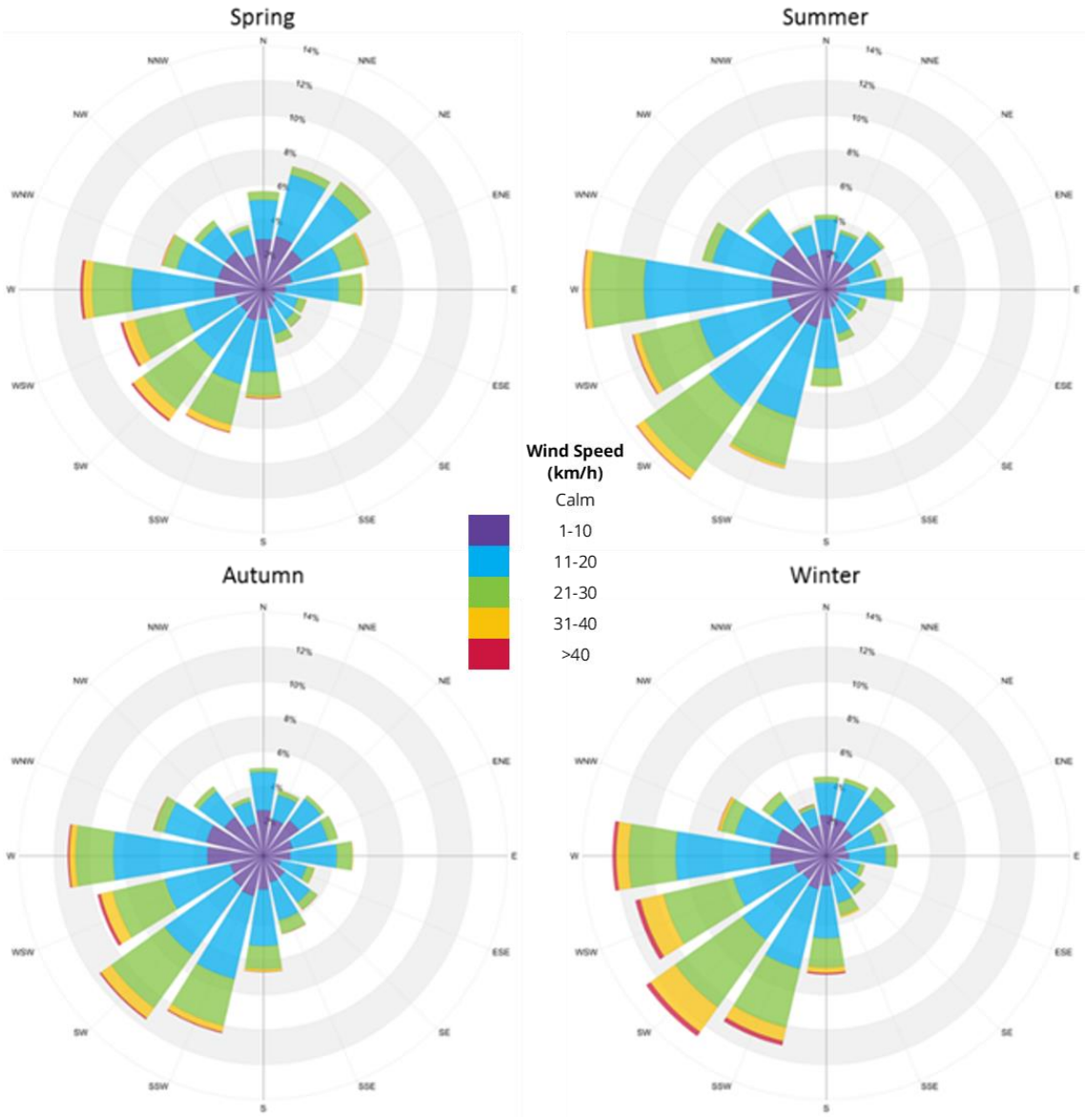


Figure 3: Seasonal Wind Roses for London Heathrow Airport (Radial axis indicates the percentage of time for which the stated wind speed threshold is exceeded)

4.2 Pedestrian Comfort

The assessment of the wind conditions requires a standard against which the measurements can be compared. This report uses the Lawson Comfort Criteria[1] that have been established for over thirty years and have been widely used on building developments across the United Kingdom. The comfort criteria seek to define the reaction of an average pedestrian to the wind as described in Table 1. If the measured wind conditions exceed the threshold wind velocity for more than 5% of the time, then they are deemed unacceptable for the intended pedestrian activity. The expectation is that there may be complaints of nuisance or people will not use the area for its intended purpose.

[1] Lawson T.V. (April 2001), Building Aerodynamics, Imperial College Press

The Criteria sets out four pedestrian activities and reflect the fact that less active pursuits require more benign wind conditions. The categories are sitting, standing, strolling and walking, in ascending order of activity level, with a fifth category for conditions that are uncomfortable for all pedestrian uses. In other words, the wind conditions in an area for sitting need to be calmer than a location that people merely walk past.

The distinction between strolling and walking is that in the strolling scenario pedestrians are more likely to take on a leisurely pace, with the intention of taking time to move through the area, whereas in the walking scenario pedestrians are intending to move through the area quickly and are therefore expected to be more tolerant of stronger winds.

The Criteria are derived for open air conditions and assume that pedestrians will be suitably dressed for the season.

The coloured key in Table 1 corresponds to the presentation of results described in the results section of this report.

Table 1: Lawson Comfort Criteria

Key	Comfort Category	Threshold	Description
	Sitting	0-4 m/s	Light breezes desired for outdoor restaurants and seating areas where one can read a paper or comfortably sit for long periods
	Standing	4-6 m/s	Gentle breezes acceptable for main building entrances, pick-up/drop-off points and bus stops
	Strolling	6-8 m/s	Moderate breezes that would be appropriate for strolling along a city/town street, plaza or park
	Walking	8-10 m/s	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
	Uncomfortable	>10 m/s	Winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

4.3 Strong Winds

In addition, the criteria stipulate two strong wind threshold limits; when winds exceed 15m/s or 20m/s for more than 0.025% of the time (approximately 2 hours of the year). The lower limit, 15m/s, if exceeded may require remedial measures depending on the sensitivity of the location i.e. is it reasonable to expect an elderly or very young pedestrian to be present at the location? Wind speeds that exceed the 20m/s threshold for more than approximately 2 hours per year would represent a safety risk for all members of the population and would therefore require mitigation to provide an appropriate wind environment.

In the UK, strong winds are associated with areas which would be classified as uncomfortable for pedestrian use. Strong winds could also be associated with areas with walking use wind conditions, that are relatively close to the uncomfortable threshold. Professional judgement incorporating RWDI's experience of a large number of similar projects both within the UK and internationally has been applied, informed by the CFD results to identify areas of the Proposed Development likely to have instances of strong winds. Mitigation applied to improve pedestrian comfort would also reduce the frequency of, and potentially eliminate, strong winds.

5 RESULTS

5.1 Details of Analysis

To account for the difference in ground height and terrain roughness between the meteorological station and the Site and the effect this will have on meteorological conditions, a terrain roughness assessment was undertaken to adjust the meteorological data from the relatively opens surrounds of the airport to the suburban surroundings of the Site. Adjustment (mean) factors were computed and applied to all assessed wind directions using the methodology set out in ESDU 01008[2] and applied to the CFD data.

5.2 Desired Pedestrian Activity around the Development

Generally, for a mixed-use development, the target conditions are:

- Strolling during the windiest season on pedestrian thoroughfares;
- Standing/entrance conditions at main entrances, drop off areas, and bus stops throughout the year;
- Sitting conditions at outdoor seating during the summer season when these areas are more likely to be frequently used by pedestrians; and
- Sitting or standing use conditions during the summer season on private amenity spaces.

The walking and uncomfortable classifications are usually avoided because of their association with occasional strong winds, unless they are on a minor pedestrian route or a route where pedestrian access could be controlled in the event of strong winds.

Achieving a sitting classification in the summer usually means that the same measurement location would be suitable for standing in the windiest season because winds are stronger during this period. This is considered an acceptable occurrence for the majority of external amenity spaces because other factors such as air temperature and precipitation influence people's perceptions about the 'need' to use seating in the middle of winter.

For a large terrace space, a mix of standing and sitting wind conditions is acceptable provided that any desired seating areas are situated in areas having sitting wind conditions.

5.3 Performance against the Lawson Comfort Criteria

The wind microclimate within and around the Site has been assessed and classified using the Lawson Comfort Criteria defined in Table 1. The results of the assessment for each configuration are described below and presented graphically in Figures 4–23.

[2] ESDU International, Computer program for wind speeds and turbulence properties: flat or hilly sites in terrain with roughness changes, ESDU 01008, 2001 01008

5.3.1 Configuration 1 – Existing Site with Existing Surrounding Buildings and Existing Landscaping

The wind microclimate results for Configuration 1 are shown in the following figures:

- Figure 4: Windiest Season: Ground Level; and
- Figure 5: Summer Season: Ground Level.

5.3.2 Configuration 2 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping

The wind microclimate results for Configuration 2 are shown in the following figures:

- Figure 6: Windiest Season: Ground Level;
- Figure 7: Summer Season: Ground Level;
- Figure 8: Windiest Season: Terraces;
- Figure 9: Summer Season: Terraces;
- Figure 10: Windiest Season: Balconies; and
- Figure 11: Summer Season: Balconies.

5.3.3 Configuration 3 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping

The wind microclimate results for Configuration 3 are shown in the following figures:

- Figure 12: Windiest Season: Ground Level;
- Figure 13: Summer Season: Ground Level;
- Figure 14: Windiest Season: Terraces;
- Figure 15: Summer Season: Terraces;
- Figure 16: Windiest Season: Balconies; and
- Figure 17: Summer Season: Balconies.

The following cumulative schemes were included:

- 204553FUL 29-39 Stirling Road And 2-10 Roslin Road;
- 214611FUL 1 Stirling Road/1-9 Colville Road and 67-81 Stirling Road;
- 214991FUL 3-15 Stirling Road; and
- *214710FUL 93 Bollo Lane.

*Whilst not consented at the time of the assessment, this scheme was included as it has a draft decision, and is situated nearby the Site, and could therefore have an impact on the local wind microclimate.

5.3.4 Configuration 4 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping and Mitigation Measures

The wind microclimate results for Configuration 4 are shown in the following figures:

- Figure 18: Windiest Season: Ground Level;
- Figure 19: Summer Season: Ground Level;
- Figure 20: Windiest Season: Terraces;
- Figure 21: Summer Season: Terraces;
- Figure 22: Windiest Season: Balconies; and
- Figure 23: Summer Season: Balconies.

The mitigation measures applied are shown in Appendix B Figures 32-35

6 DISCUSSION

This discussion compares the measured wind conditions (shown in the contour plots) to the anticipated use of the Site, to provide an assessment of whether the conditions would be suitable or too windy for the intended use.

Any areas not specifically mentioned would be suitable, or calmer than required, for the desired pedestrian use. Mitigation has been identified for areas where windier than suitable conditions for the intended pedestrian use, save for pre-existing wind conditions which are also identified in Configuration 1.

6.1 Configuration 1: Existing Site with Existing Surrounding Buildings

Results for Configuration 1 are presented in Figure 4 and Figure 5 for ground level during the windiest and summer seasons respectively.

6.1.1 Pedestrian Comfort

Wind conditions around the Site range from suitable for sitting to strolling use during the windiest season, with a localised area of walking conditions south of the assessed area. As the Site is currently empty, the wind conditions within it would be fairly calm with standing conditions. Off-Site, localised areas of walking conditions occur due to building corner accelerations.

6.1.1.1 Thoroughfares (Figure 4)

Pedestrian thoroughfares around the Site and in the surrounding area mainly range from suitable for sitting to strolling use during the windiest season. There is a localised area of walking conditions to the south within Chiswick Business Park, furthest south of the assessed area; whilst walking conditions are one category too windy, there are trees which would help provide shelter that were not included in this assessment.

6.1.1.2 Entrances (Figure 4)

Entrances to surrounding buildings have wind conditions suitable for sitting and standing use during the windiest season.

6.1.1.3 Bus Stops (Figure 4)

Bus stops along Bollo Lane would have wind conditions suitable for standing use during the windiest season.

6.1.2 Strong Winds

Strong winds with the potential to be a safety concern for cyclists and more vulnerable pedestrians would be anticipated to occur when wind conditions are uncomfortable for all intended uses during the windiest season. Strong winds could also be associated with areas with walking use wind conditions, that are relatively close to the uncomfortable threshold. Professional judgement has been applied, informed by the CFD results, to identify areas likely to have instances of strong winds.

Whilst walking conditions occur within Chiswick Business Park, there are trees which would help provide shelter that were not included in this assessment, which would help reduce the occurrence of strong winds.

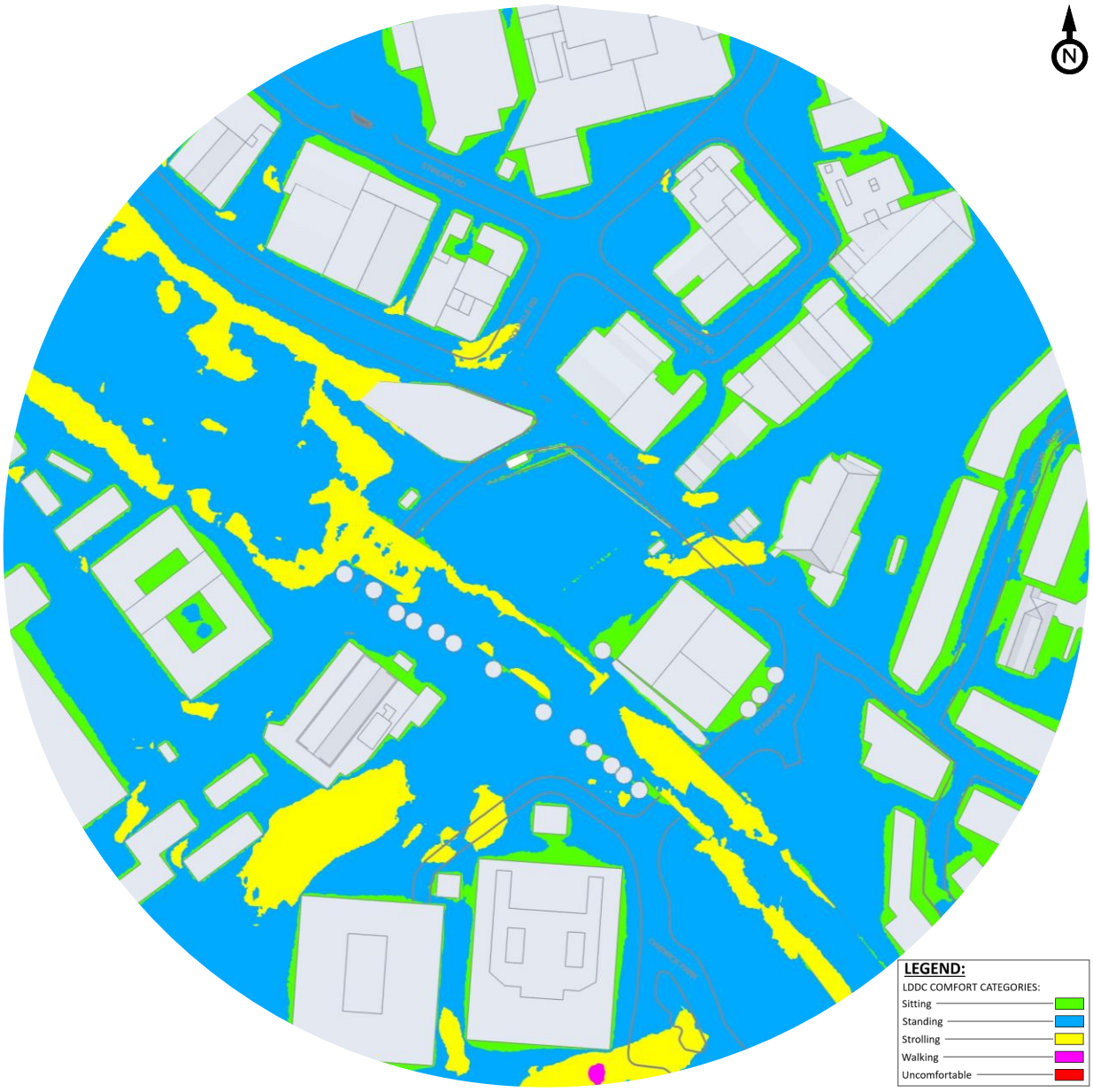


Figure 4: Configuration 1 – Existing Site with Existing Surrounding Buildings – Ground Level, Windiest Season

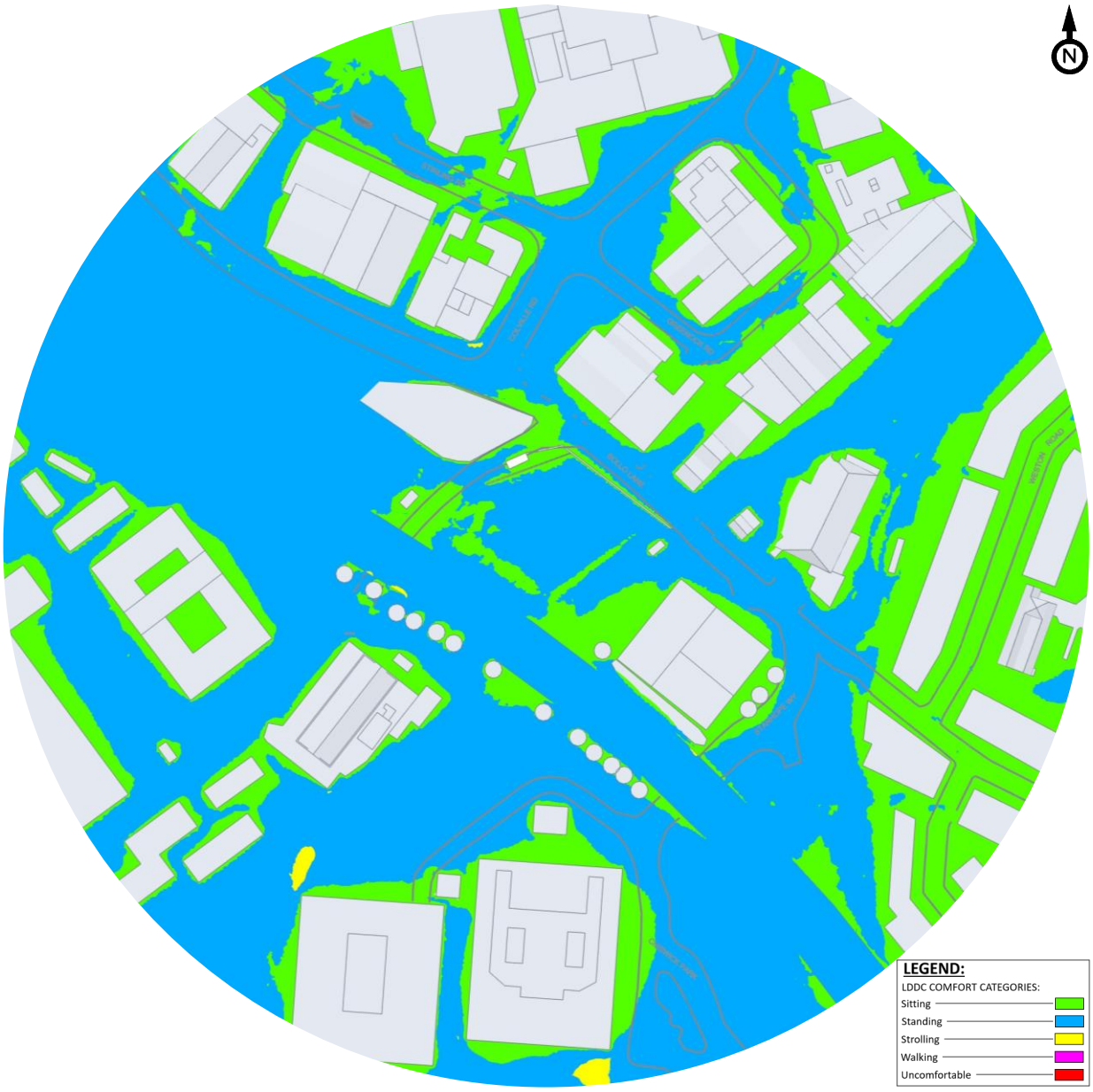


Figure 5: Configuration 1 – Existing Site with Existing Surrounding Buildings – Ground Level, Summer Season

6.2 Configuration 2: Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping

Results for Configuration 2 are presented in Figure 6 and Figure 7 for ground level during the windiest and summer seasons respectively. Figures 8 and 9 present the results at terraces during the windiest and summer seasons respectively. Figures 10 and 11 present the results at balconies during the windiest and summer seasons respectively.

6.2.1 Pedestrian Comfort

With the introduction of the Proposed Development, wind conditions within the Site would become windier overall, in comparison to the baseline scenario. This is due to the Proposed Development being taller than the nearby surroundings, therefore bring winds downwards towards ground level.

6.2.1.1 Thoroughfares (Figure 6)

Pedestrian thoroughfares around the Proposed Development and surrounding area would range from suitable for sitting to walking use during the windiest season. Walking conditions would occur within Chiswick Business Park, at the corner of Colville Road and at the southern corner of the Proposed Development. Conditions within Chiswick Business Park occur in the baseline scenario and therefore would not require mitigation. At the corner of Colville Road, there would be a small, localised area of walking conditions introduced; given the small magnitude, this would be considered tolerable for a thoroughfare. On-Site at the southern corner, whilst the majority of walking conditions on the railway tracks (inaccessible to pedestrians), there is a small occurrence directly at the corner. As this space is inaccessible no mitigation would be required.

6.2.1.2 Entrances (Figure 6)

Entrances to the Proposed Development and surrounding buildings would be suitable for sitting and standing use during the windiest season, suitable conditions for entrances.

6.2.1.3 Bus Stops (Figure 6)

Bus stops along Bollo Lane would have wind conditions suitable for standing use during the windiest season, acceptable for the current use.

6.2.1.4 Ground Level Amenity Spaces (Figure 7)

Ground level amenity on-Site would be situated on the northern side of the Proposed Development. Wind conditions during the summer season within this space would be suitable for sitting and standing use, with sitting conditions at seating areas. Wind conditions would therefore be suitable for the intended use.

6.2.1.5 Terraces (Figure 9)

Wind conditions at the 4th level terrace would have standing and strolling conditions during the summer season. Strolling conditions would be windier than suitable, and standing conditions would be windier than suitable if there is seating proposed. Mitigation measures would therefore be required at this terrace.

The upper roof level terrace would have areas of strolling, walking and uncomfortable conditions during the summer season, windier than suitable for a terrace, requiring mitigation measures.

The specific terrace areas requiring mitigation are highlighted in Figure 31 Appendix B.

6.2.1.6 Balconies (Figure 11)

Several balconies along the northern, western and southern façades, and some high-level balconies on the eastern façade would have strolling and walking conditions during the summer season, windier than suitable. Mitigation measures would therefore be required at these balconies. The specific balconies requiring mitigation are highlighted in Figure 30 Appendix B.

6.2.2 Strong Winds

Strong winds with the potential to be a safety concern for cyclists and vulnerable pedestrians would be anticipated to occur when wind conditions are uncomfortable for all intended uses during the windiest season. Strong winds could also be associated with areas with walking use wind conditions, that are relatively close to the uncomfortable threshold. Professional judgement has been applied, informed by the CFD results, to identify areas likely to have instances of strong winds.

At ground level, walking conditions which would occur within Chiswick Business Park occur in the baseline scenario (Configuration 1), therefore would not require mitigation measures as the Proposed Development is not making conditions worse in this area. Walking conditions which would occur at the southern corner would require mitigation if this corner is accessible to pedestrians.

The corner of the 4th level terrace, and the majority of the upper roof level terrace would have walking and uncomfortable conditions during the windiest season, therefore anticipated strong wind exceedances, requiring mitigation.

Similar to above, balconies which would be windier than suitable would also be anticipated to have strong wind exceedances, as walking and uncomfortable conditions occur during the windiest season, requiring mitigation.

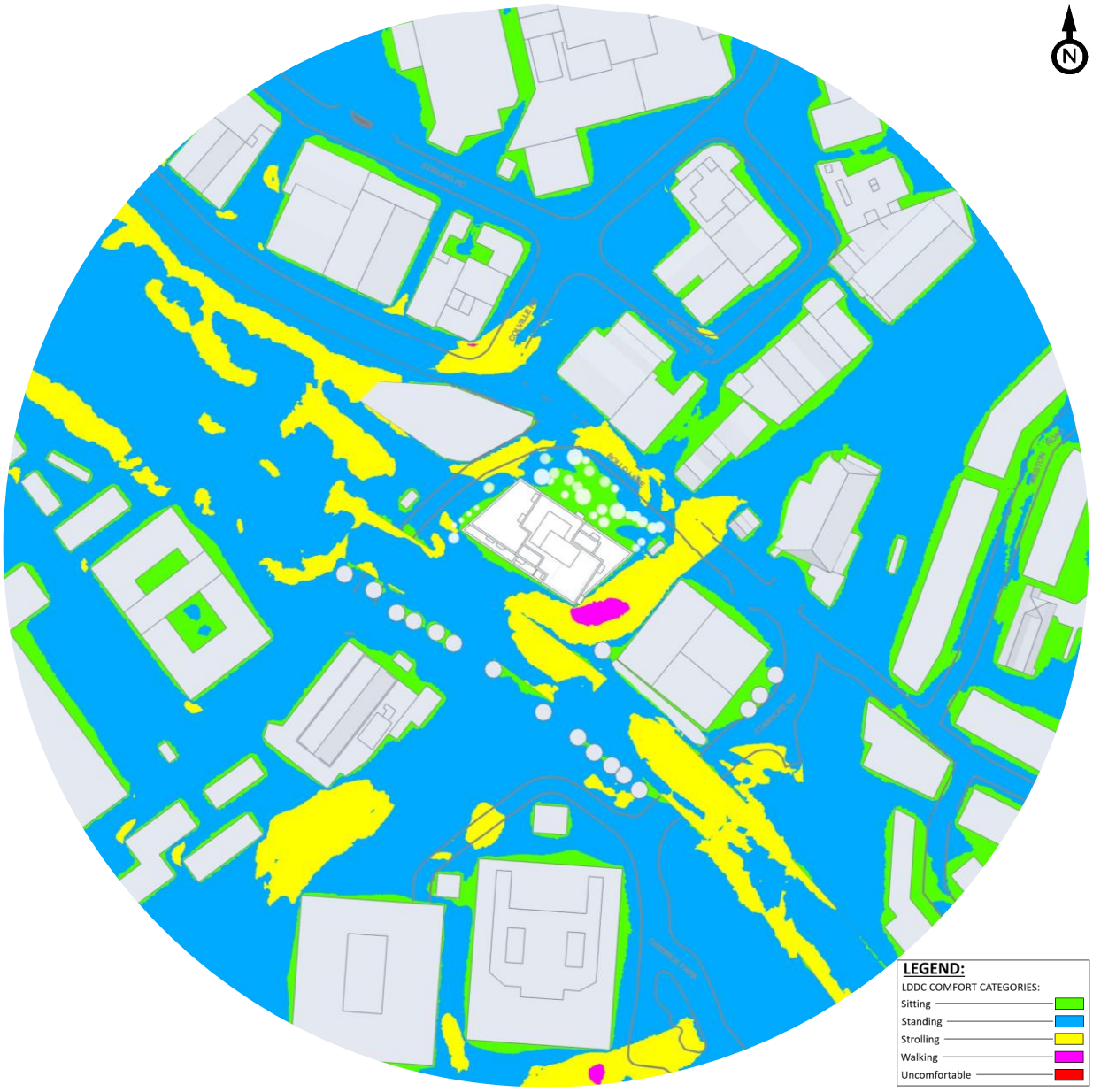


Figure 6: Configuration 2 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping– Ground Level, Windiest Season

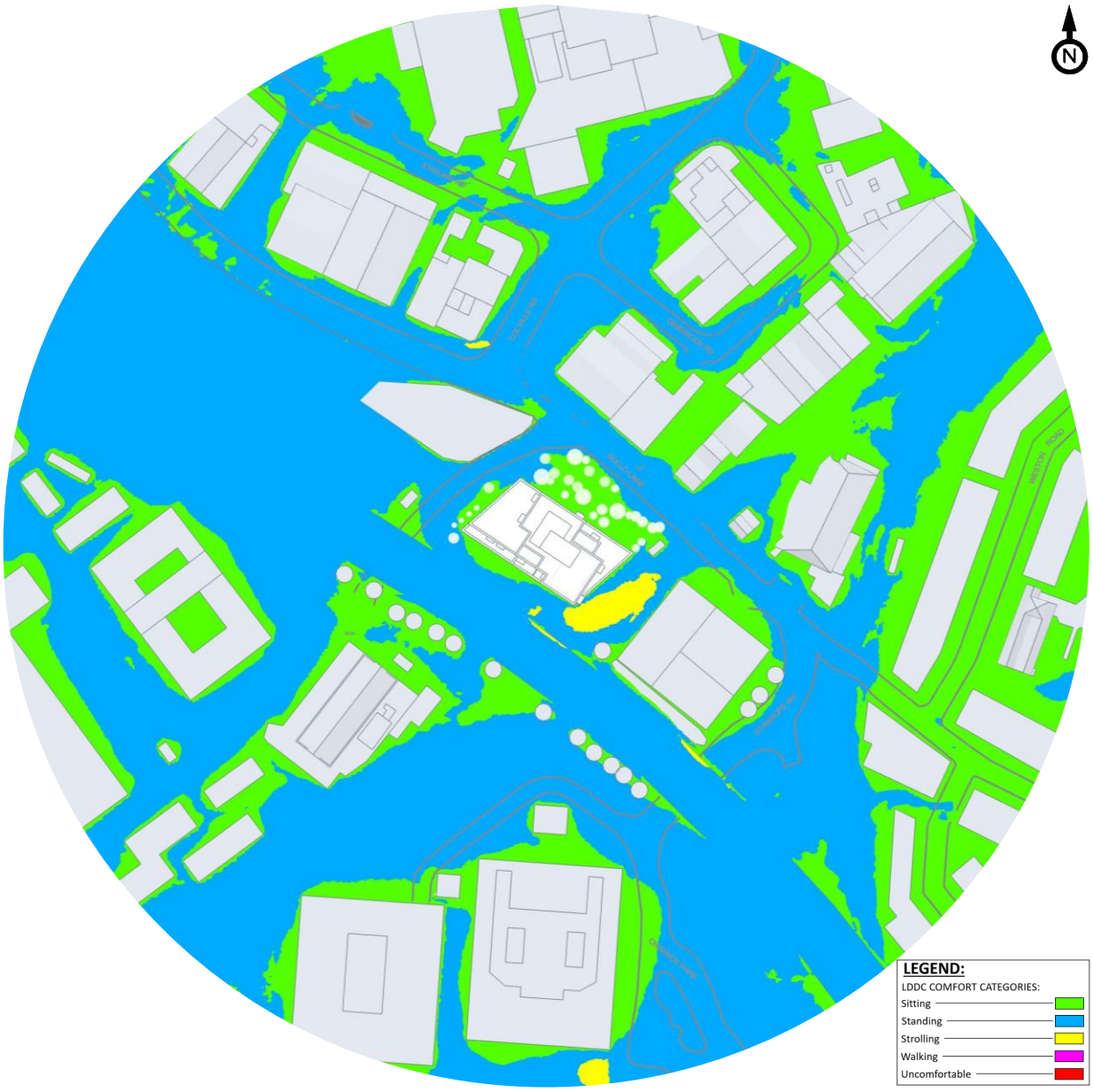


Figure 7: Configuration 2 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping – Ground Level, Summer Season

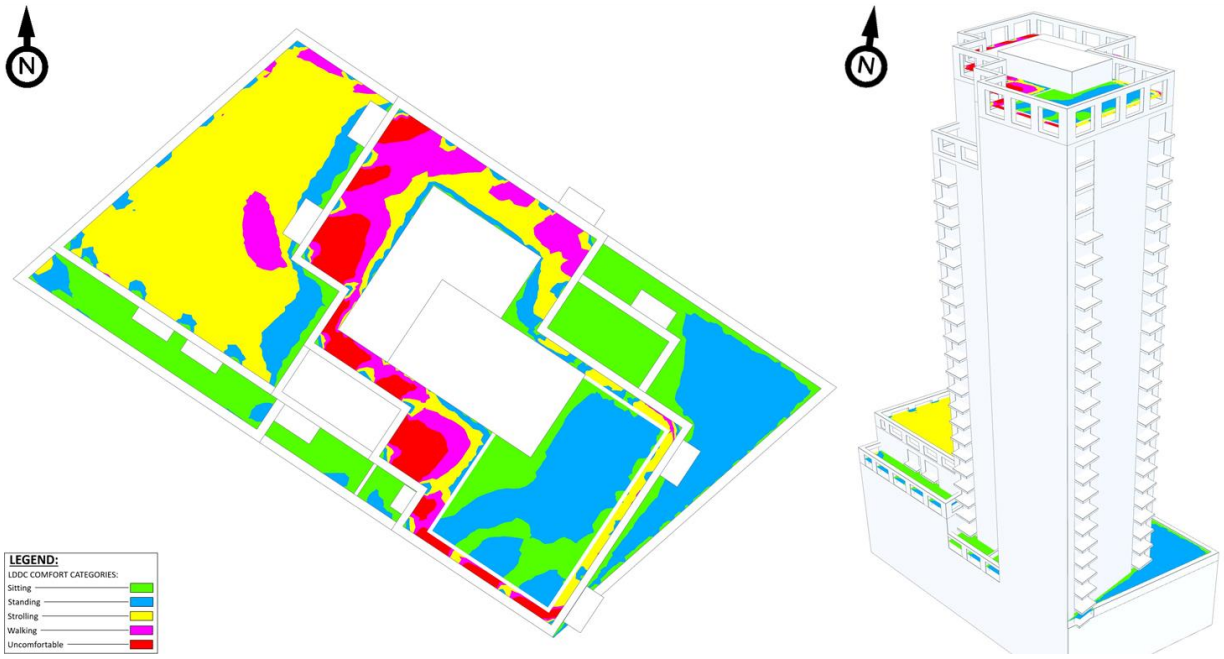


Figure 8: Configuration 2 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping – Terrace Levels, Windiest Season

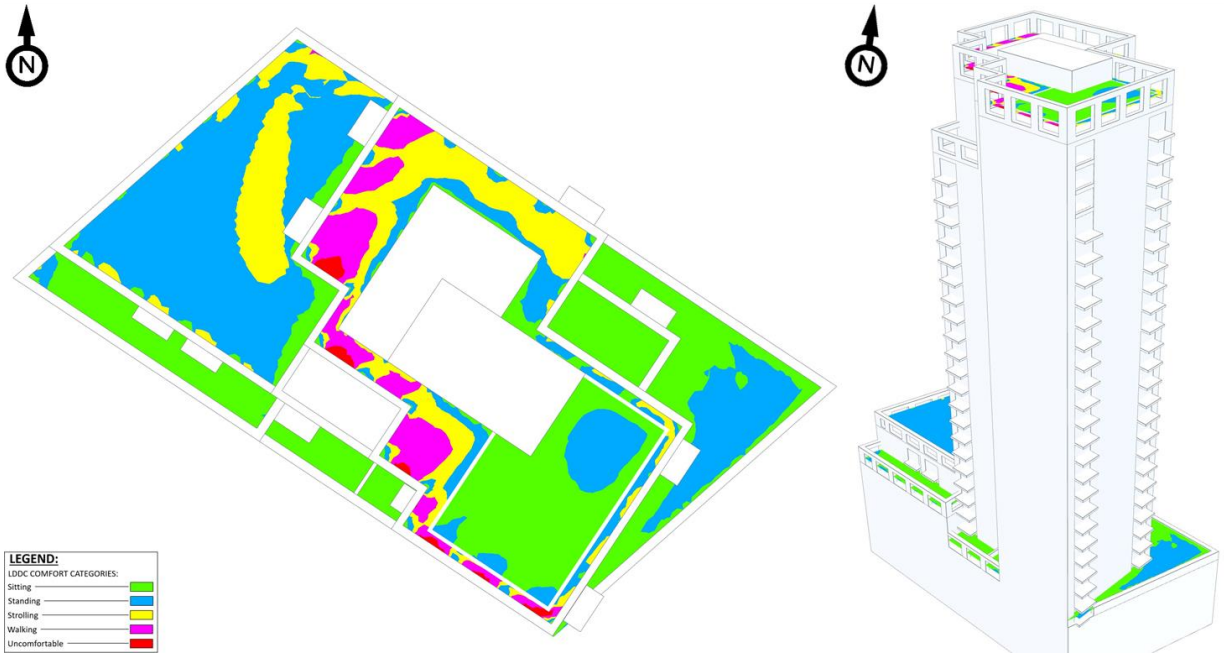


Figure 9: Configuration 2 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping – Terrace Levels, Summer Season

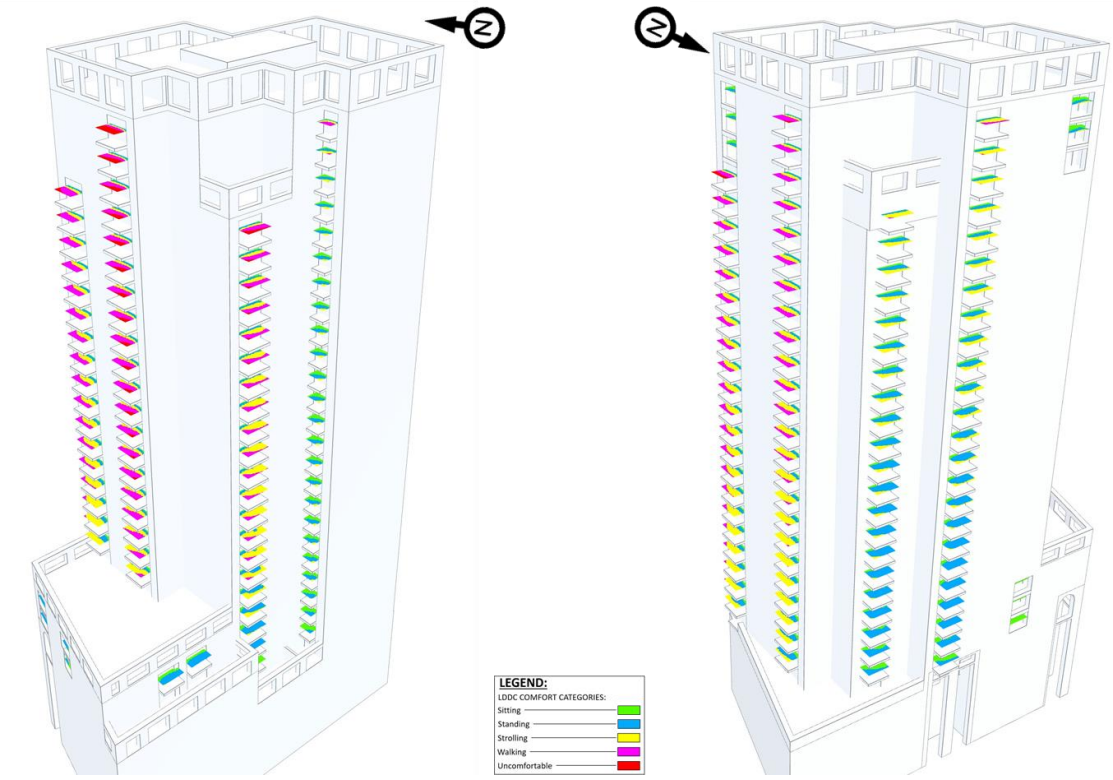


Figure 10: Configuration 2 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping – Balconies, Windiest Season

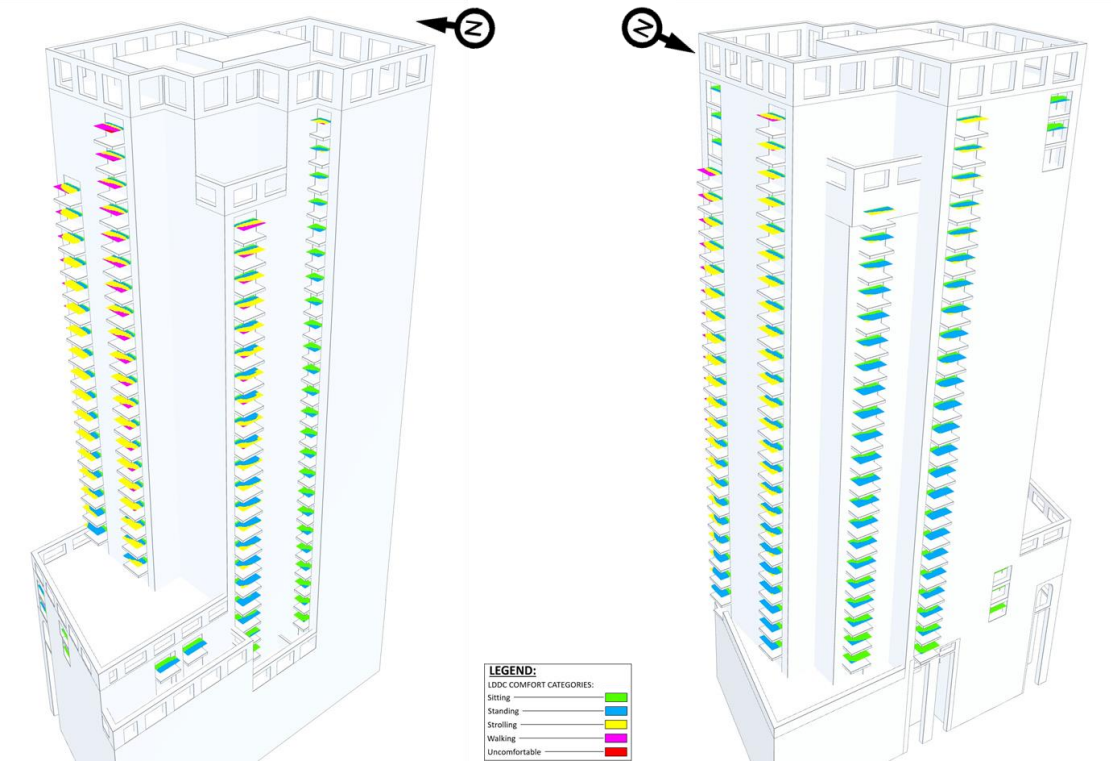


Figure 11: Configuration 2 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping – Balconies, Summer Season

6.3 Configuration 3: Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping

Results for Configuration 3 are presented in Figure 12 and Figure 13 for ground level during the windiest and summer seasons respectively. Figures 14 and 15 present the results at terraces during the windiest and summer seasons respectively. Figures 16 and 17 present the results at balconies during the windiest and summer seasons respectively.

6.3.1 Pedestrian Comfort

With the inclusion of nearby cumulative schemes, wind conditions at ground level would overall become slightly windier, as the cumulative schemes are taller than the existing buildings, and therefore would also introduce more wind towards ground level in comparison to the baseline scenario. The majority of assessed locations would remain materially similar to that reported in Configuration 2. However, there would be localised areas of walking and uncomfortable conditions situated around the corner of 214611FUL 1 Stirling Road/1-9 Colville Road and 67-81 Stirling Road; this would be expected to be a local effect, not caused by the Proposed Development. It should also be noted this assessment does not include any nearby landscaping/mitigation associated with that scheme, which would help improve the wind conditions.

6.3.2 Strong Winds

Strong winds with the potential to be a safety concern for cyclists and vulnerable pedestrians would be anticipated to occur when wind conditions are uncomfortable for all intended uses during the windiest season. Strong winds could also be associated with areas with walking use wind conditions, that are relatively close to the uncomfortable threshold. Professional judgement has been applied, informed by the CFD results, to identify areas likely to have instances of strong winds.

Strong wind exceedances would be anticipated to occur in the same locations as reported in Configuration 2, with the addition of the corner of 214611FUL 1 Stirling Road/1-9 Colville Road and 67-81 Stirling Road. As discussed above, this would be expected to be a local effect, not caused by the Proposed Development.

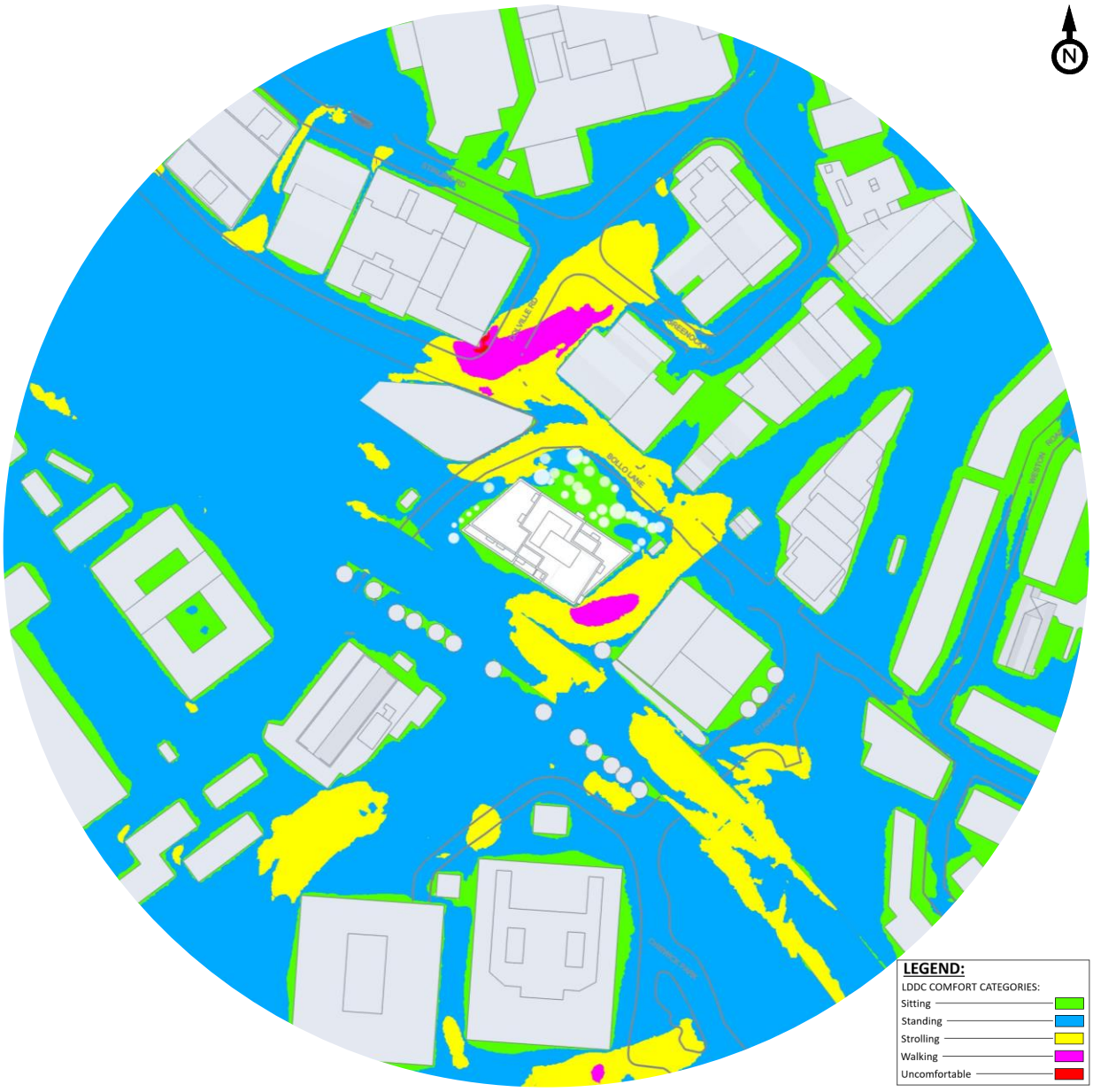


Figure 12: Configuration 3 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping– Ground Level, Windiest Season

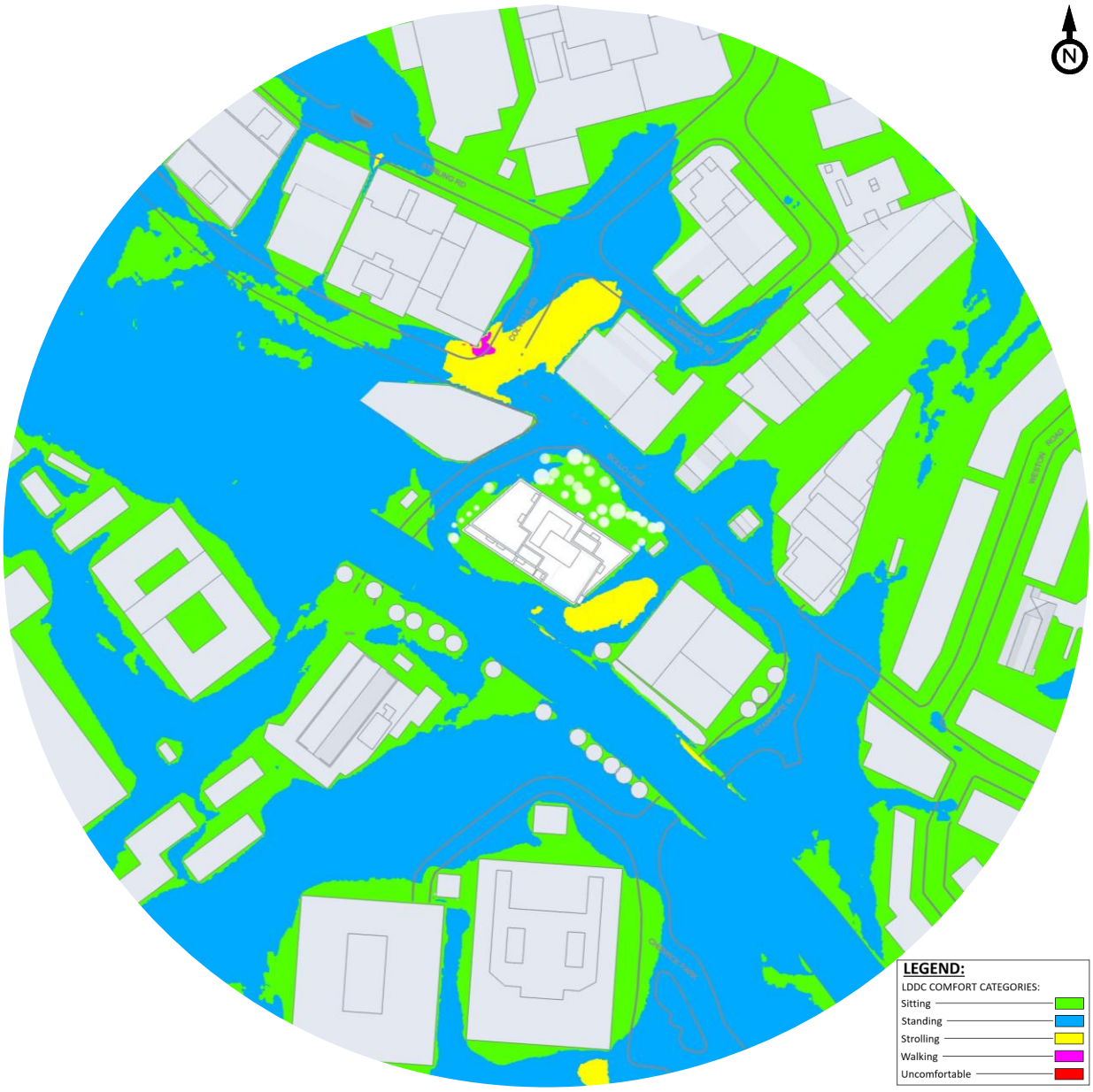


Figure 13: Configuration 3 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping– Ground Level, Summer Season

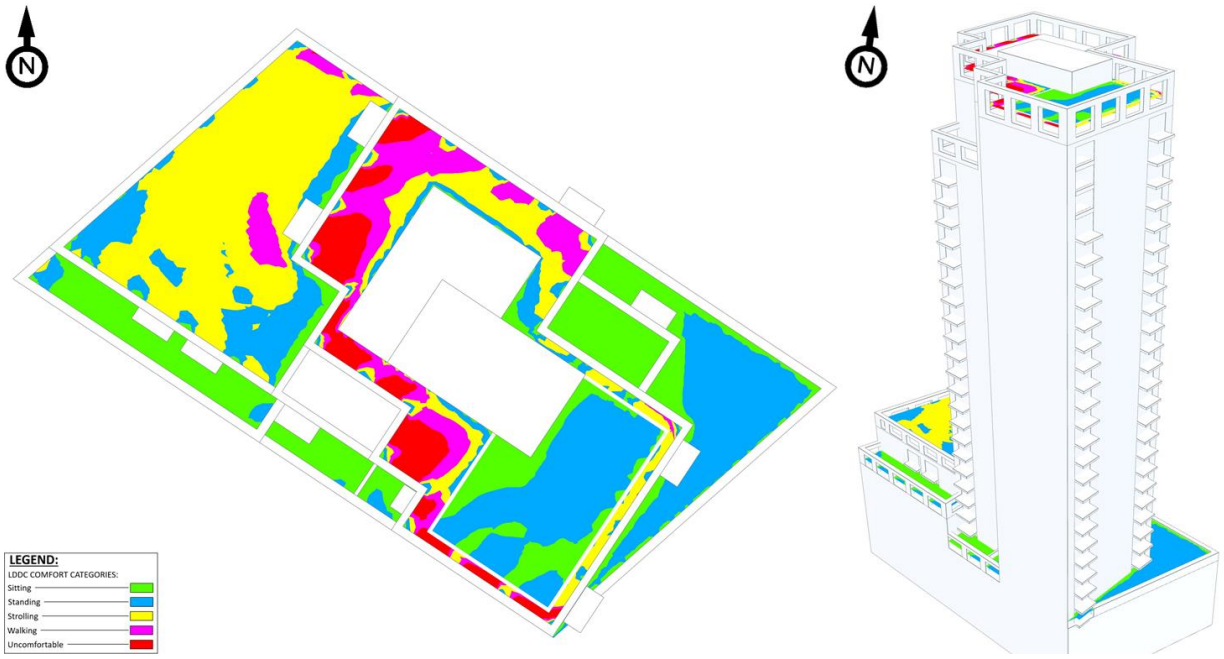


Figure 14: Configuration 3 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping – Terrace Levels, Windiest Season

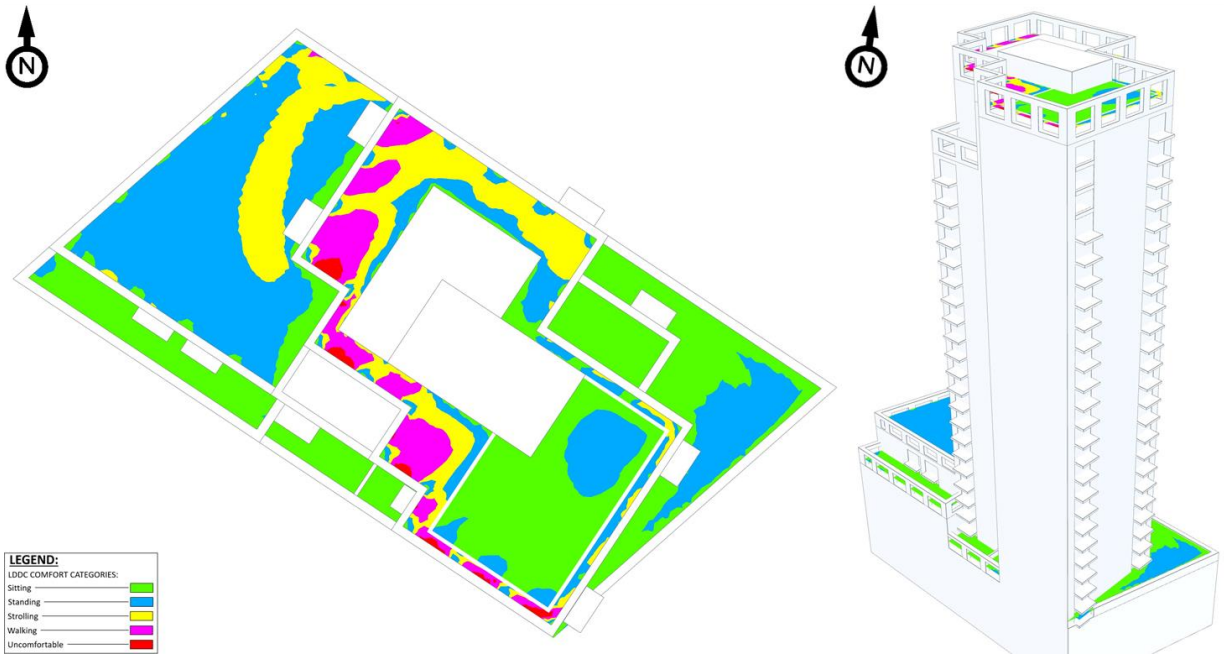


Figure 15: Configuration 3 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping – Terrace Levels, Summer Season

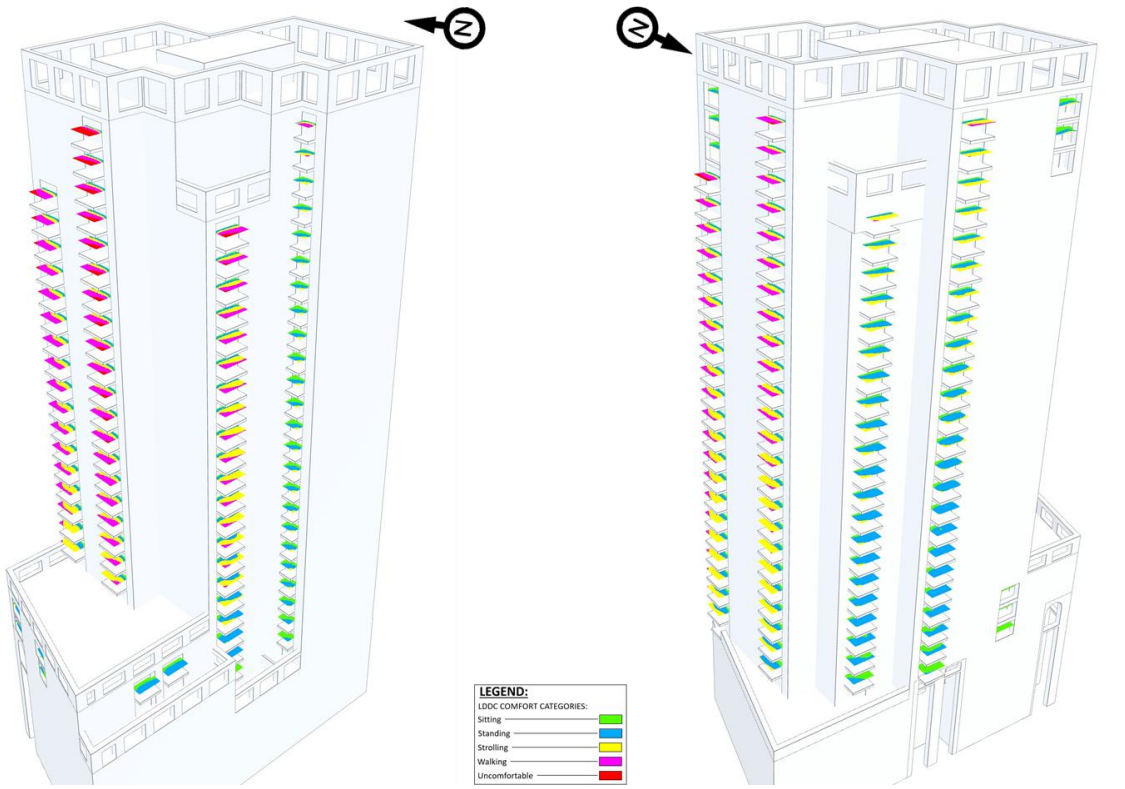


Figure 16: Configuration 3 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping – Balconies, Windiest Season

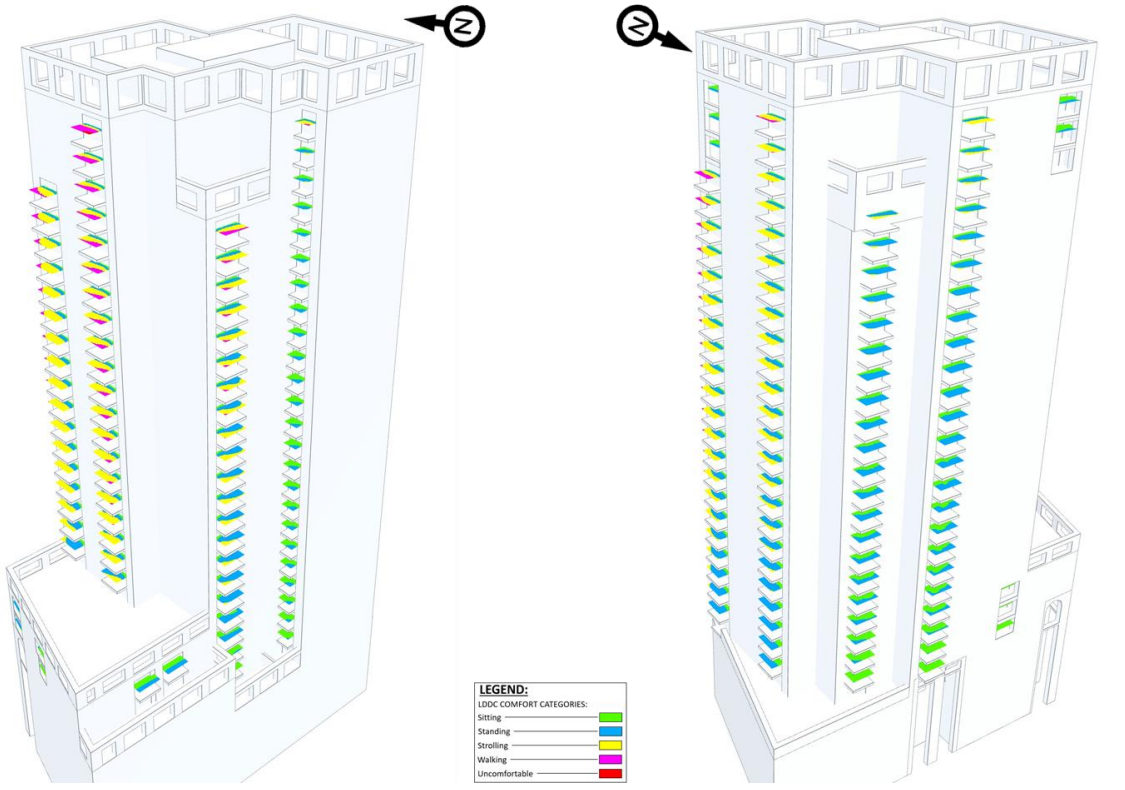


Figure 17: Configuration 3 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping – Balconies, Summer Season

6.4 Configuration 4: Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping and Mitigation Measures

Results for Configuration 4 are presented in Figure 18 and Figure 19 for ground level during the windiest and summer seasons respectively. Figures 20 and 21 present the results at terraces during the windiest and summer seasons respectively. Figures 22 and 23 present the results at balconies during the windiest and summer seasons respectively.

6.4.1 Pedestrian Comfort

With the mitigation measures being applied to the balconies and terraces, wind conditions at ground level are materially the same as those reported in Configuration 2, suitable for the intended uses.

At the 4th level terrace, the inclusion of the planters, porous screens and playhouse would help disperse south-westerly winds, thereby improving wind conditions in comparison to Configuration 2. Wind conditions would be suitable for sitting and standing use during the summer season. There would be a small, isolated area of strolling conditions; however, given the small area this would be considered tolerable. The terraces would have large areas of standing conditions, located where seating is proposed; it is advised to relocate the seating to areas with sitting conditions, or alternatively removed. The seating provisions which are located in areas with standing conditions are shown in Figure 36 Appendix B.

The upper roof level terrace benefits from the increased balustrade, planting and pergola structure. Wind conditions would mainly be suitable for sitting and standing use during the summer season, with a small, isolated area of strolling conditions. Given the small area this would be considered tolerable. There would be seating provisions on the roof terrace where standing conditions would occur; it is advised to relocate the seating to areas with sitting conditions, or alternatively removed. The seating provisions which are located in areas with standing conditions are shown in Figure 36 Appendix B.

With the implementation of 1.5m tall 50% open balustrades at all projecting balconies, wind conditions would improve, with the balconies being suitable for sitting and standing use during the summer season, appropriate conditions.

6.4.2 Strong Winds

Strong winds with the potential to be a safety concern for cyclists and vulnerable pedestrians would be anticipated to occur when wind conditions are uncomfortable for all intended uses during the windiest season. Strong winds could also be associated with areas with walking use wind conditions, that are relatively close to the uncomfortable threshold. Professional judgement has been applied, informed by the CFD results, to identify areas likely to have instances of strong winds.

At ground level, walking conditions which would occur within Chiswick Business Park occur in the baseline scenario (Configuration 1), therefore would not require mitigation measures as the Proposed Development is not making conditions worse in this area. Walking conditions which would occur at the southern corner would require mitigation if this corner is accessible to pedestrians.

6.4.3 Mitigation in the Cumulative Scenario

Mitigation measures have been assessed in the context of existing surrounding buildings, as this was deemed the worst-case scenario (with slightly windier conditions) when comparing the results at terraces for Configurations 2 and 3 during the windiest season. As conditions between both existing and cumulative scenarios are similar (slightly windier in the existing scenario), the mitigation applied would be expected to simultaneously benefit in the cumulative scenario.

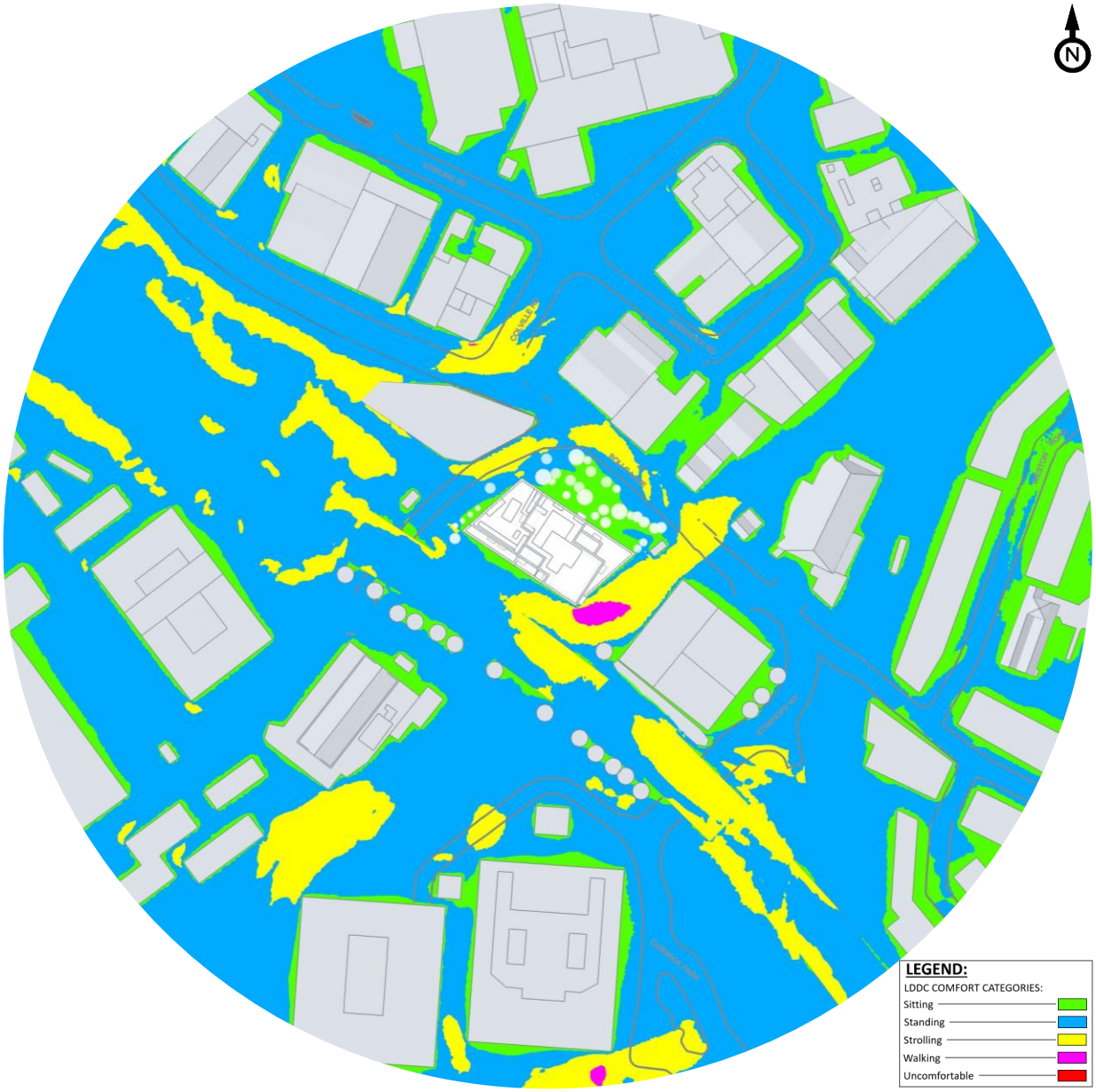


Figure 18: Configuration 4 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping and Mitigation Measures – Ground Level, Windiest Season

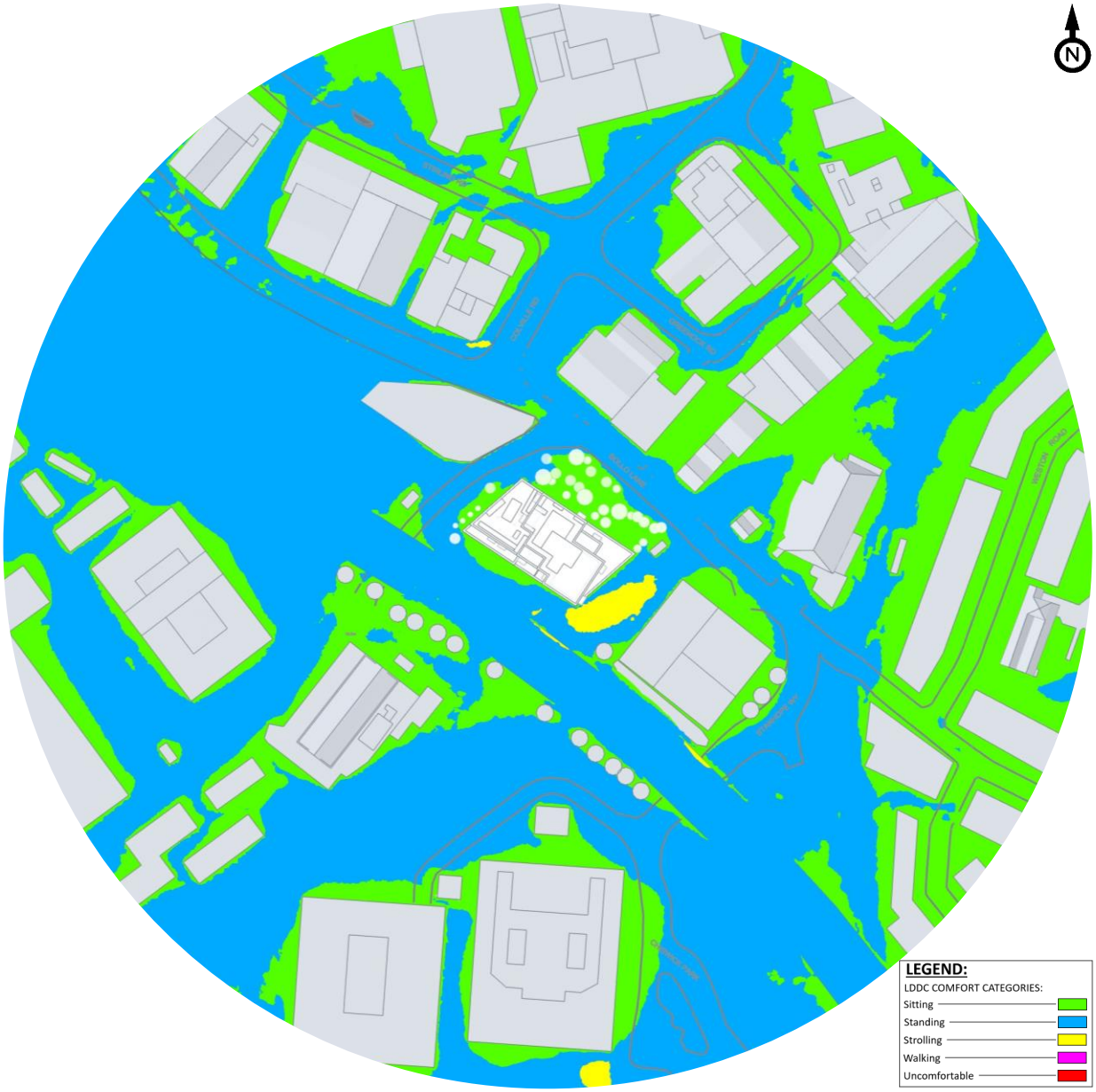


Figure 19: Configuration 4 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping and Mitigation Measures – Ground Level, Summer Season

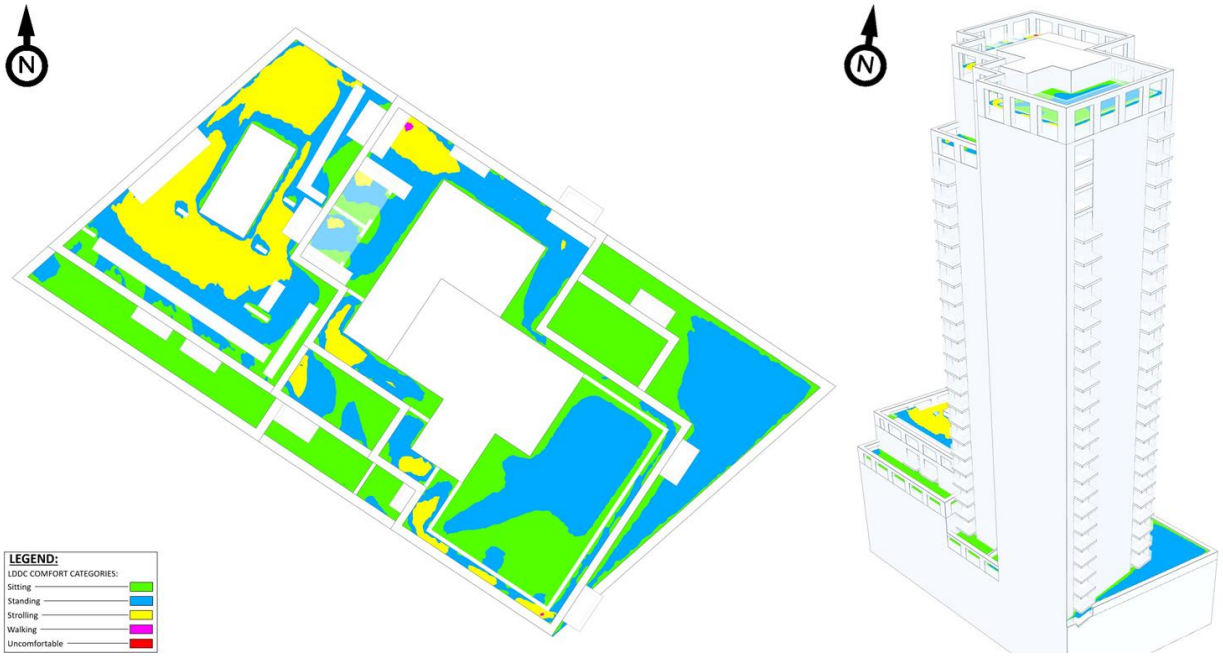


Figure 20: Configuration 4 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping and Mitigation Measures – Terrace Levels, Windiest Season

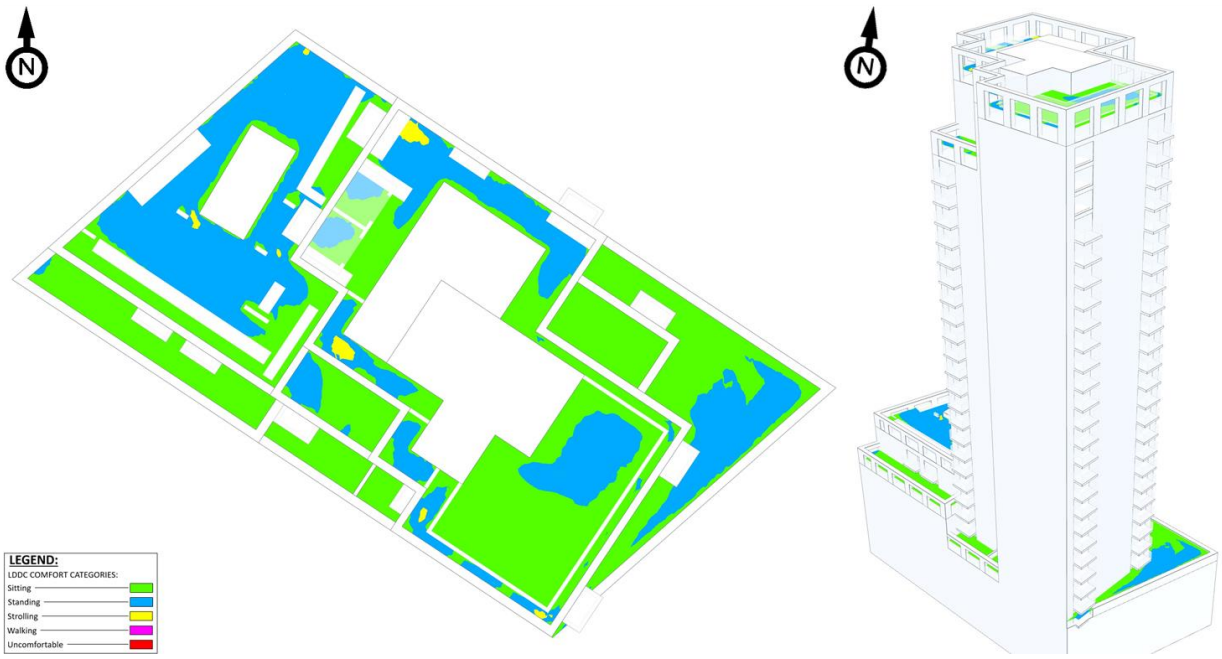


Figure 21: Configuration 4 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping and Mitigation Measures – Terrace Levels, Summer Season

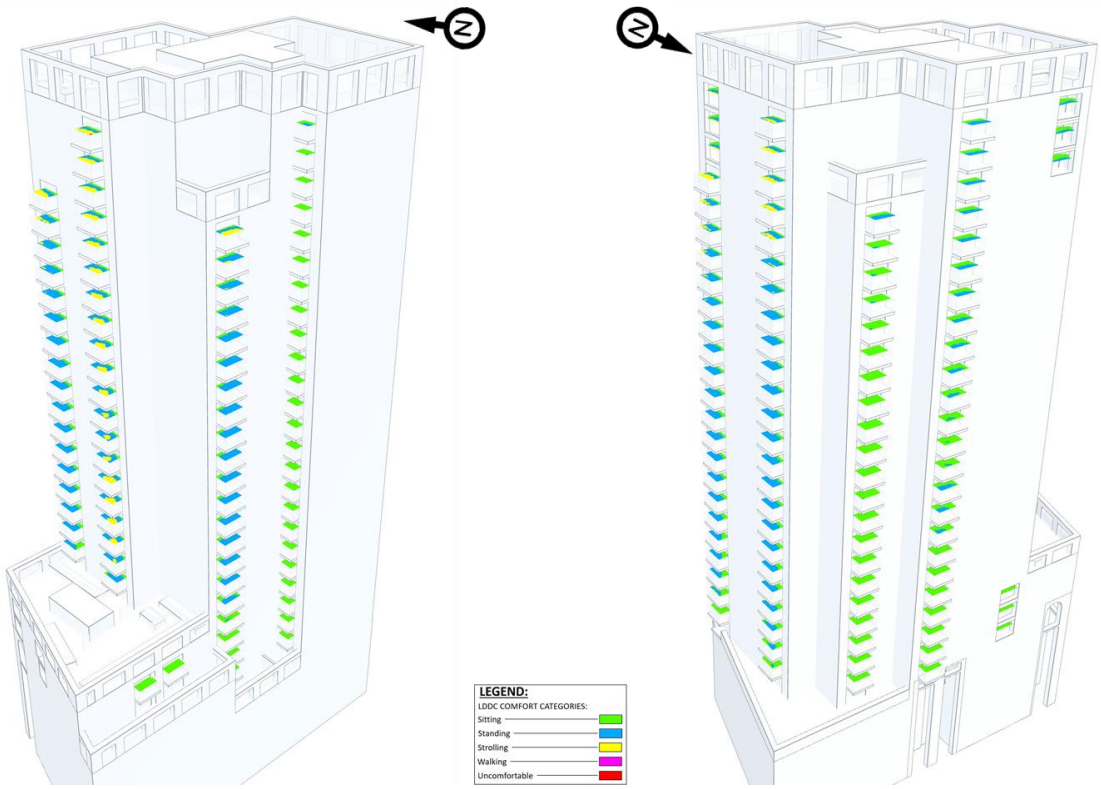


Figure 22: Configuration 4 – Balconies, Windiest Season

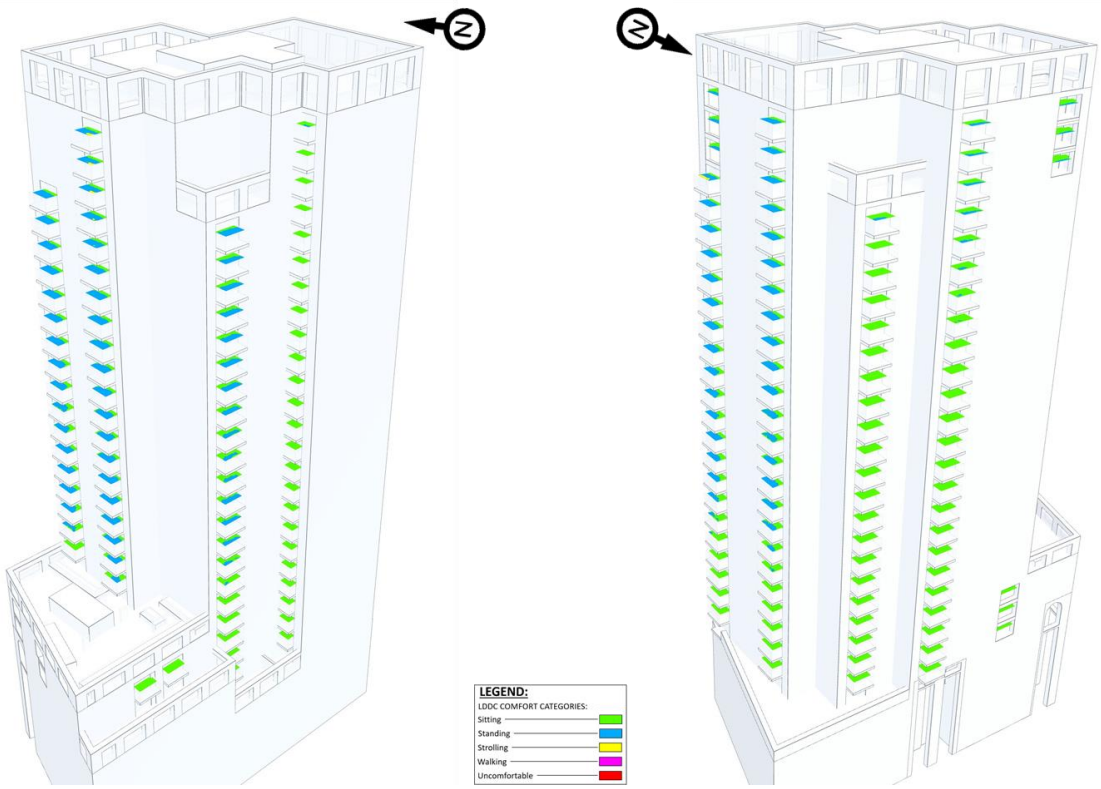


Figure 23: Configuration 4 – Balconies, Summer Season

7 CONCLUDING REMARKS

This report has identified the wind microclimate effects on the Proposed Development and surrounding area, based on an assessment conducted using Computational Fluid Dynamics (CFD) simulations. The following is a summary of the key points described in the report:

- The meteorological data for the Site indicates prevailing winds blowing from the south-west throughout the year. There is a secondary wind from the north-east most common during the late spring season.
- Wind conditions for the baseline scenario (Configuration 1) range from suitable for sitting to walking use during the windiest season. There are windier than suitable for the current use conditions and strong wind exceedances at isolated thoroughfares, however the inclusion of existing landscaping would be expected to improve conditions.
- With the introduction of the Proposed Development (Configuration 2) and proposed landscaping, wind conditions at the majority of ground level areas would remain suitable for the pedestrian uses. There would be balconies and terraces with windier than suitable conditions and strong wind exceedances.
- The inclusion of the cumulative schemes (Configuration 3) would result in similar conditions to those reported in Configuration 2.
- Mitigation measures were developed and tested for the balconies and terraces (Configuration 4). With the implementation of this mitigation, wind conditions at these spaces would be suitable, on the basis seating shown on the terraces can be removed or relocated to calmer areas.
- Overall, wind conditions would no worse than those presented for the approved scheme.

8 STATEMENT OF LIMITATIONS

This report entitled Pedestrian Level Wind Microclimate Assessment dated December 6th, 2023, was prepared by RWDI for Barratt London ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the development described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final design stage to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilise the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

9 ASSUMPTIONS AND LIMITATIONS

The findings included in this report are based on the following information ("Project Data") disclosed to RWDI:

- Landscape drawings – received 31st August 2023;
- 3D Model and drawings – received 1st September 2023;
- Mitigation "252 Bollo Lane - Plot 3A Wind Mitigation Measures 261023" – received 26th October 2023; and
- Design and Access Statement – received 6th December 2023.

The recommendations and conclusions are based on the following assumptions:

- The Project Data is accurate and complete;
- The Proposed Development, when built, does not deviate substantially from the information listed above. "Substantially" in this case means any change to the exterior form of the buildings that would change the wind flow around it, in a way that would impact pedestrian comfort or safety.
- Sensitive areas of the Site (such as amenity spaces) are expected to be used in line with the temporal specifications set out in the report body.

Any change in the Project Data or Project Specific Conditions not reflected in this report can impact and/or alter the recommendations and conclusions in this report. Therefore, it is incumbent for the Client and/or any other third party relying on the recommendations and conclusions in this report to contact RWDI in the event of any change in the Project Data and Project Specific Conditions in order to determine whether any such change(s) may impact the assumptions upon which the recommendations and conclusions were made.

Finally, the recommendations and conclusions in this report are partially based on historical data and can be affected by a number of external factors, including but not limited to Project design, quality of materials and construction, site conditions, meteorological events, and climate change. As such, the conclusions and recommendations contained in this report do not list every possible outcome.

10 REFERENCES

1. Lawson T.V. (April 2001), Building Aerodynamics, Imperial College Press
2. ESDU International, Computer program for wind speeds and turbulence properties: flat or hilly sites in terrain with roughness changes, ESDU 01008, 2001 01008

APPENDIX A: COMPUTATIONAL MODEL

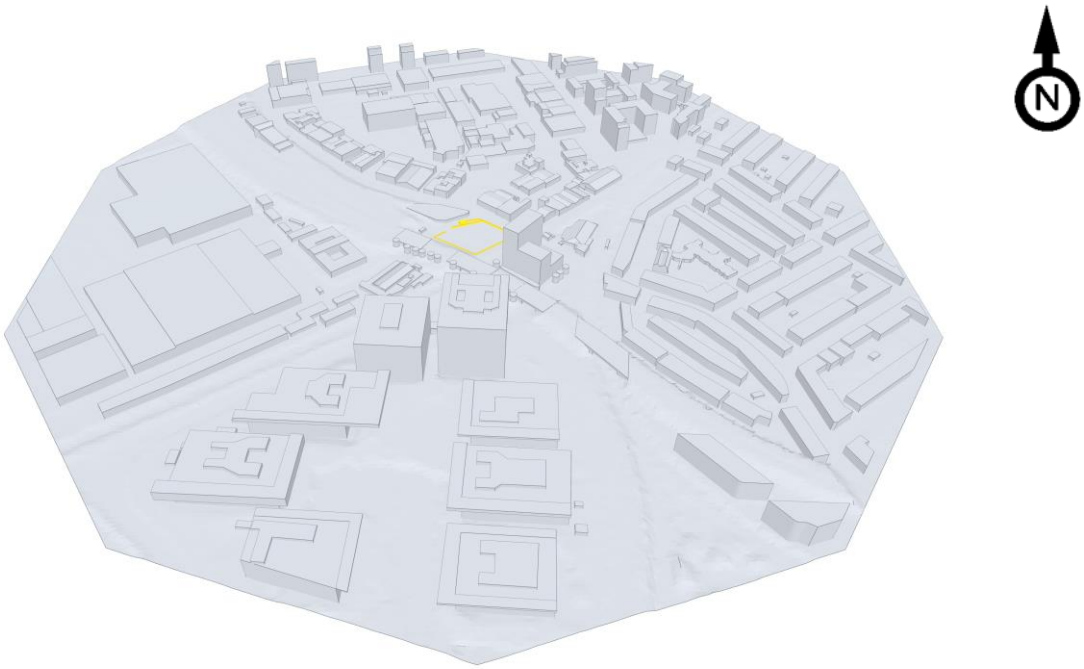


Figure 24 – Existing Site with Existing Surrounding Buildings and Existing Landscaping 3D model used for Computational Fluid Dynamic simulations (view from the south)

Figure 25 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping 3D model used for Computational Fluid Dynamic simulations (view from the south)

Figure 26 – Proposed Development with Cumulative Surrounding Buildings, Existing and Proposed Landscaping 3D model used for Computational Fluid Dynamic simulations (view from the south)

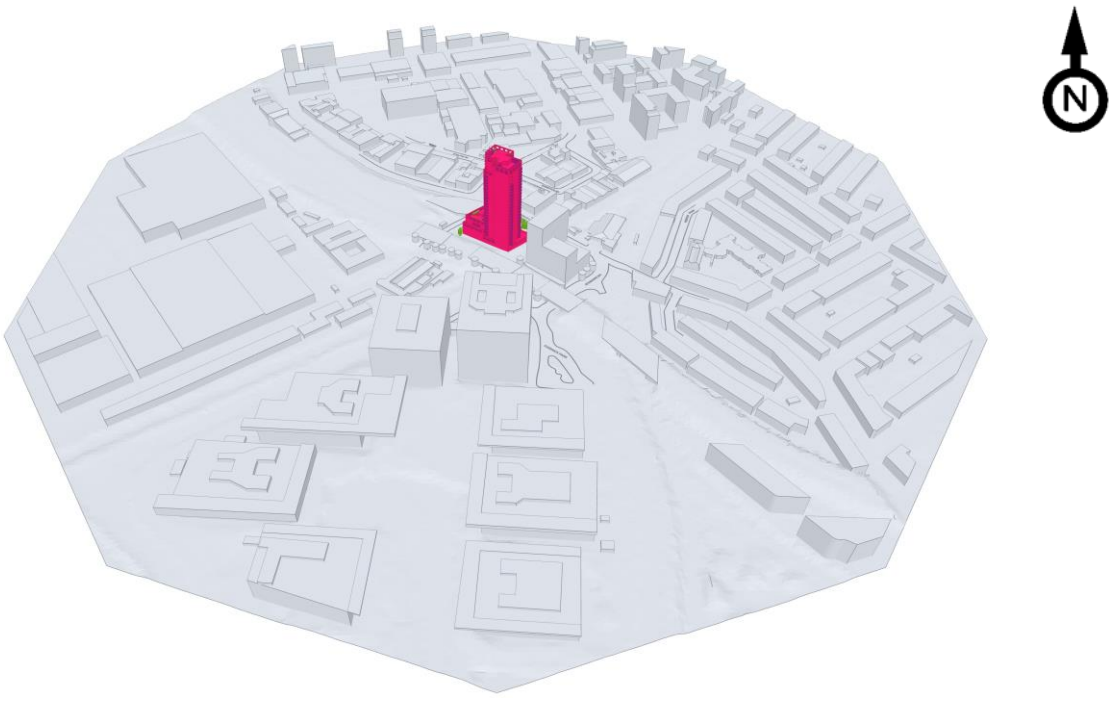


Figure 27 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping and Mitigation Measures 3D model used for Computational Fluid Dynamic simulations (view from the south)

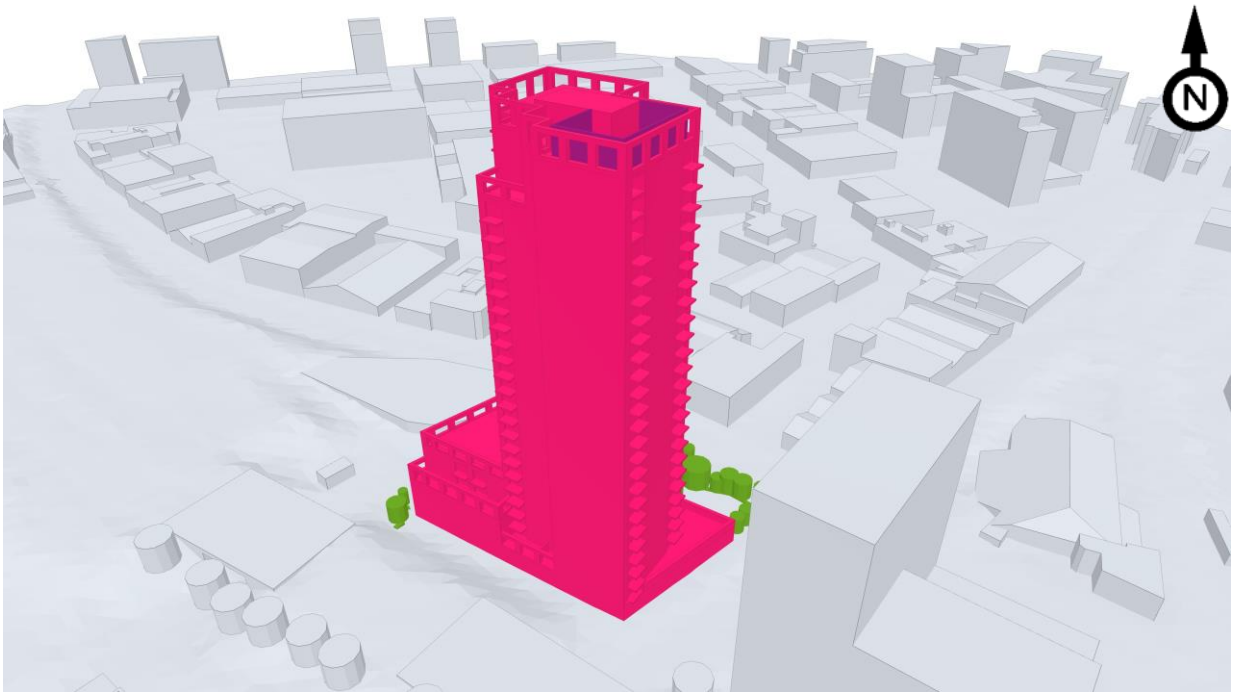


Figure 28 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping 3D model used for Computational Fluid Dynamic simulations (view from the south)

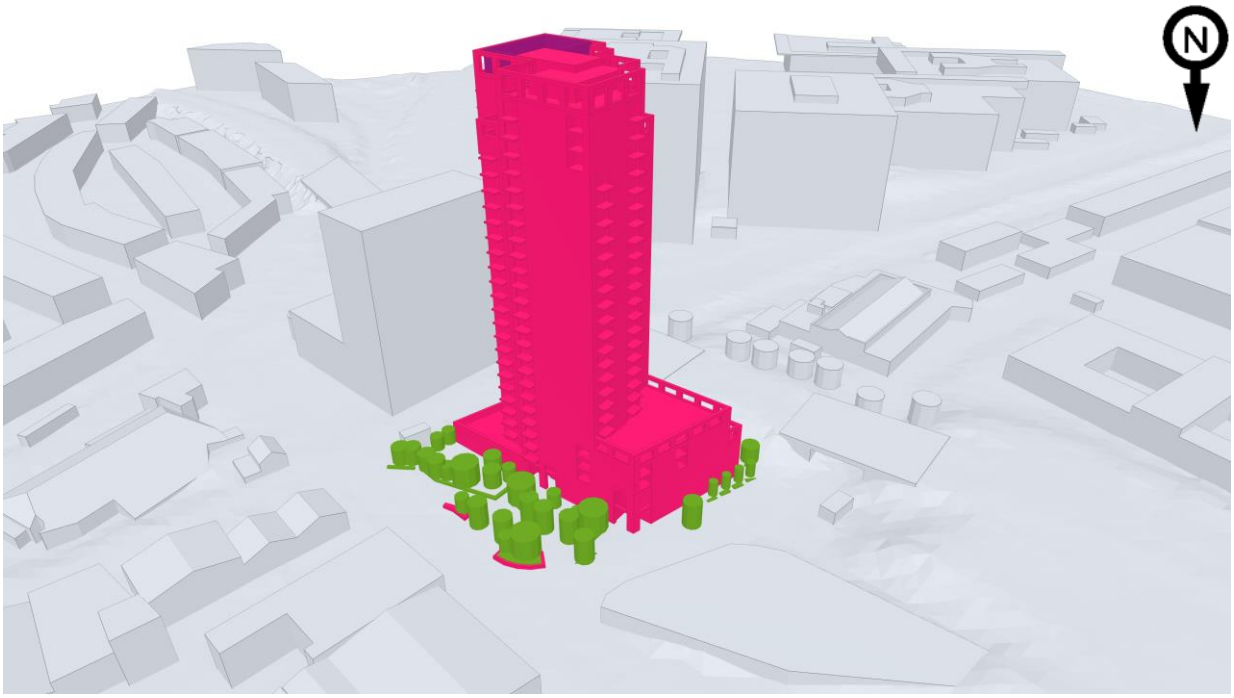


Figure 29 – Proposed Development with Existing Surrounding Buildings, Existing and Proposed Landscaping 3D model used for Computational Fluid Dynamic simulations (view from the north)

APPENDIX B: MITIGATION

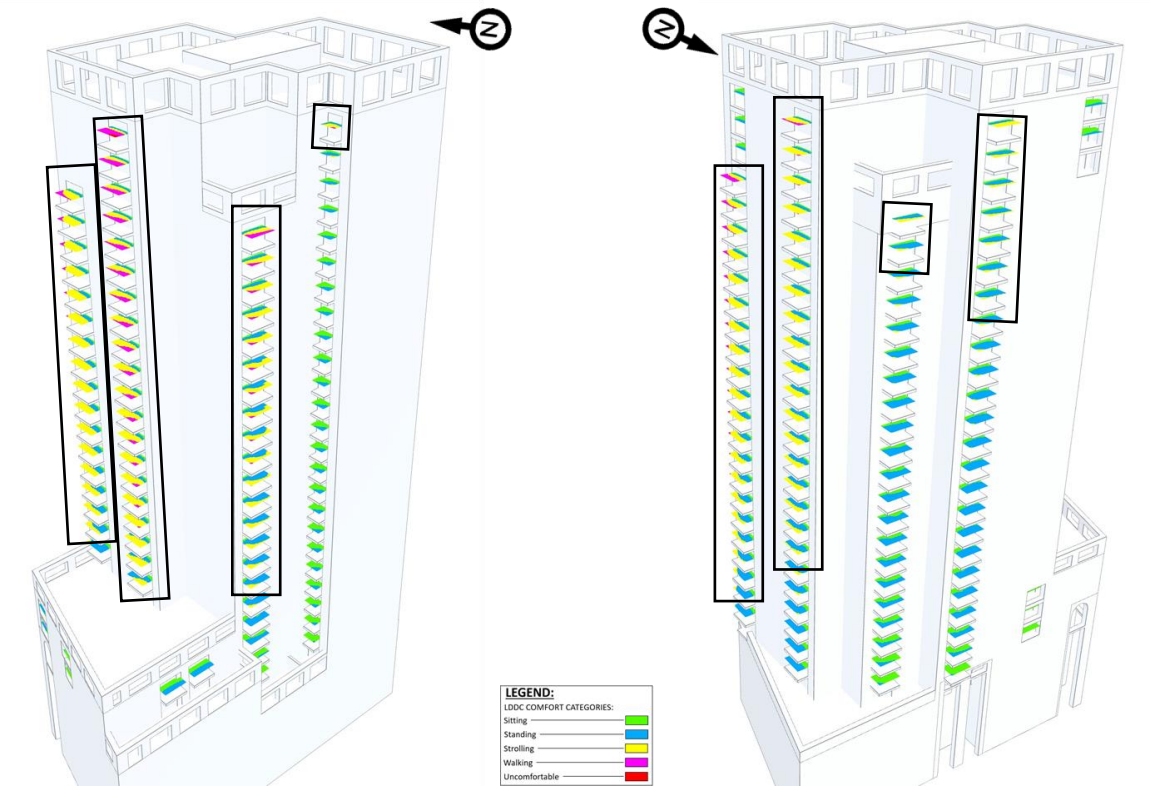


Figure 30 – Markup of balconies that required mitigation in Configurations 2 and 3 (highlighted in black, note mitigation was tested in Configuration 4)

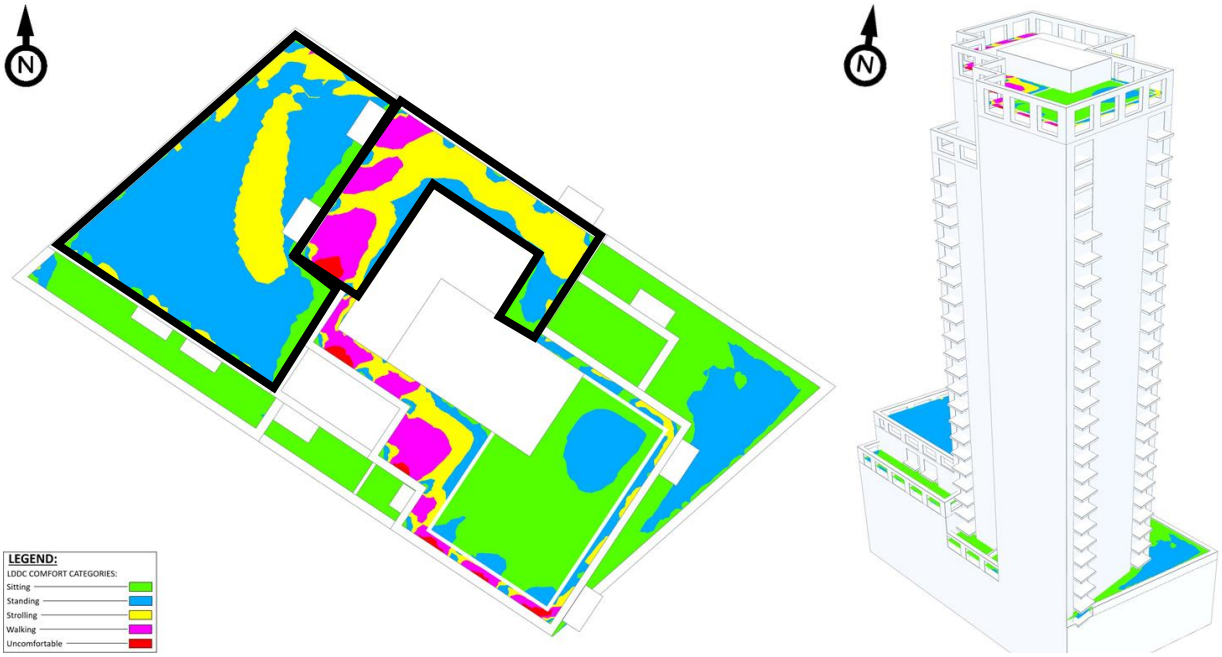


Figure 31 – Markup of terraces that required mitigation in Configurations 2 and 3 (highlighted in black, note mitigation was tested in Configuration 4)

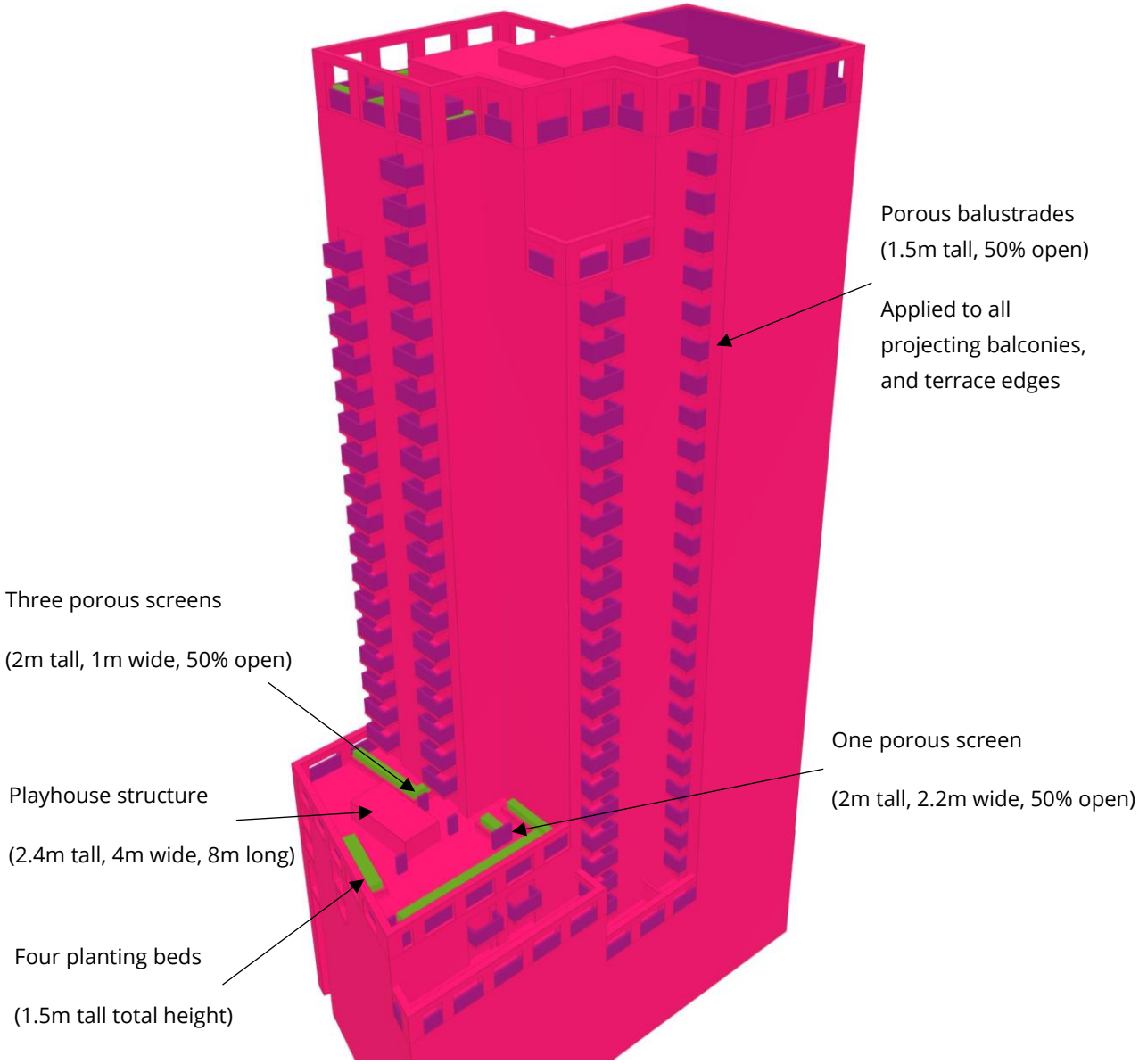


Figure 32 – Mitigation Markup (tested in Configuration 4)

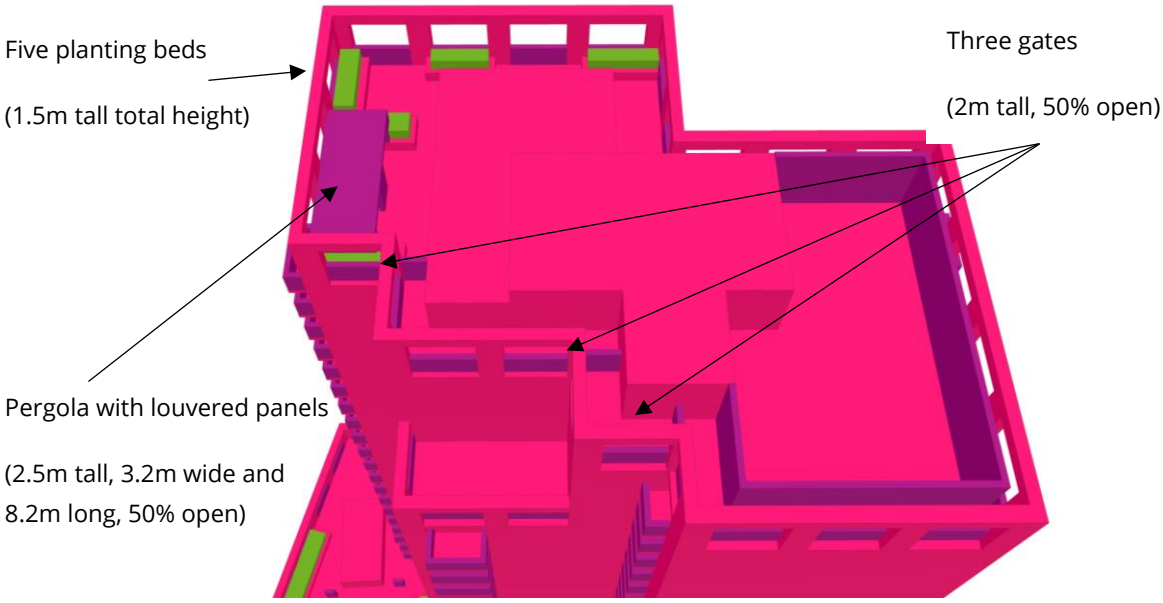


Figure 33 – Mitigation Markup (tested in Configuration 4)

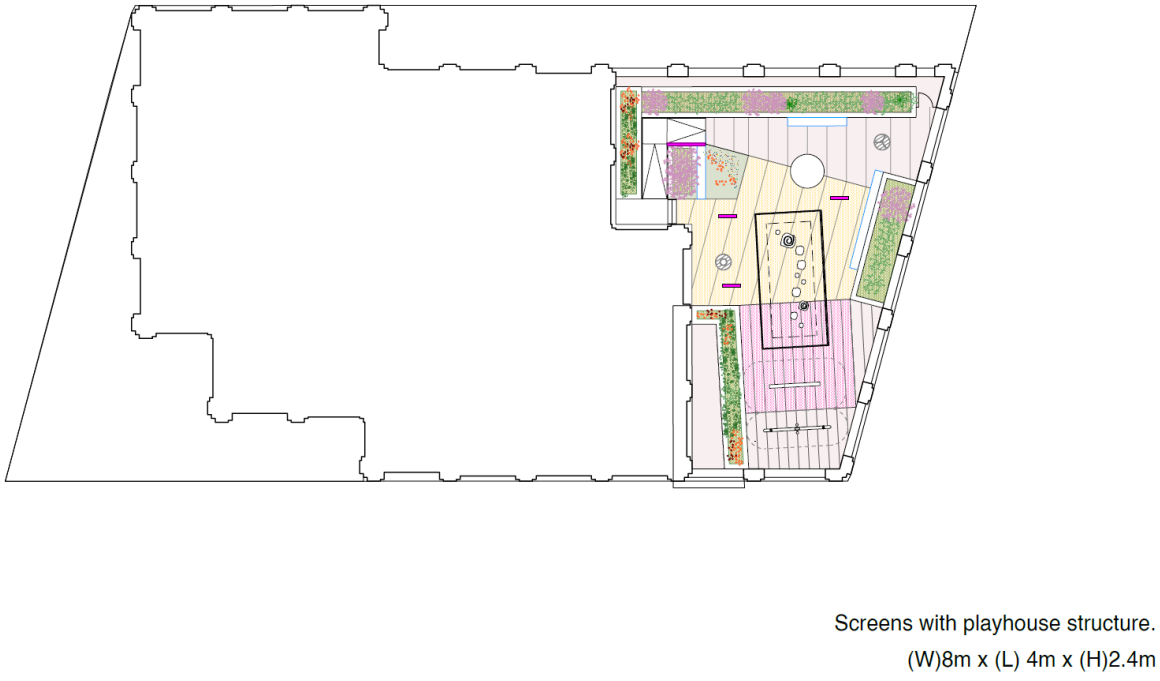
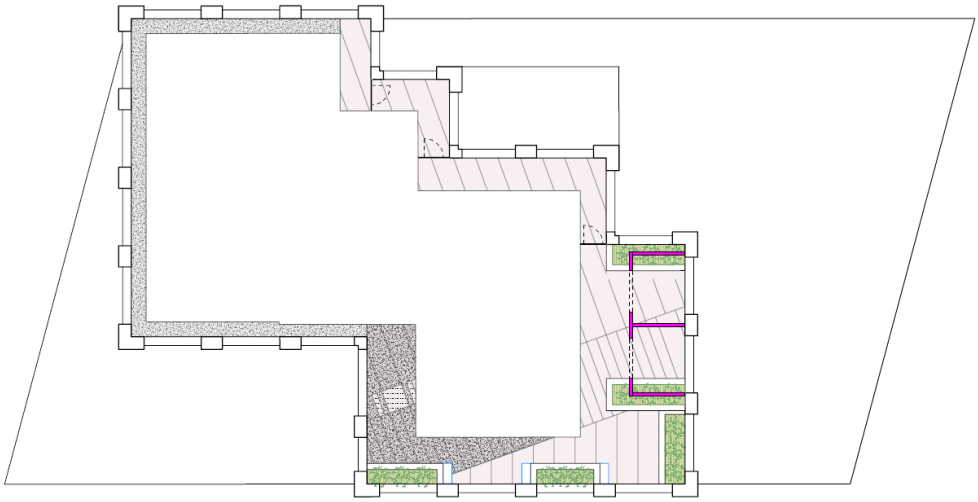


Figure 34 – 4th level terrace Landscape Plan (file titled '252 Bollo Lane - Plot 3A Wind Mitigation Measures 261023', by East)



Pergola Structure with planting / louvred panels
(W)3.2m x (L)8.2m x (H)2.5m

Figure 35 – Upper roof level terrace Landscape Plan (file titled '252 Bollo Lane - Plot 3A Wind Mitigation Measures 261023', by East)

Figure 36 – Markup of seating areas in areas with standing conditions (windier than suitable), to be moved or removed