

12 February 2018

610.13932-L03-v0.1 UB4 S96.docx

Meriton Apartments Pty Ltd
Level 11, Meriton Tower
528 Kent Street
SYDNEY NSW 2000

Attention: Ms Norelle Jones

Dear Norelle

**130-150 Bunnerong Road, Pagewood - UB4
Communal Open Space and Roof Terraces – Wind Mitigation**

SLR has previously completed qualitative (Desktop) wind reports covering various elements of the UB4 Project located at Bunnerong Road, Pagewood.

- SLR Report 610.13932.00100-R8 dated 31 January 2017

Current design updates propose the addition of six private apartment terraces (Refer **Figure 4**).

SLR has been commissioned by Karimbla Pty Ltd to quantify wind speeds at the roof private terraces of the development and provide detailed advice on specific wind mitigation options for the terraces and Level 6 communal open space.

Wind speeds within the areas of interest have now been quantified via Computational Fluid Dynamics (CFD) wind modelling.

Our response is contained herein.

If you have any questions please do not hesitate to contact me on 0401 416 274 / (02) 9427 8100 or via email at nal-khalidy@slrconsulting.com.

Yours sincerely



DR Neihad Al-Khalidy
Technical Director– CFD, Wind and Energy
(Call at any time on 0401 416 274)

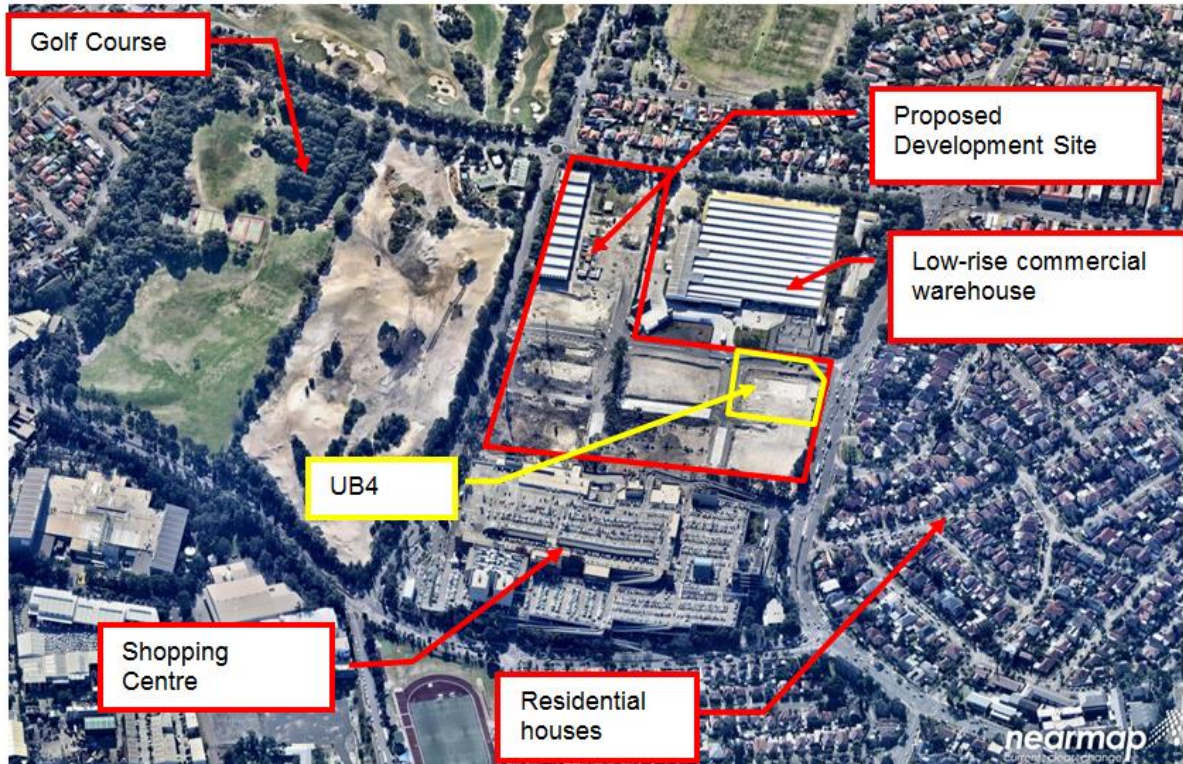
Submission Details
Reviewed by: JC

1 BACKGROUND

SLR has previously prepared a qualitative (Desktop) environmental impact of a proposed development at Urban Block 4 (UB4), 130-150 Bunnerong Road, Pagewood, with regard to the wind environment in and around the development (SLR Report 610.13932.00100-R8 dated 31 January 2017).

The proposed development is bound by Banks Avenue, Heffron Road, Bunnerong Road and Westfield Drive, with UB4 located on the corner Bunnerong Road and Westfield Drive.

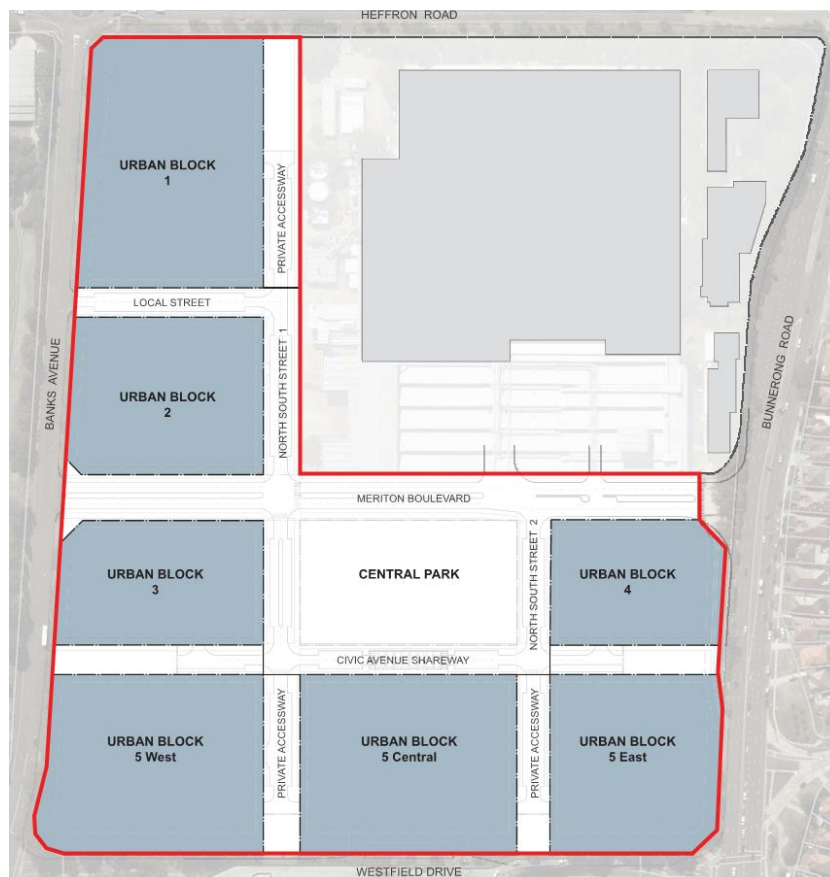
Figure 1 Site Location



To the west and north-west of the proposed development site are golf courses, while the eastern and northern sides consist mostly of low-level residential housing. To the north of the proposed development site is a low-rise commercial warehouse which will provide moderate shielding particularly at street level. The low rise shopping centre to the south will provide some shielding from prevailing southerly winds. Upper levels are generally exposed to all directions.

There are seven blocks with a central park as shown in **Figure 2**.

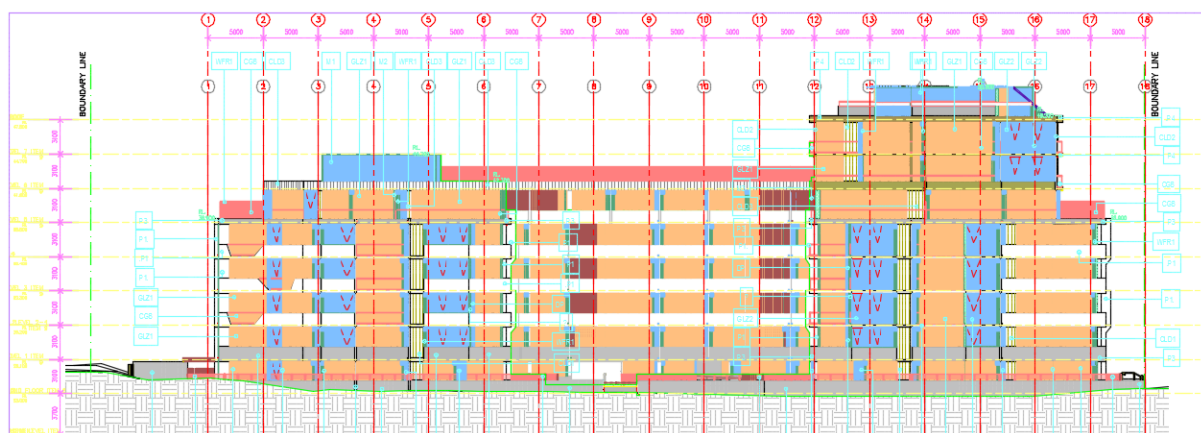
Figure 2 Site layout



UB4 consists of the following:

- 8 levels with residential tenancies on each level;
- Childcare on ground floor;
- 1 level of basement car parking; and
- Outdoor communal areas on ground floor and level 6.

Figure 3 UB4 – North Elevation

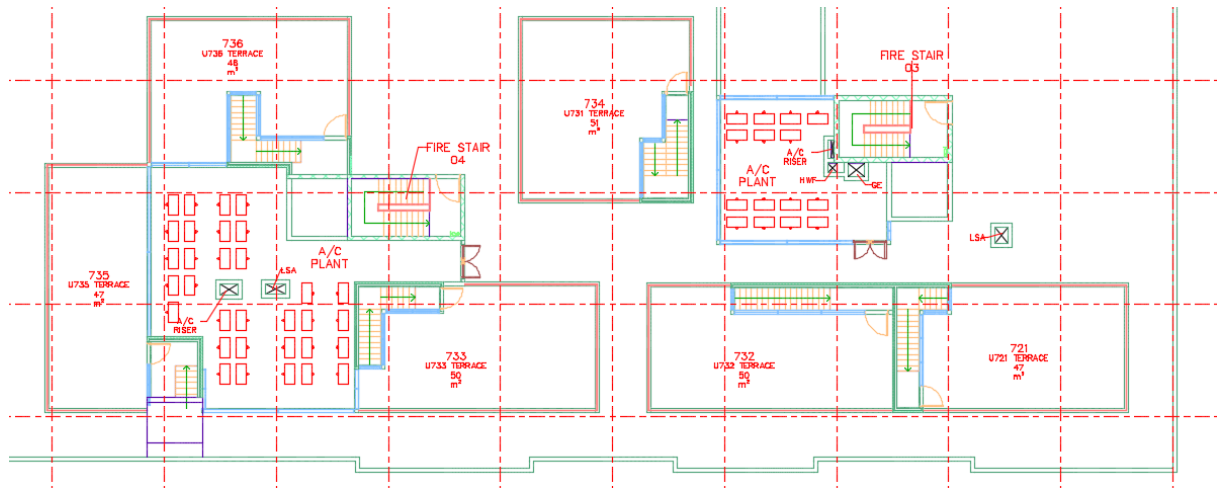


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Wind speeds within the areas of interest have now been quantified via Computational Fluid Dynamics (CFD) wind modelling.

Figure 4 UB4 – Proposed Roof Terraces



2 CFD WIND MODELLING

The wind acceptability criteria provided in **Table 1** have been used for the CFD study.

It should also be emphasised that the criterion listed in **Table 1** are gust wind speeds as opposed to steady mean wind speeds modelled in the current CFD investigation. For a normally distributed process it is reasonable to assume that the peak 2-3 second mean maximum gust may be up to 3.5 standard deviations above the mean. It is therefore reasonable (and usually conservative) to assume that mean winds could be approximately half the magnitude of gust wind speeds given the level of wind turbulence expected at the proposed site.

Table 1 Standard Local Government Wind Acceptability Criteria

Type of Criteria	Limiting Gust Wind Speed Occurring Once Per Year	Activity Concerned
Safety	24 m/s	Knockdown in Isolated Areas
	23 m/s	Knockdown in Public Access Areas
Comfort	16 m/s	Comfortable Walking
	13 m/s	Standing, Waiting, Window Shopping
	10 m/s	Dining in Outdoor Restaurant

2.1 CFD Methodology

The mean wind speed profile used in the CFD Study was determined using the Sydney Region wind rose and the AS 1170.2:2002 wind code. The model was then run with winds from the south, south-east, north-east and west wind directions, noting that southerly and westerly winds are worse case scenarios for Sydney.

The geometry for the CFD modelling is shown in **Figure 5**.

The domain for the CFD modelling covers an area of 4 km² and extends 450 m above the proposed development.

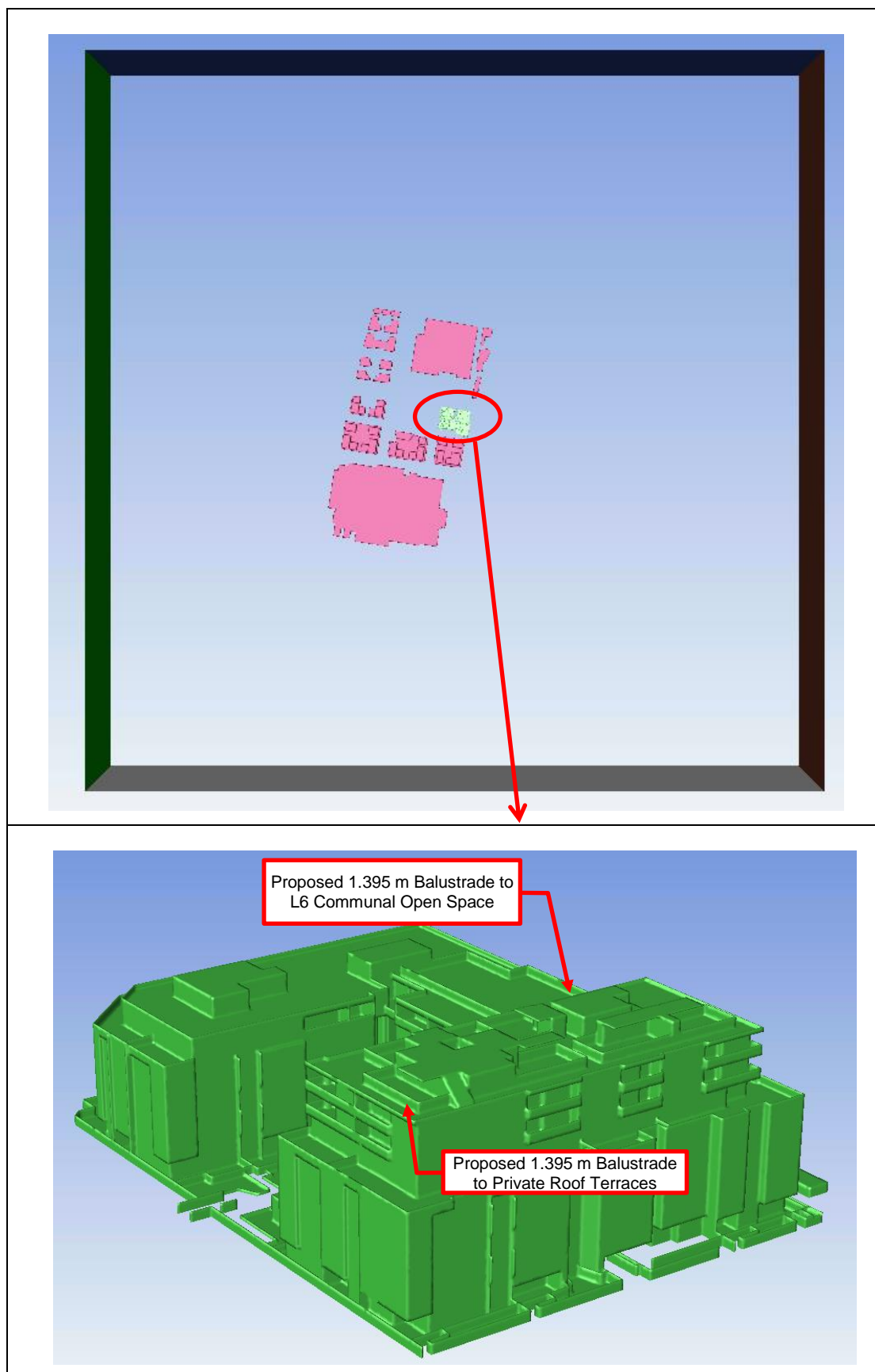
The influence of the immediate surrounding physical environment, all neighbouring buildings and local topography around the proposed development were included in the CFD model as shown in **Figure 5**.

The surrounding buildings and terrain were simplified to reduce computational time. This includes the removal of all trees and vegetation, which means that the model can be considered slightly conservative as the presence of trees and vegetation would typically reduce ground level wind speeds.

The following prevailing wind conditions were modelled:

- West Winds (which provide the strongest winds in the Sydney region)
- Northeast Winds
- South Winds (which also provide strong winds in the Sydney region)
- South East Winds

Figure 5 3D Geometry for CFD Modelling



2.2 CFD Results

2.2.1 West Winds

Figure 6 shows mean wind speeds at 1.5 m above the ground for the wind flowing from the west (Wind Angle = 270°). Mean velocity magnitudes are plotted on a colour coded scale between 0 and 11.5 m/s. Dark blue represents still conditions at 0 m/s and red representing the strongest wind speed. The following conclusions can be reached:

- The CFD model captures the fluid flow characteristics in significant detail (Refer **Figure 6**). Wind approaching the site from the west channels between buildings, accelerated near the edges and stagnated and recirculated behind the buildings.

Figure 7 and **Figure 8** show the mean wind speeds at 1 and 1.5 m above the ground of the communal open space (Level 6) and private roof terraces. The following conclusions can be reached:

- The communal open space receives significant shielding from the development itself (Refer **Figure 7**).
- The roof terraces receive a significant shielding from UB3 and other developments to the west.
- There are no areas predicted to experience winds which may pose an actual hazard to users of the development, ie exceed safety criteria.
- There are no areas predicted to experience wind speeds above the comfort criteria for walking or standing.
- All areas shown in yellow, green and blue are suitable for dining.

2.2.2 North-East Winds

Northeast winds are generally mild and the potential therefore for high wind speeds are likely to be very infrequent.

Figure 9 and **Figure 10** show mean wind speeds for the wind flowing from the northeast (Wind Angle = 45°). The following conclusions can be reached:

- There are no areas predicted to experience winds which may pose an actual hazard to users of the development, ie exceed safety criteria.
- The site has low-level shielding to the north-east from the low-rise residential dwellings and the communal open space may experience wind speeds above the comfort criteria for walking. The maximum predicted mean wind speed is 9.1 (m/s). The corresponding gust is 18.2 m/s hence exceeding the comfort criterion at the scoured area in **Figure 9**.
- There are no areas on the private roof terraces predicted to experience wind speeds above the comfort criteria for walking.
- U735 and U736 private courtyards experience wind speeds above the comfort criteria for standing (Refer **Figure 10B**). The maximum mean wind speed is 7.9 (m/s). The corresponding gust is 15.8 m/s hence exceeding the comfort criterion for standing.
- All areas shown in yellow, green and blue are suitable for dining.

2.2.3 South Winds

Figure 11 and **Figure 12** shows mean wind speeds at areas of interest for the wind flowing from the south (Wind Angle = 180°). The following conclusions can be reached:

- There are no areas predicted to experience winds which may pose an actual hazard to pedestrians, ie exceed safety criteria.

- The Level 6 communal open area has a reduced level of upstream shielding at this level and may experience wind speeds above the comfort criteria for walking. The maximum predicted mean wind speed is 8.8 (m/s). The corresponding gust is 17.6 m/s hence exceeding the walking comfort criterion at the scoured area in **Figure 11B**.
- The roof terraces receive a reasonable shielding from UB5 development to the south. There are no areas predicted to experience wind speeds above the comfort criteria for walking.
- There are no areas on private terraces are predicted to experience wind speeds above the comfort criteria for standing.
- All areas shown in yellow, green and blue are suitable for dining.

2.2.4 South East Winds

Figure 13 and **Figure 14** shows mean wind speeds at 1.5 m above the ground for the wind flowing from the south (Wind Angle =135°). The following conclusions can be reached:

- There are no areas predicted to experience winds which may pose an actual hazard to pedestrians, ie exceed safety criteria.
- The maximum predicted mean wind speed at the roof terrace area is 8.8 (m/s). The corresponding gust is 17.6 m/s hence exceeding the walking comfort criterion at the scoured area in **Figure 13B**.
- There are no areas on private roof terraces areas predicted to experience wind speeds above the comfort criteria for walking.
- U736 private courtyard experiences wind speeds above the comfort criteria for standing (Refer **Figure 14B**). The maximum mean wind speed is 7.3 (m/s). The corresponding gust is 14.6 m/s hence exceeding the comfort criterion for standing.
- There are no areas on other private terraces are predicted to experience wind speeds above the comfort criteria for standing.
- All areas shown in yellow, green and blue are suitable for dining.

Figure 6 Velocity Vectors (m/s) at 1.5 m above the Ground – West Winds

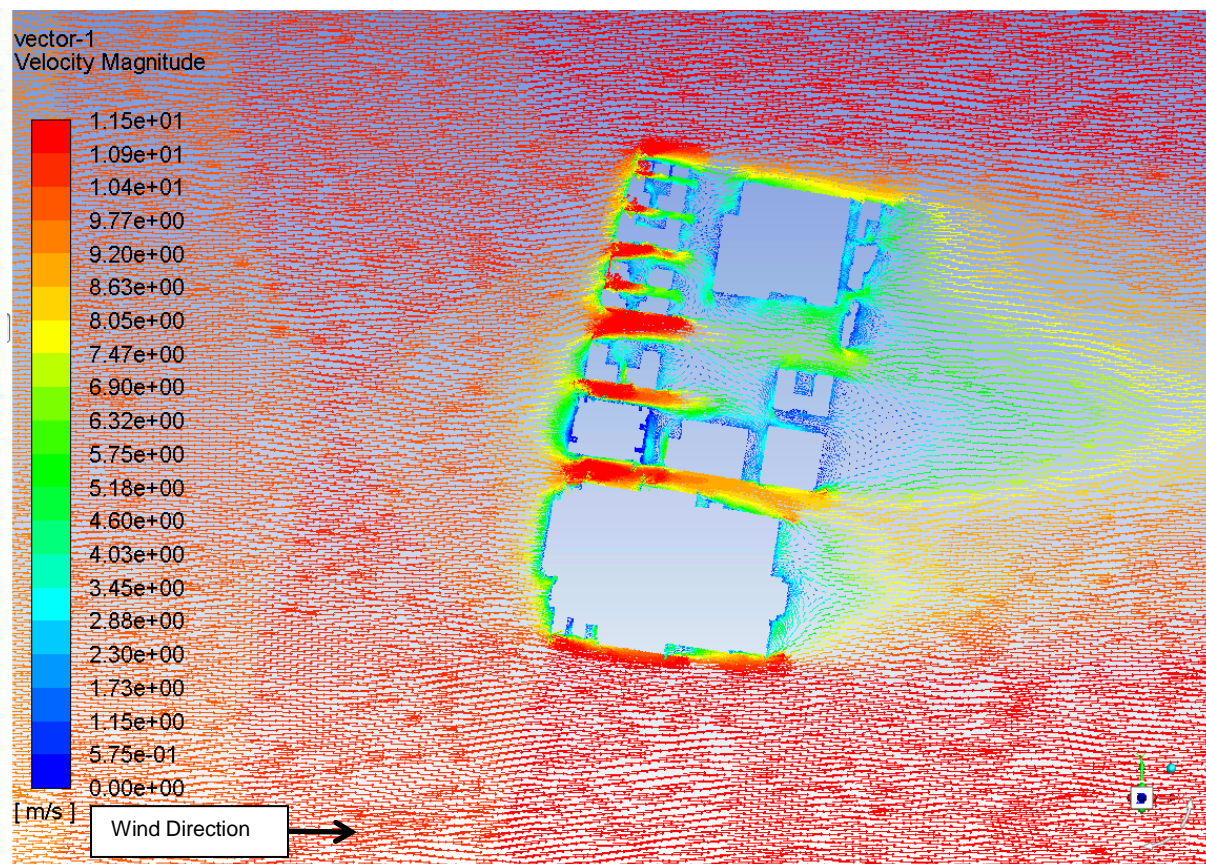


Figure 7 Velocity Magnitudes (m/s) above floor of L6 Communal Open Space – West Winds

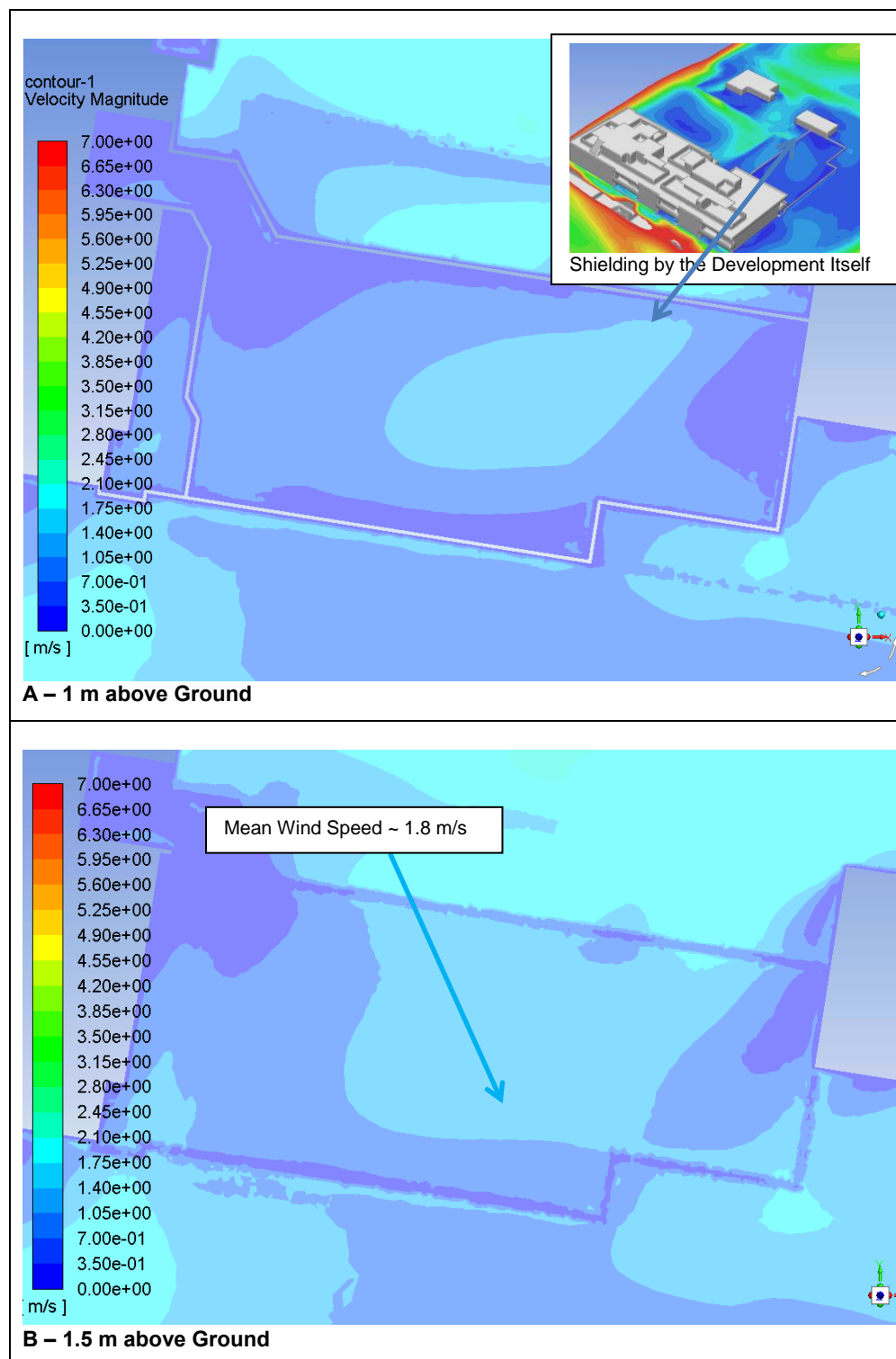


Figure 8 Velocity Magnitudes (m/s) above floor of the Private Roof Terraces – West Winds

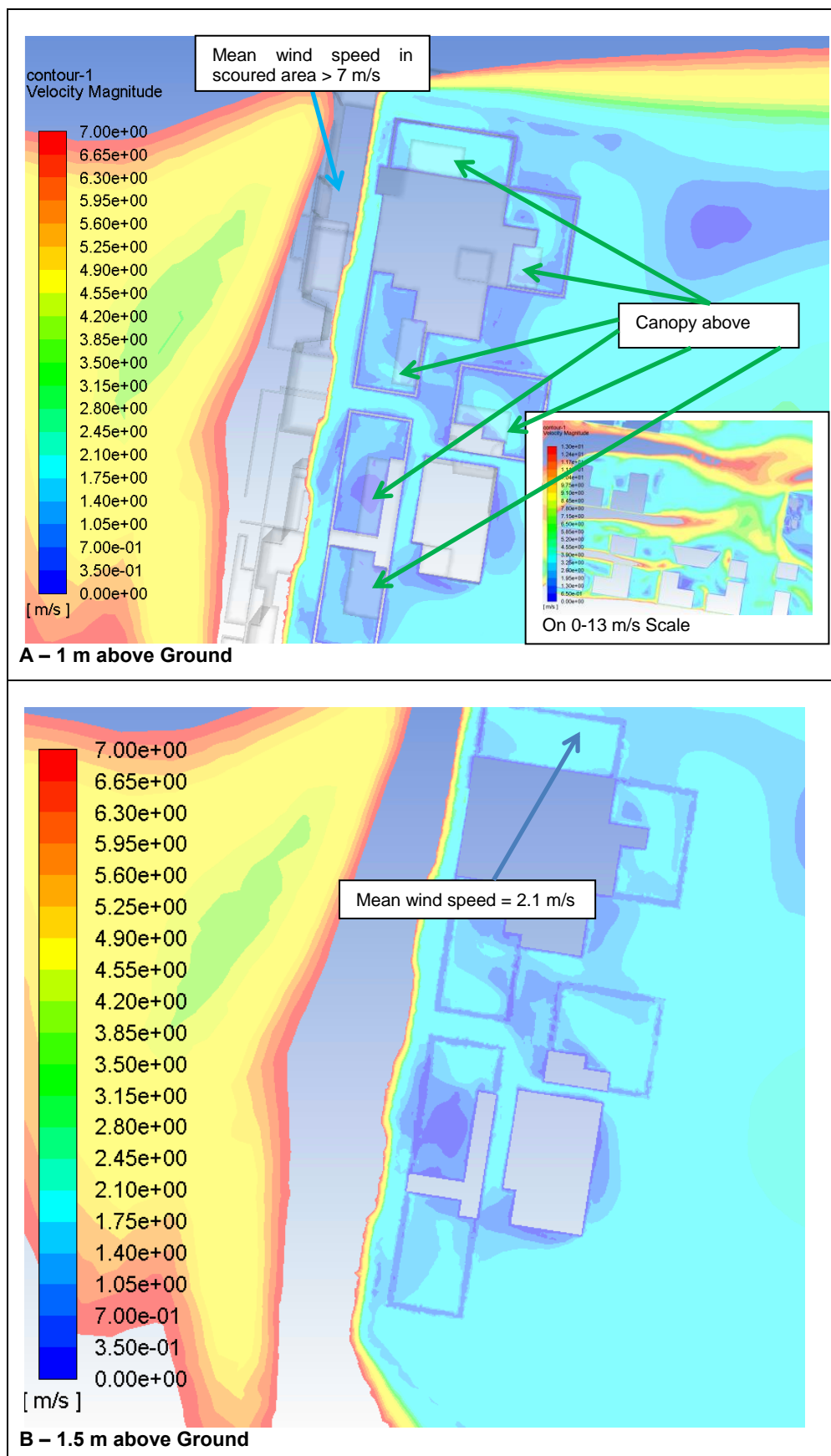


Figure 9 Velocity Magnitudes (m/s) above floor of Level 6 Communal Open Space – North East Winds

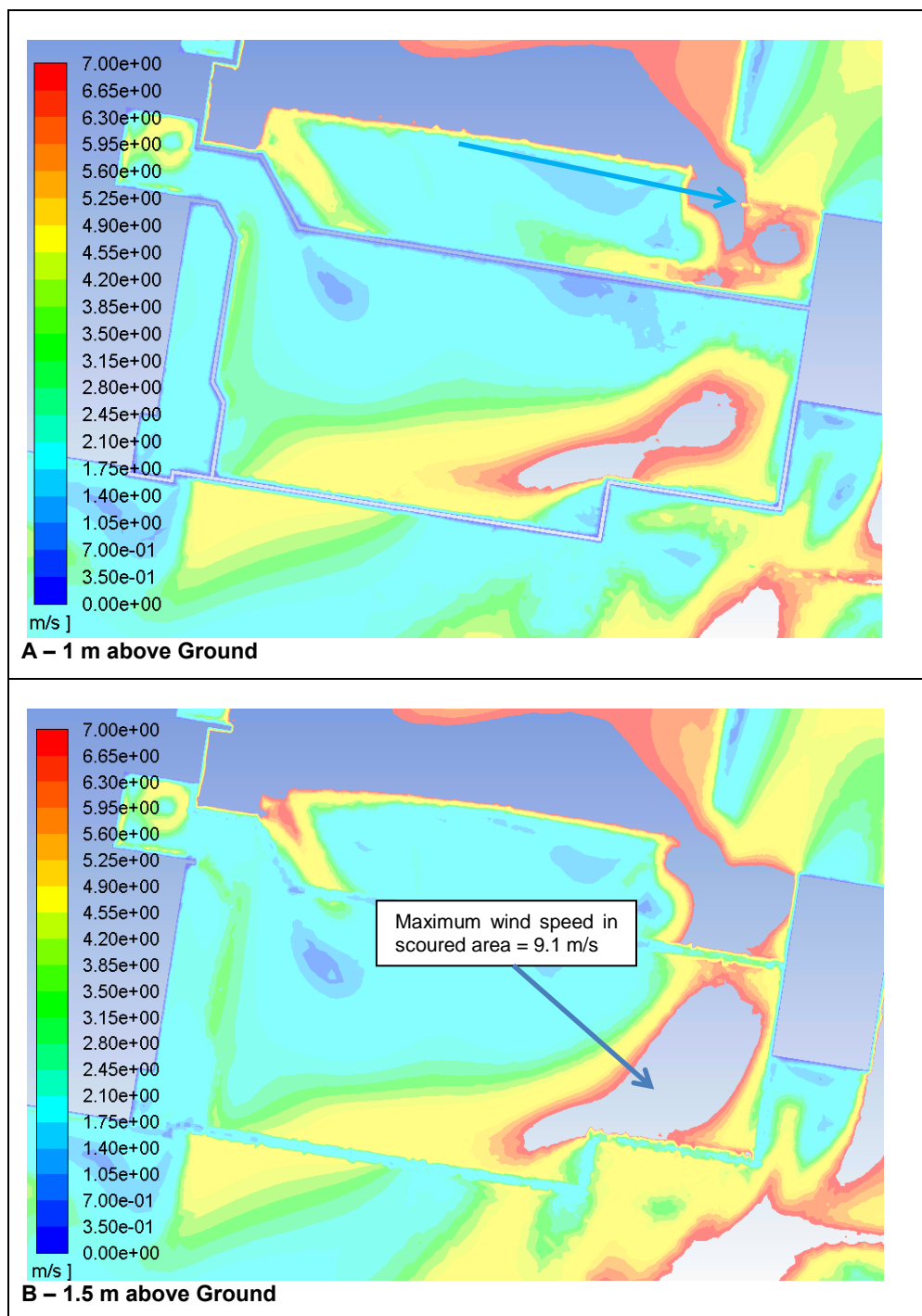


Figure 10 Velocity Magnitudes (m/s) above floor of the Private Roof Terraces – North East Winds

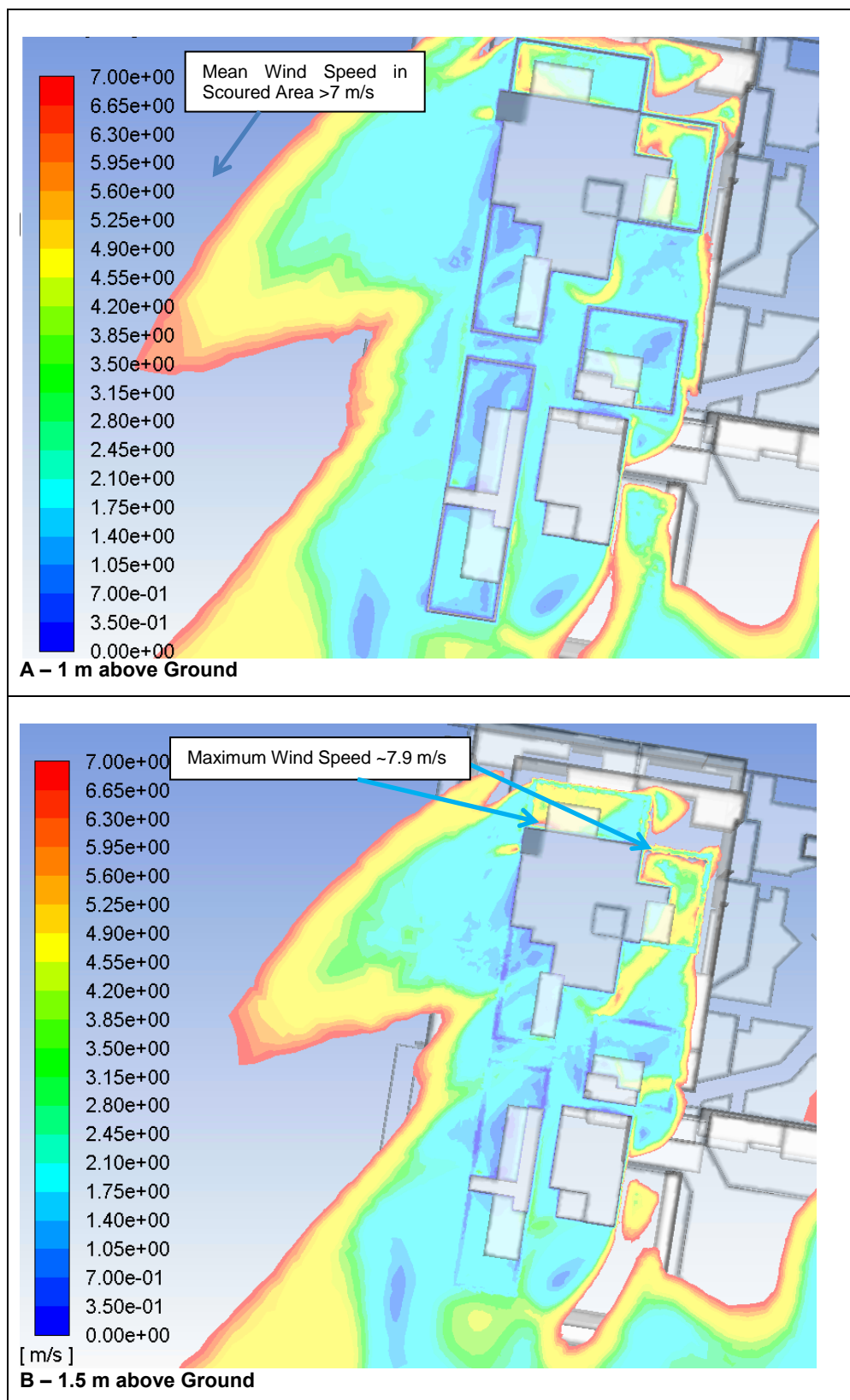


Figure 11 Velocity Magnitudes (m/s) above floor of L6 Communal Open Space – South Winds

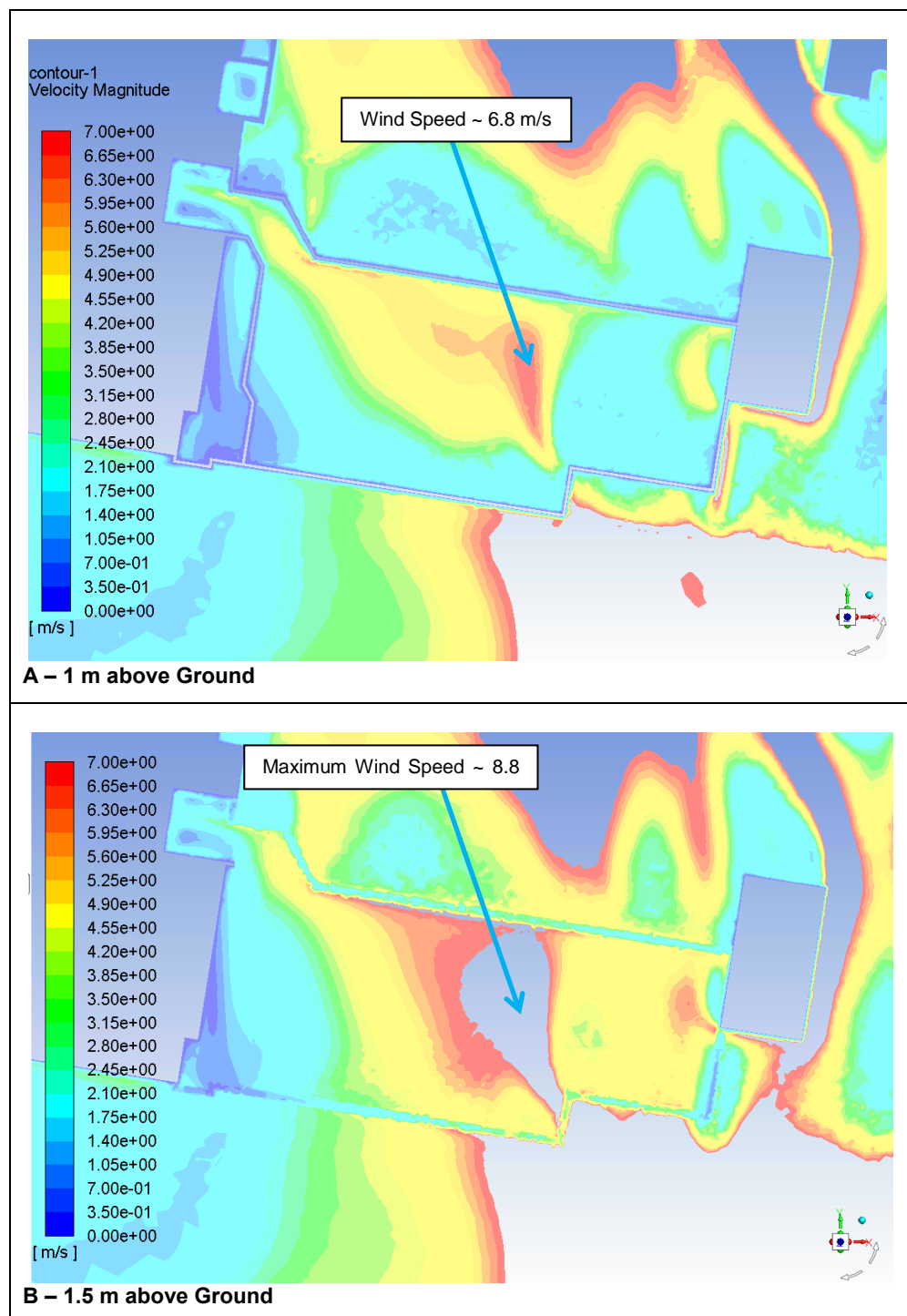


Figure 12 Velocity Magnitudes (m/s) above floor of the Private Roof Terraces – South Winds

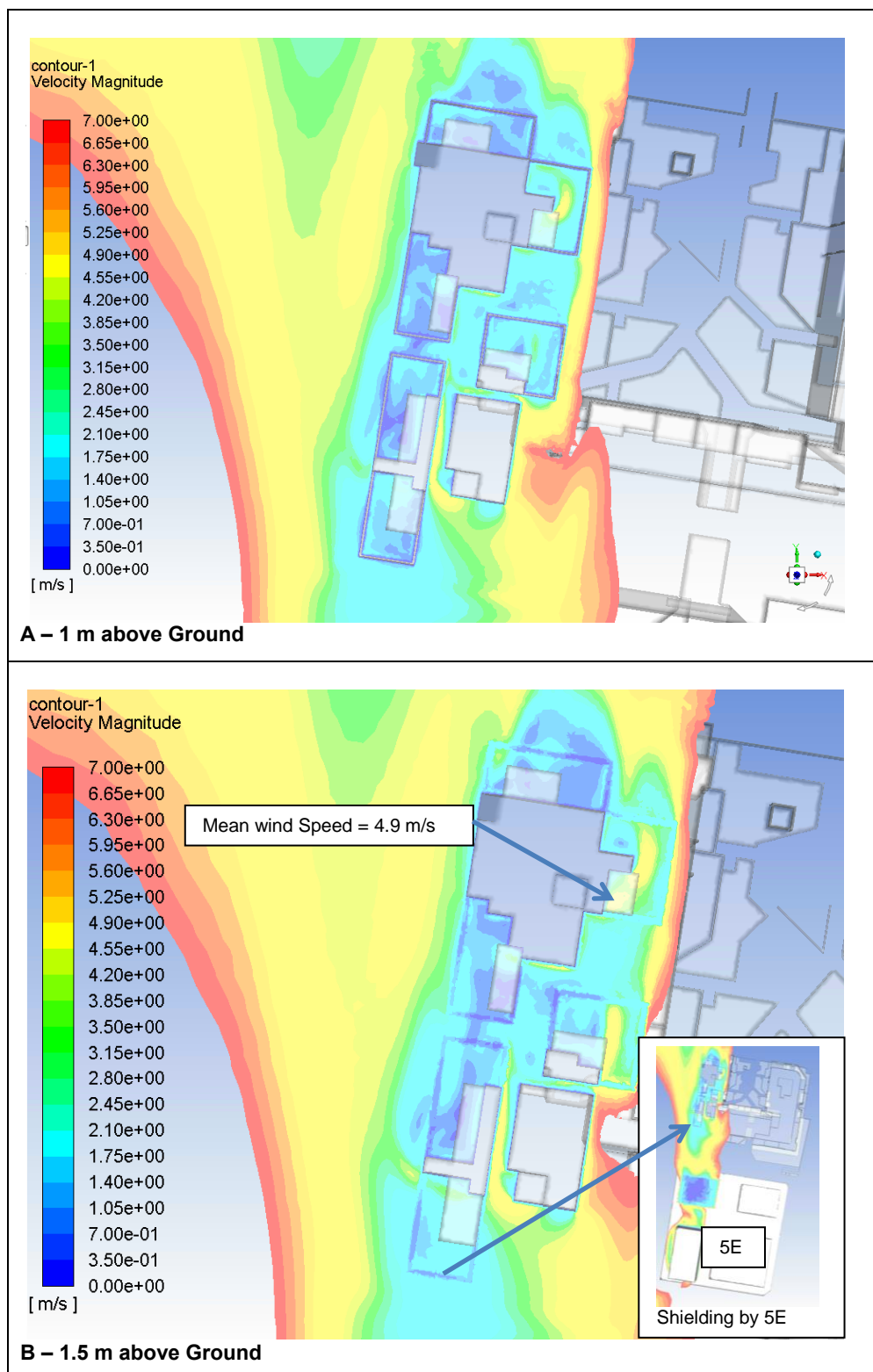


Figure 13 Velocity Magnitudes (m/s) above floor of L6 Communal Open Space – South East Winds

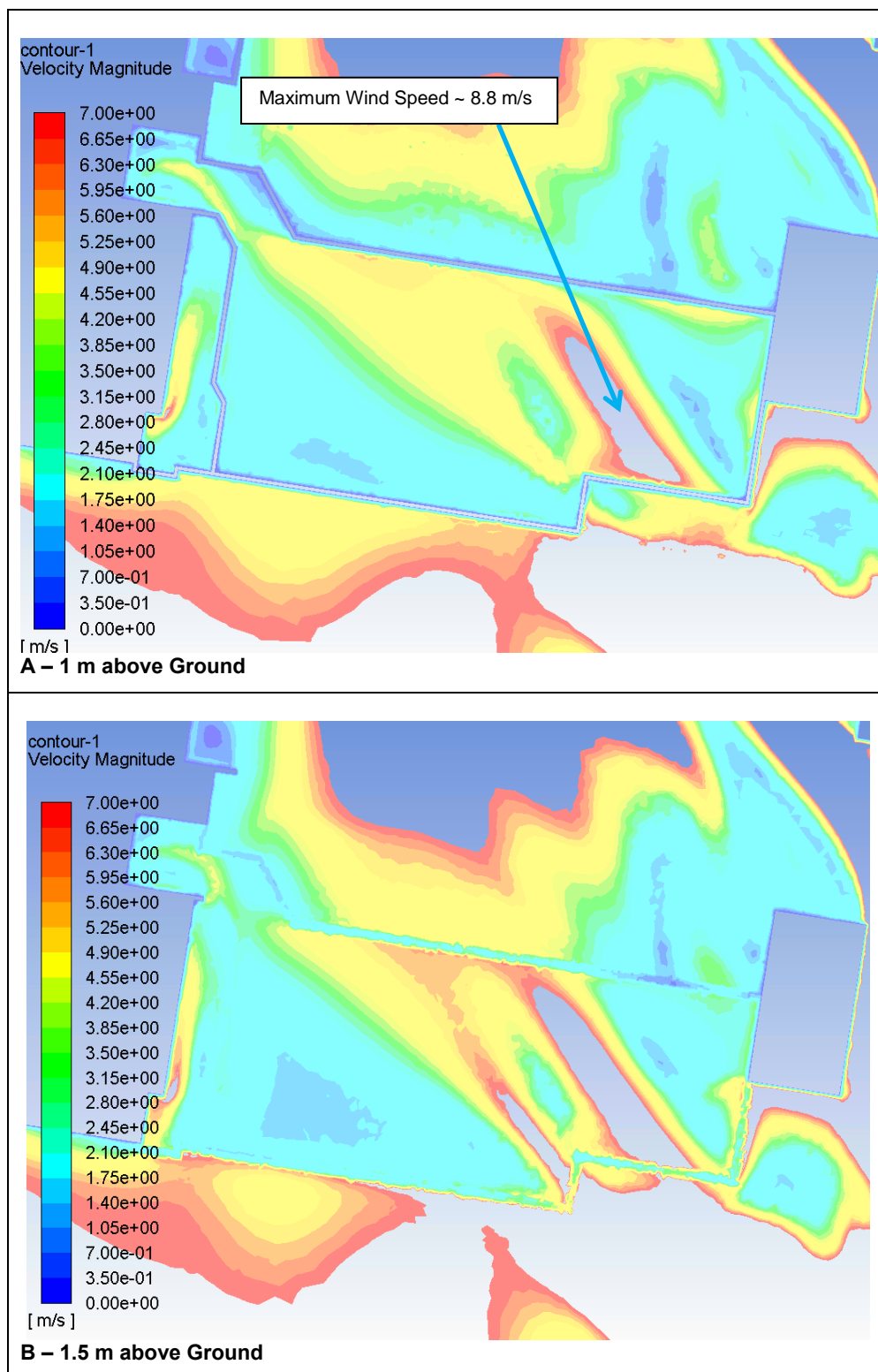
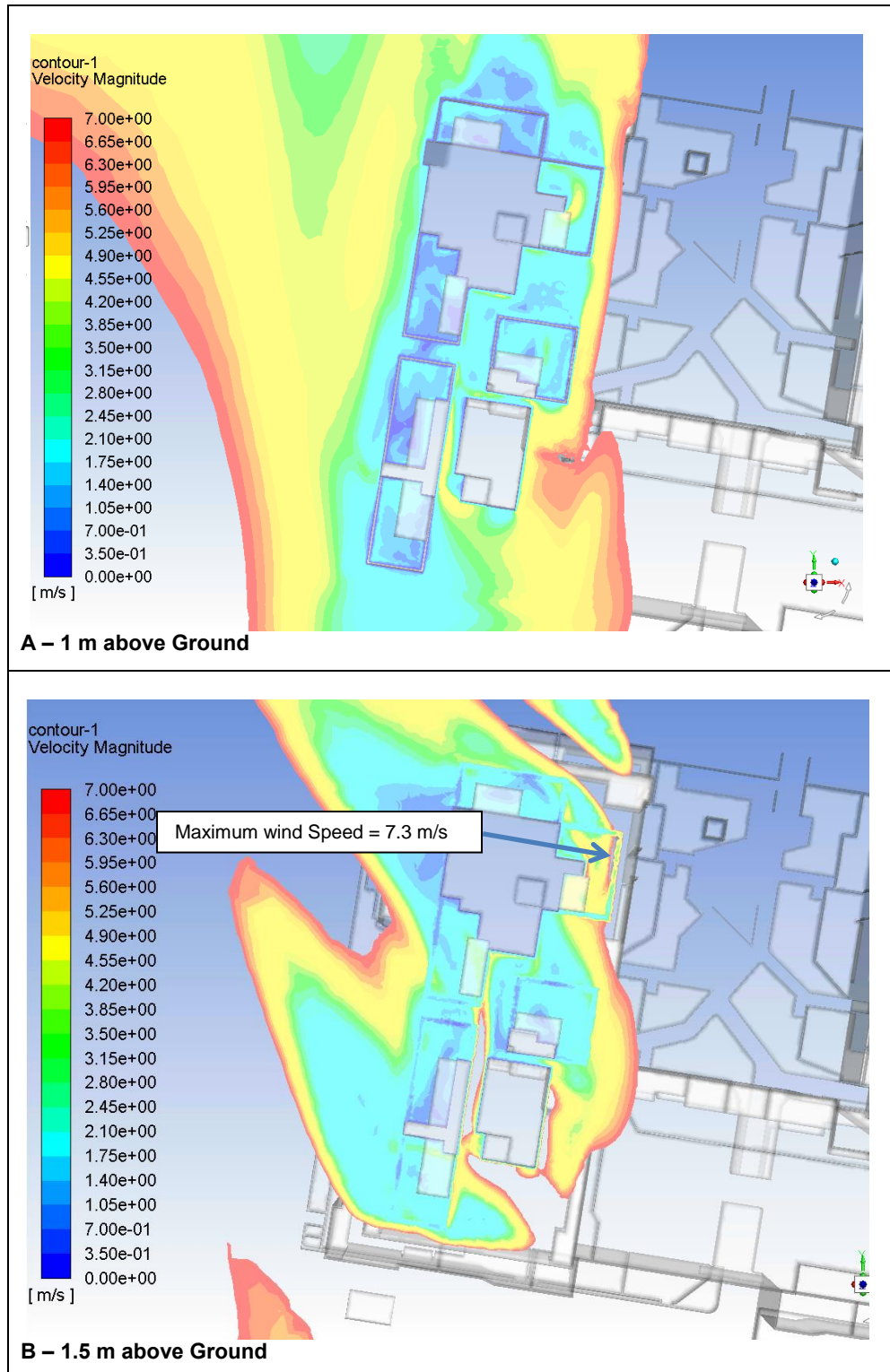


Figure 14 Velocity Magnitudes (m/s) above floor of the Private Roof Terraces – South East Winds



3 CONCLUSIONS AND RECOMMENDATIONS

On the basis of the CFD modelling described in this study, there are no areas predicted to experience winds which may pose an actual hazard to users of the development, ie exceed safety criteria. The following recommendations are made to improve the comfort conditions:

1. Increase the height of the vertical wind screen to 1.8 m (1.395 m balustrade + 0.405 m planter) where specified on the Level 6 communal open space and private roof terraces (Refer **Figure 15** and **Figure 16**), remaining balustrade to be set at proposed 1.m.
2. Use Pergolas or similar over Level 6 communal open space seating 395 area.

Figure 15 Mitigation Recommendations – Level 6 Communal open Space

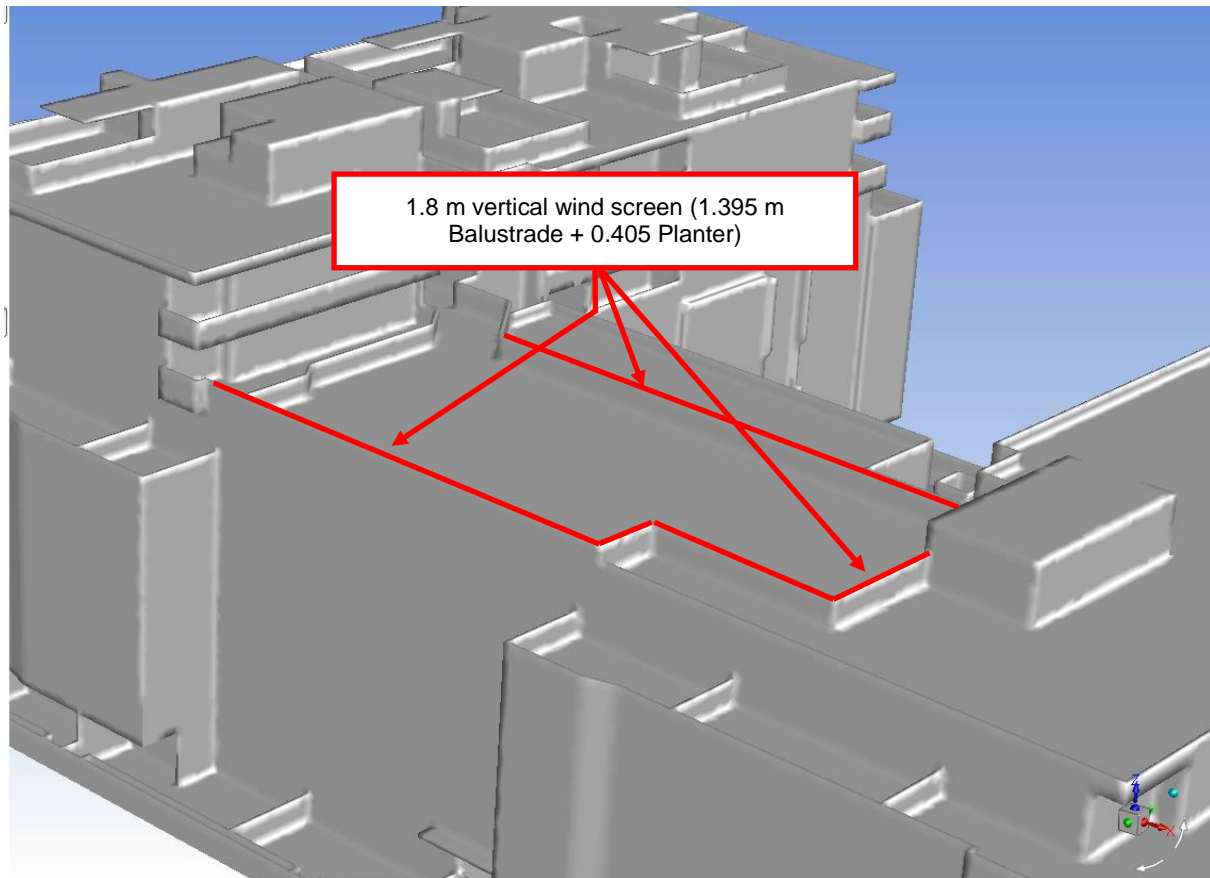


Figure 16 Mitigation Recommendations – Roof Terraces

