INTRODUCTION

Hydrock has been appointed by Rhondda Cynon Taf County Borough Council to provide planning and design stage building services and engineering consultancy for the Taff Vale Redevelopment situated in Pontypridd.

Purpose of Report

This document has been produced to inform the design team of the results of an assessment into the proposed development and its potential impact on wind speed and microclimate in the immediate surroundings.

The assessment has been carried out in accordance with the guidelines and recommendations contained in BRE Digest (DG) 520, Wind Microclimate Around Buildings (BRE, 2011).

The following has been undertaken:

▪ Building (proposed and adjacent existing development massing) has been modelled using IES Virtual Environment.
▪ Computational Fluid Dynamics (CFD) software has been used to assess the local wind environment using benchmark (representative conditions).
▪ Suitable microclimate weather conditions have been determined based on historic weather data. Criteria and scenarios based on representative climatic conditions (winter, summer, storm).
▪ The impact of the proposed development massing on the local wind environment has been determined.
▪ Potential receptors (risk areas) for assessment have been developed through review of external amenity areas.
▪ Occupant and pedestrian comfort conditions have been reviewed in accordance with BRE guidelines.
▪ The wind environment has been assessed using Lawson comfort criteria.
▪ Potential mitigation strategies for any building related discomfort conditions (where necessary) have been explored.

Project Description

The proposed new development will consist of three buildings, a shared basement and associated public realm works. A brief description of each building is provided below:

Building A - A proposed 5 storey (ground to 4th floor) office building with roof top plant area.
A small restaurant space is proposed at the eastern end of the building at ground floor.

Building B - A proposed 5 storey (ground to 4th floor) office building with roof top plant area.
A small café / restaurant will be provided at the western end of the building at ground floor.

Building C - A proposed 3 storey (ground to 2nd floor) mixed use building with RCTCBC ‘one for all’ space and cafés at ground floor, a public library at ground and first floor (with double height section at first floor) and a public gym at first and second floor (consisting of a fitness suite, spin room and changing facilities).

Basement - A shared basement spanning the length of Buildings A, B and C will be provided for parking, storage and plant areas. The basement will be inaccessible to the public. The majority of the parking will be provided for use of the Building A tenant, with limited disabled parking provided for staff of Buildings B and C.

Public Realm - The scheme proposes two new streets running perpendicular to Taff Street and a new public riverside ‘plateau’ between Taff Street and the Gas Road car park. Another pedestrian connection is proposed to Bridge Street. The new streets shall be high quality public spaces for access and general amenity.
The software used for the analysis is Virtual Environment (VE) 2016 developed by Integrated Environmental Solutions (IES) Limited. IES is recognised as a world leader in 3D performance analysis software that is used to design energy efficient buildings. The software is supported by integrated consulting services as well as research and development teams. Among the main capabilities, it can identify best passive solutions, compare low-carbon technologies, draw conclusions on energy use, CO$_2$ emissions, occupant comfort, light levels, airflow, Part L, BREEAM, LEED and EPC ratings.

The IES VE module used for the computational fluid dynamics (CFD) analysis is Microflo:
- It is based on ‘Finite Volume Method’ of discretisation of the partial differential equations that describe the fluid flow.
- The calculation uses steady state three-dimensional convection-heat transfer and flow model.
- The algorithm is used to achieve the coupling between pressure and velocity fields.
- Turbulence models are available. Non-linear eddy viscosity model has been utilised.
- Uses wall functions to calculate near-wall properties of turbulence as well as flux of heat and momentum.
- Features a structured non-uniform cartesian grid.

The external CFD simulation allows for analysis of flow over the buildings. This type of simulation is isothermal in nature and does not allow for modelling of heat transfer. This simulation is purely a flow only simulation. Inputs include direction of wind, wind speed and size of domain. A number of assumptions have been made during the modelling process:
- All external openings such as windows and doors are assumed to be closed, there is no interaction between internal and external air.
- Wind speed and direction are attributed by the user based on wind analysis data. Microflo does not read any weather data or use a weather file.
- The development has been modelled in a “suburban” environment, which is defined as “urban and suburban areas, wood areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.”
- For this assessment, no internal geometry has been modelled as this has no relevance for the wind speed assessment.
- The model constraints are as follows:
  - Default grid spacing: 5m
  - Grid line merge tolerance: 1m
  - Domain extents: upwind 150m, downwind 350m, side 150m.

It is important to note that as with any modelling exercise there are assumptions and approximations that have to be made. As far as possible, details of all assumptions made, and approximations used are supplied as part of the report. These should be read carefully. All results are based on the output from computer modelling software and should be taken as an indication of the likely final situation, but these conditions cannot be guaranteed.

Model Geometry
Model geometry is based on the Architect’s plans and 3D model.

Existing buildings have been determined based on the site plan and relevant building information sourced from Architect’s model, maps, elevations and online mapping tools.

Key building topography and terrain are included which will have an impact on the site wind environment.
Taff Vale Redevelopment
Wind Microclimate Assessment

WIND DATASET

The wind speed and direction throughout the year has been calculated based on historic weather data from nearby weather stations.

Weather data is taken from Meteonorm software. This contains worldwide weather data from over 8,000 weather stations, geostationary satellites and other sources and uses interpolation models to deliver global location data on the following information:
- Irradiation;
- Temperature; and
- Wind environment.

The dataset is based on averages taken from 2000 – 2009.

The dataset also makes allowance for future climate change scenarios; these have not currently been assessed, although storm conditions have been modelled to determine potential impacts (albeit without determination of occurrence probability).

The following location coordinates were used:
- Latitude: 51.604436
- Longitude: -3.3393820

The terrain situation category chosen was ‘Open’ (‘City’ classification is only appropriate for towns and cities larger than 100,000 inhabitants).

The former Department for Energy and Climate Change (DECC) Wind Speed Database has also been reviewed. The following figures were obtained:

<table>
<thead>
<tr>
<th>Height above ground (m)</th>
<th>Wind speed (m/s) (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2.4 (5.4)</td>
</tr>
<tr>
<td>25</td>
<td>3.2 (7.2)</td>
</tr>
<tr>
<td>45</td>
<td>3.9 (8.7)</td>
</tr>
</tbody>
</table>

Table 1 – Average wind speed

Figure 5 - Local weather stations and interpolation position

Figure 6 - Physical terrain (Rhondda Cynon Taff)
Taff Vale Redevelopment
Wind Microclimate Assessment

**WIND OCCURRENCES**

The wind rose for the development is shown in Figure 7. The prevailing winds for the site are westerlies, north-westerlies, south-westerlies, and southerlies with a wind speed of between 3–6 m/s. The site will also experience colder northerlies during the winter.

![Wind rose diagram](image)

**Figure 7 - Wind rose for the Taff Vale development (metonorm)**

<table>
<thead>
<tr>
<th>Wind Speed (m/s)</th>
<th>Occurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 4 m/s</td>
<td>47%</td>
</tr>
<tr>
<td>4 – 6 m/s</td>
<td>26%</td>
</tr>
<tr>
<td>6 – 8 m/s</td>
<td>16%</td>
</tr>
<tr>
<td>8 – 10 m/s</td>
<td>7%</td>
</tr>
<tr>
<td>10 – 15 m/s</td>
<td>4%</td>
</tr>
<tr>
<td>&gt;15</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 2 – Average wind speed occurrences

<table>
<thead>
<tr>
<th>Wind Direction</th>
<th>Occurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-E</td>
<td>10%</td>
</tr>
<tr>
<td>E-S</td>
<td>24%</td>
</tr>
<tr>
<td>S-W</td>
<td>36%</td>
</tr>
<tr>
<td>W-N</td>
<td>31%</td>
</tr>
</tbody>
</table>

Table 4 – Wind directions (summary)
Taff Vale Redevelopment
Wind Microclimate Assessment

Revision: P0
Issue Date: 10/05/17

POTENTIAL RECEPTORS

A number of potential receptors have been identified for the Taff Vale development. These relate to potential risk areas for elevated wind speed or building massing wind effects.

The positions analysed are as follows:

- **Amenity areas (ground level, roof level, balconies)** – these have been selected as areas likely to be utilised for leisure purposes and as such should be comfortable surroundings, in particular for warmer months.
- **Pedestrian routes and seating areas** – to determine if locations are comfortable for dining and leisure activities.
- **Entrance to the buildings** – to determine if there is potential for pressure related issues for entrances or lobbies.
- **Landscaped areas** – where there are seating or other sheltered areas.
- **Impact to existing or adjoining developments** – where the proposed buildings will cause discomfort conditions through proximity related issues.

The receptor location analysed have been numbered as follows:

1. Soft landscaping (new)
2. External seating areas for café
3. Pedestrian routes around building
4. Urban landscaping and seating (including open air market)
5. Existing surrounding pedestrian routes
6. Possible rooftop terrace area to Block B

Figure 8 - Potential receptors
Taff Vale Redevelopment

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BASELINE WIND ENVIRONMENT

South westerly wind 4.2 m/s

A pedestrian comfort analysis on the baseline has been evaluated in order to verify the current wind distribution across the site. The results will be compared with the proposed development to determine the impact on the site.

The following analysis shows that for the typical day (pre development condition) in which wind is blowing at 4.2 m/s the velocity of the air at 1.5 m above the ground level is between 0.5 – 1.5 m/s. All the receptors are within the LCC comfort range A, suitable for sitting and standing in long exposure to wind.

Figure 9: Ground floor level
THE EFFECT OF BUILDINGS

The wind flow around buildings can have a major impact on pedestrian comfort and safety. A pleasant (and safe) pedestrian-level wind environment is a crucial requirement of good building design.

The pedestrian-level wind environment is governed by the layout and massing of buildings. Tall buildings can cause strong downward currents of air and are a major cause of wind problems at pedestrian level.

Downwash

When the wind strikes the front face of a building, it will produce positive pressures that reach maximum value at a point between about two thirds and three-quarters of the building height. Below this height the wind will tend to be deflected down the front face towards the ground, often called 'downwash', and accelerated around the corners at ground level producing areas of high wind speed and strong negative pressure. Above this height the wind will be deflected upwards and accelerated over the roof, again causing areas of high wind speed and increased turbulence.

Building A has a large flanking face that could potentially present a risk during high instances of southerly (perpendicular) wind conditions, however, these are generally during summer months when wind speeds are less. In addition, the building form includes articulation on this façade that will reduce downwash. This will be reviewed in the CFD model.

Building Wake

Downwind, the flows around the building will recombine into a region of negative pressure known as the ‘wake’. This will persist for between about six and 10 times the building height before the original flow patterns are re-established. The larger the building, the larger the volume of air that must be displaced, and the larger the potential ground-level wind speeds.

Tall, isolated slab-sided buildings adjacent to large open spaces and wide streets will tend to produce high wind speeds at pedestrian level, whereas similar-height buildings separated by narrow streets will tend to give rise to fairly sheltered conditions at ground level. Buildings A, B and C while being larger than their neighbours are not sufficiently isolated or of different scale to present a high risk in terms of transverse wake flow. This would be more pronounced where they in isolated rural environment.
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Terrain

Terrain has a strong influence on local wind speed.

![Variation of mean wind speed with height over terrain](image)

The site can be considered suburban. This has been modelled in IES. Local topography includes the River Taff to the south.

Building Height

As described above, wind speed increases with height above ground. However, not all tall buildings cause wind problems; what is important is the relative height of the building compared with that of neighbouring buildings. In line with BRE guidelines a check has been carried out to determine if the buildings present a high risk due to height differential. Building A, B and C all pass this test.

A separate check of the potential roof terrace on Building B (Receptor 6) will also be carried out in CFD to determine wind speed and comfort conditions if this area is used by occupants.

Passageways

Where passageways or tunnels pass beneath a building at ground level, this will frequently be a source of wind problems because there is a direct path from the positive pressure on the windward face to the low-pressure region in the wake.

Such features are often best avoided unless they are intended for vehicular access only, as is the case for Taff Vale.

Building Form

In general, tall, rectangular, sharp-edged buildings will generate the highest local ground-level wind speeds and the largest ‘footprint’ area of unpleasant wind speeds. Where such buildings are unavoidable, they should be orientated so that their long axis is aligned with the prevailing wind direction in order to minimise their impact on the surrounding area. This is the case for Taff Vale (Buildings A and B), where the prevailing winds are south-westers and westerlies.

The extent of this footprint depends on the building dimensions. Circular or multi-faceted buildings (such as Building C) provide a more aerodynamic profile to the wind so tend to cause less downwash because more air is spilled around the sides. Building C’s geometry will actually be beneficial during winter storm conditions as downwash risk, corner stream and other detrimental effects will be reduced. This type of plan form can still generate high local wind speeds at their base, although the footprint area of unpleasant winds tends to be smaller than for an equivalent rectangular tower and the location of the highest wind speeds tends to move further downwind. This will be explored in the CFD analysis.

Funneling

Wind funneling and flow acceleration can occur where there are gaps between buildings. The effect is stronger where the axes of the buildings make an angle of 90° or less. This is not the case for Taff Vale, although cross winds may still cause issues due to the relatively high breadth of the adjacent buildings and building heights adjacent to the gap (funnel gap meets check criteria in BRE guidelines, i.e. further testing required). This will be explored in the CFD model.
Street Canyons and Geometry

The optimum height-to-width (h/w) ratio for ideal wind comfort is approximately 0.65. As h/w increases, the pedestrian-level wind speeds are likely to reduce but this can have a detrimental effect on other environmental factors such as pollution and heat build-up, which increase as streets become narrower. At the other extreme, very wide streets with h/w < 0.3 will not benefit from wind shelter and are likely to be quite exposed.

- Canyon A-B h/w = 1.22 (PASS)
- Canyon B-C h/w = 1.48 (PASS)

However, street design cannot be based just on the consideration of wind microclimate; other factors such as sunlight, convective cooling and pollution dispersal all have to be considered. Street layout will therefore be a compromise. Table 5 shows these other design aspects. Wind comfort is in line with guidelines, generally all other design criteria exceeds the guidelines although the canyon length is relatively low.

In city centres with buildings of irregular heights interspersed with high-rise buildings, the requirement to maintain a safe and pleasant wind environment becomes more crucial because of the potential for increased wind speeds. Long street canyons should not be aligned with the prevailing wind direction, which in the UK is generally south-west. While the canyons are aligned with this direction, they are sheltered from other buildings to the north (existing).

<table>
<thead>
<tr>
<th>Aspect of design</th>
<th>Optimum</th>
<th>Good</th>
<th>Undesirable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind comfort</td>
<td>&gt;0.65</td>
<td>&gt;0.4</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>Pollution dispersal</td>
<td>&lt;0.3</td>
<td>&lt;0.65</td>
<td>&gt;1.0</td>
</tr>
<tr>
<td>Solar radiation</td>
<td>&lt;0.3-0.4</td>
<td>&lt;0.5</td>
<td>&gt;0.5</td>
</tr>
<tr>
<td>Sense of enclosure</td>
<td>0.4-0.5</td>
<td>0.33-0.67</td>
<td>&lt;0.3 or &gt;1.0</td>
</tr>
<tr>
<td>Convective cooling</td>
<td>0.4-0.6</td>
<td>&lt;0.65</td>
<td>&gt;0.65</td>
</tr>
<tr>
<td>Best compromise</td>
<td>0.4-0.5</td>
<td>0.3-0.65</td>
<td>&lt;0.3 or &gt;1.0</td>
</tr>
</tbody>
</table>

Table 5 – Summary of factor for urban street design

Entrances

Entrances should ideally be positioned at less windy locations around the building and away from corners. This will be reviewed in the CFD model.
## Taff Vale Redevelopment
### Wind Microclimate Assessment

**Revision:** P0  
**Issue Date:** 10/05/17

### Summary Design Checks

<table>
<thead>
<tr>
<th>Design guidance</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid large flanking walls facing the prevailing wind</td>
<td>Prevailing winds are westerlies. Building orientated east west.</td>
</tr>
<tr>
<td>Orientate the long axis parallel to the prevailing wind</td>
<td>Prevailing winds are westerlies. Building orientated east west.</td>
</tr>
<tr>
<td>Avoid funnel like gaps between buildings</td>
<td>While canyons are present, these are not of a scale to warrant</td>
</tr>
<tr>
<td>Use podiums to prevent downwash reaching ground level</td>
<td>Podium not present. This will be explored in the CFD model.</td>
</tr>
<tr>
<td>Avoid large cubical buildings with plain facades</td>
<td>Facades include articulation in the form of window reveals. There is further articulation on the leading edge exposed south westerly façade of Block A that will bear the most windward forces.</td>
</tr>
<tr>
<td>Avoid passageways beneath buildings at ground level</td>
<td>Passageway only present for car park at basement level.</td>
</tr>
<tr>
<td>Group buildings to minimise height differential</td>
<td>Height differential in line with guidelines.</td>
</tr>
<tr>
<td>Avoid issues related to transverse wake flow</td>
<td>This will be explored in the CFD model.</td>
</tr>
</tbody>
</table>

**Summary Risk Areas**

The following will be reviewed in detail as part of the CFD modelling:

- **Downwash** risk to Building A resulting from southerlies (Receptor 2).
- **Building wake** affecting pedestrian routes and amenity areas (Receptors 2 and 3) around perimeter.
- **Building height** test of potential rooftop terrace area on Building B (Receptor 6).
- **Building form** pressure related impacts on windward and leeward face of Building A resulting from south westerlies (Receptor 4).
- **Funnelling** risk between buildings resulting from high westerlies (Receptor 4).
- ** Entrances** located at south west corner of Building A (facing prevailing winds).
LAWSON COMFORT CRITERIA ASSESSMENT

Wind conditions in the built environment can impact upon the comfort and wellbeing of site occupants. While there are no all-encompassing criteria that can be used to assess pedestrian comfort, the most widely accepted criteria in the UK is the Lawson Comfort Criteria, also referenced by the BRE in wind speed guidelines.

This is a well-established benchmark assessment that is used to assess the suitability of wind conditions in the urban environment based on a number of threshold values of wind speed and frequency defined against a range of pedestrian activities.

If the wind conditions at the site exceed the threshold value, then the conditions can be considered unacceptable for the designated activity.

The Lawson Comfort Criteria and associated Beaufort Force (measure of wind speed and conditions) are shown in the following tables.

The tables can be used to assess whether or not wind speed will have a negative impact or not. For example, if the wind speed exceeds Beaufort Force 3 (B3) for more than 1% of the time, it will be unsuitable for sitting out for long periods.

The Assessment

The development has been assessed against the thresholds set within the Lawson Comfort Criteria detailed above.

It should be noted that the wind speed data used is representative only, as it is based on average weather data. For a truly accurate profile on the site, wind speed measurements would need to be taken over a yearly period.

The results shown on the following page are based on CFD analysis for wind speed from four different wind directions. These have been adjusted to take into account the variation in wind speed and wind direction throughout the year.
**Taff Vale Redevelopment**

**Wind Microclimate Assessment**

**PEDESTRAIN COMFORT RESULTS**

**Overview**

The wind speed across the year was tested using IES MicroFlo, to gain a sense of how the wind environment varies a number of wind directions and speeds were tested. This was based on the information taken from the wind rose for the site.

For each receptor the wind environment has been classified as one of the following:

- Unacceptable – unpleasant conditions for a given activity, which should not normally be allowed to occur;
- Tolerable – Conditions that would be described as ‘windy’, but which would be tolerated for the given activity;
- Acceptable – Conditions that will elicit no adverse comments about the wind.

The results for each receptor are shown in Table 6. These results take into account the variation of wind speed and direction throughout the year at the site. Details of the site wind conditions can be found in Tables 2 and 3.

**Observations**

Throughout the year, the receptor locations have either an acceptable, or tolerable wind environment and fall within the Lawson Comfort Criteria classification for their intended use.

**Receptor 2 – Café Seating Area**

The wind environment for the café external seating area is tolerable and is meeting the required wind speed for long term sitting for 89% of the year. The days of the year when the wind speed is above the recommended value for long-term sitting are days in which the wind speed at the site is circa 10 m/s (22mph). This is moderately windy and is not the typical wind speed for the site.

**Receptor 4 – Urban Landscaped Area**

Receptor 4, the urban landscaped area between Block A and B, is performing within the acceptability criteria for long-term sitting with only minor wind funneling occurring. The impact of this funneling is not sufficient enough to create an unsuitable wind environment. The majority of the areas between the blocks are benefits from a degree of sheltering from all wind directions with the exception of easterlies. Easterly winds only typically occur for 10% of the year, so this is not deemed to be a significant issue.

**Receptor 5 and 3 – Pedestrian Routes**

The existing pedestrian routes (receptor 5) will not experience any negative impact from the proposed development. The new pedestrian routes (receptor 3) surrounding the building are acceptable for their use and in almost all cases will be sheltered from the wind by either the building itself or the existing buildings surrounding the site.

**Receptor 1 – Soft Landscaping**

The area of soft landscaping is not experiencing any adverse wind effects caused by the development. Throughout the year, the wind speed in this area is acceptable for its intended use.

**Effects of Downwash**

Any downwash caused by the façade of Building A is only prevalent during southerly winds at high wind speeds of above 12 m/s. At this wind speed, there is some downwash created with wind being directed down towards the ground at between 4-5 m/s. At lower wind speeds the downwash effect is minimal. This is not sufficient enough to create an adverse pedestrian wind environment and is not deemed to be significant.

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### PEDESTRAIN COMFORT RESULTS

<table>
<thead>
<tr>
<th>Receptor Location</th>
<th>LCC Activity</th>
<th>Resultant Wind Speed</th>
<th>Percentage of Time Exceeding LCC Criteria</th>
<th>Acceptability Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Soft Landscaping</td>
<td>Pedestrian strolling, slow walking</td>
<td>1.4 – 5.0 m/s</td>
<td>1%</td>
<td>Acceptable</td>
</tr>
<tr>
<td>2 – Cafe seating area</td>
<td>Long-term sitting</td>
<td>1.8 – 6.5 m/s</td>
<td>11%</td>
<td>Tolerable</td>
</tr>
<tr>
<td>3 – Pedestrian routes surrounding building</td>
<td>Pedestrian strolling, slow walking</td>
<td>1.2 – 4.5 m/s</td>
<td>1%</td>
<td>Acceptable</td>
</tr>
<tr>
<td>4 – Urban landscaping and seating</td>
<td>Long-term sitting</td>
<td>1.8 – 5.5 m/s</td>
<td>4%</td>
<td>Acceptable</td>
</tr>
<tr>
<td>5 – Existing pedestrian routes</td>
<td>Business walking from A to B</td>
<td>1.6 – 4.3 m/s</td>
<td>0%</td>
<td>Acceptable</td>
</tr>
<tr>
<td>6 – Roof terrace</td>
<td>Long-term sitting</td>
<td>2 – 6.5 m/s</td>
<td>11%</td>
<td>Tolerable</td>
</tr>
</tbody>
</table>

| Table 9 - LCC results for each receptor |

**Building Entrances**

For the majority of the wind speed at building entrances will fall within the LCC criteria. However, during moderately southerly wind events (above 8 m/s) the wind speed in these areas is anticipated to be between 6 – 9 m/s. These conditions building occupants may notice an increase in wind speed in these areas. This is caused by the southerly wind being deflected around the building as there is little sheltering in this direction.

In all other wind directions the entrances are sheltered from existing nearby buildings and the development itself, creating a pleasant wind environment.
Wind Speed Plots

The distribution and wind speed for a sample day is shown below. It should be noted that these images show instances in time deemed to be representative of the average conditions at the site based on the site-specific data shown in Table 2 and 3.

The graphics shown opposite are for a typical day with a southwest wind speed of 4 m/s, and a stormy day at 15 m/s.

Detailed images for each wind direction and wind speed modelled are given in Appendix A.
SUMMARY AND CONCLUSIONS

This report has provided an assessment of the pedestrian wind environment for the Taff Vale redevelopment.

To assess wind speed at the site a number of potentially sensitive receptor locations were identified as follows:

1. Soft landscaping
2. Café seating area
3. Pedestrian routes surrounding the building
4. Urban landscaping and seating area
5. Existing pedestrian routes
6. Roof terrace.

The anticipated wind environment at each receptor location was calculated using IES MicroFlo using site specific wind speed and direction data.

The acceptability of wind speed for each receptor has been determined using the Lawson Comfort Criteria for pedestrian wind environment. All receptors were found to have an acceptable or tolerable wind environment for their intended use. This means that there is unlikely to be any significant occupant comfort issues throughout the year. The summary table shows the results in terms of Lawson Comfort Classification for each receptor point.

In summer the south westerly or westerly wind does not introduce any occupant discomfort within the new development site. Most of the receptors at ground level are within the comfort range A and B. At the roof terrace (4th floor), higher wind speed has been evaluated however this is generally within comfort ranges.

Under higher wind velocity conditions, this can be perceived positively as it helps to calibrate the human thermal balance and allow for latent heat transfer cooling effects (through perspiration).

During infrequent storm events, higher wind speeds will be experienced at receptors. This is not deemed to be a significant issue as the wind speed overtakes 10 m/s for 1% of the year, and it is likely that this occurrence will be in the context of the windiest days.

<table>
<thead>
<tr>
<th>Receptor Location</th>
<th>LCC Activity</th>
<th>Acceptability Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Soft landscaping</td>
<td>Pedestrian strolling, slow walking</td>
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</tr>
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<td>Long-term sitting</td>
<td>Tolerable</td>
</tr>
<tr>
<td>3 – Pedestrian routes surrounding building</td>
<td>Pedestrian strolling, slow walking</td>
<td>Acceptable</td>
</tr>
<tr>
<td>4 – Urban landscaping and seating</td>
<td>Long-term sitting</td>
<td>Acceptable</td>
</tr>
<tr>
<td>5 – Existing pedestrian routes</td>
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</tr>
<tr>
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<td>Long-term sitting</td>
<td>Tolerable</td>
</tr>
</tbody>
</table>

Table 10 - LCC results for each receptor
## APPENDIX A – DETAILED WIND MODELLING RESULTS

### Westerly Winds (prevailing wind direction)

<table>
<thead>
<tr>
<th>Receptor Location</th>
<th>4 m/s</th>
<th>6 m/s</th>
<th>8 m/s</th>
<th>10 m/s</th>
<th>15 m/s</th>
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<td>1 – Soft Landscaping</td>
<td>1.9</td>
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<td>3.6</td>
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</tr>
<tr>
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</tbody>
</table>

Table 1.1 – Resultant receptor wind speed

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#### Figure 25
Building downwash for southerly wind at 8 m/s

#### Figure 26
Westerly wind at 4m/s ground floor (top) and roof (bottom)

#### Figure 27
Wind speed vectors (4m/s)
Figure 28 - Ground floor (top) and roof (bottom) at 15 m/s storm event.

Figure 29 - Ground floor (top) and roof (bottom) at 8 m/s westerly.
Southwesterly Winds

<table>
<thead>
<tr>
<th>Receptor Location</th>
<th>4 m/s</th>
<th>6 m/s</th>
<th>8 m/s</th>
<th>10 m/s</th>
<th>15 m/s</th>
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Table 12 – Resultant receptor wind speed

Figure 31 – Wind speed at the entrances for southwesterly winds of 4 m/s

Figure 30 – Southwesterly wind at 4 m/s on the ground plane (top) and roof (bottom)
Figure 33 - Southwesterly wind at 8m/s on the ground place (top) and roof (bottom).

Figure 32 - Southwesterly wind 8m/s section viewed from the east (top) and west (bottom).
**Northerly Winds**

<table>
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<th>Receptor Location</th>
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Table 13 – Resultant receptor wind speed

**Figure 34** - Northerly wind 4ms ground (top) and roof (bottom)

**Figure 35** - Northerly wind at 4m/s section view
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Figure 36 - Northerly wind at 15m/s storm event ground plane (top) and roof (bottom).

Figure 37 - Northerly wind at 8m/s ground plane (top) and roof (bottom).
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### Southerly Wind

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Table 14 – Resultant receptor wind speed

Figure 38 - Southerly wind at 4m/s, ground plane (top) and roof (bottom)

Figure 39 - Southerly wind speed 4m/s building downwash
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Figure 40 - Southerly wind speed at 8m/s downwash

Figure 41 - Southerly wind at 8m/s on the ground plane (top) and roof terrace (bottom)

Colour | Velocity [m/s]
--- | ---
0.05
0.95
1.86
2.76
3.67
4.57
5.46
6.36
7.29
8.19
9.10
10.00
Taff Vale Redevelopment

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Figure 44 - Southerly wind speed at 15 m/s on the ground plane (top) and roof (bottom)

Figure 42 - Downwash shown on the front facade of Block A at a wind speed of 15 m/s

Figure 43 - Sheltering behind Block A at a speed of 15 m/s
## Taff Vale Redevelopment

### Wind Microclimate Assessment

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### Easterly Winds

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<th>10 m/s</th>
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<td>4 – Urban landscaping and seating</td>
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<tr>
<td>5 – Existing pedestrian routes</td>
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<td>7</td>
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<tr>
<td>6 – Roof terrace</td>
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Table 15 – Resultant receptor wind speed

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**Figure 45** - Easterly winds at 4m/s on the ground plane (top) and roof terrace (bottom)

**Figure 46** - Easterly winds at 4m/s section
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Figure 48 - Easterly wind at 8m/s on the ground place (top) and roof (bottom)

Figure 47 - Easterly wind at 15m/s on the ground place (top) and roof (bottom)