22 CLEELAND ROAD
SOUTH OAKLEIGH VIC 3167
AUSTRALIA

M E L
CONSULTANTS

(ACN 004 230 013)

Ref: 85-19-DE-EWC-01

20 December 2021

Time & Place
Level 26, 35 Collins Street
Melbourne VIC 3000

Attn: Richard Hampton

Dear Richard,

11-17 Dorcas Street, South Melbourne
Town Planning Report December 2021
Environmental Wind Considerations

A wind tunnel model study of the environmental wind conditions was completed for the development at 11-17 Dorcas Street, South Melbourne, in August 2018 with the wind tunnel model constructed to drawings by Wood Marsh dated 14th June, 2019. The findings of the study were reported in MEL Consultants Report 85-19-WT-ENV-00 (1st August 2019). The report included measurements of the wind conditions for the Existing and Proposed Configurations, as defined in Report 85-19-WT-ENV-00.

The conclusions of the wind tunnel study were as follows:

> *The wind conditions for the Proposed Configuration surrounding the development site have been shown to achieve the Walking Comfort criterion for all Test Locations for all wind directions, with many Test Locations shown to achieve the criteria for stationary activities.*
>
> *The wind conditions for the Proposed Configuration on the elevated balconies/terraces are shown to range from above the Walking Comfort criterion to the Long-Term Stationary criterion depending on the location on the tower faces and exposure to the prevailing wind directions for Melbourne.*

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The wind conditions at all Test Locations have been shown to meet the Safety Criteria for all wind directions.

The design of the development has been revised and Wood Marsh have provided a Town Planning Report dated December 2021 containing revised drawings that are listed in Appendix A. MEL Consultants have reviewed the drawings and while the built form of the development is similar there are the following changes are noted:

- Car parking moved from the podium to basements
- The main entrance is located at the northeast corner
- The height of the podium has been reduced

The wind tunnel study showed the proposed development would have good shielding from surrounding buildings of similar height, i.e. there is little significant change of existing wind conditions at the majority of the ground level study locations.

MEL Consultants have considered the revised design of the development at 11-17 Dorcas Street, South Melbourne, and concluded that the wind conditions in the surrounding streetscapes would be expected to be similar than those reported in Report 85-19-WT-ENV-00. Therefore, the findings of the report would still be valid for the revised design detailed in the Town Planning drawings listed in Appendix A.

Yours sincerely,

M. Eaddy
MEL Consultants Pty Ltd

Attachments: MEL Consultants Report 85-19-WT-ENV-00

Appendix A – Drawing List

Drawing #	No.	Date	Title
A00-000	10	16/12/21	Title and Drawing Schedule
A00-010	10	16/12/21	Site Survey Plan
A00-100	10	16/12/21	Site Plan
A03-001	10	16/12/21	Basement 05
A03-002	10	16/12/21	Basement 04
A03-003	10	16/12/21	Basement 03
A03-004	10	16/12/21	Basement 02
A03-005	10	16/12/21	Basement 01
A03-006	10	16/12/21	Basement Mezzanine
A03-007	10	16/12/21	Level 00
A03-010	10	16/12/21	Level 01
A03-020	10	16/12/21	Level 02
A03-030	10	16/12/21	Level 03
A03-040	10	16/12/21	Level 04
A03-050	10	16/12/21	Level 05
A03-060	10	16/12/21	Level 06
A03-070	10	16/12/21	Level 07
A03-080	10	16/12/21	Level 08
A03-090	10	16/12/21	Level 09
A03-100	10	16/12/21	Level 10
A03-110	10	16/12/21	Level 11
A03-120	10	16/12/21	Level 12
A03-130	10	16/12/21	Level 13
A03-140	10	16/12/21	Level 14
A03-150	10	16/12/21	Level 15
A03-160	10	16/12/21	Level 16
A03-170	10	16/12/21	Level 17
A03-180	10	16/12/21	Level 18
A03-190	10	16/12/21	Level 19
A03-200	10	16/12/21	Level Roof
A05-000	10	16/12/21	Elevation South & West
A05-001	10	16/12/21	Elevation North & East
A06-001	10	16/12/21	Section AA
A06-002	10	16/12/21	Section BB
A06-003	10	16/12/21	Section CC
A06-004	10	16/12/21	Section DD

ENVIRONMENTAL WIND SPEED MEASUREMENTS ON A WIND TUNNEL MODEL OF THE 11-17 DORCAS STREET SOUTH DEVELOPMENT, MELBOURNE

By

T. Kerr

J. Kostas

and

M. Eaddy

SUMMARY

Wind tunnel tests have been conducted on a 1/400 scale model of the 11-17 Dorcas Street, South Melbourne. The model of the Development within surrounding buildings was tested in a simulated upstream boundary layer of the natural wind to determine likely environmental wind conditions. These wind conditions have been related to the freestream mean wind speed at a reference height of 300m and compared with criteria developed for the Melbourne region as a function of wind direction.

The wind conditions for the Proposed Configuration surrounding the development site have been shown to achieve the Walking Comfort criterion for all Test Locations for all wind directions, with many Test Locations shown to achieve the criteria for stationary activities.

The wind conditions for the Proposed Configuration on the elevated balconies/terraces are shown to range from above the Walking Comfort criterion to the Long-Term Stationary criterion depending on the location on the tower faces and exposure to the prevailing wind directions for Melbourne.

The wind conditions at all Test Locations have been shown to meet the Safety Criteria for all wind directions.

Report 85-19-WT-ENV-00

July 2019

11-17 DORCAS STREET, SOUTH MELBOURNE
ENVIRONMENTAL WIND TUNNEL MODELLING

MEL CONSULTANTS REPORT NO: **85-19-WT-ENV-00**

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Engineer Date: 24 July 2019

REVIEWED BY:

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Director Date: 24 July 2019

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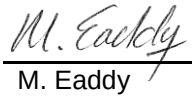

M. Eaddy
Director Date: 1st August 2019

REVISION HISTORY

Revision No:	Date Issued	Reason/Comment
0	1st August 2019	Report

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CONTENTS

1. INTRODUCTION

The 11-17 Dorcas Street development will consist of a 6-level podium and an apartment tower of 13 levels (totalling approximately 63.5 high including lift overrun). The location of the site is highlighted in red in Figure 1. A 5-storey brick and concrete panel building currently exists on the development site. The surrounding terrain, over which the flow develops, is typical suburban housing for most wind directions excluding the northwest through to north northeast. Through these wind directions the approach terrain includes the Melbourne CBD.

Figure 1 - Aerial view of the 11-17 Dorcas Street development site.

A wind tunnel model study was commissioned by V-Leader to provide environmental wind conditions around the proposed Development and, if required, to develop further wind-break features to achieve conditions satisfying the recommended environmental wind criteria.

These tests were carried out in the MEL Consultants 400kW Boundary Layer Wind Tunnel during July, 2019.

2. ENVIRONMENTAL WIND CRITERIA

The advancement of wind tunnel testing techniques, using large boundary layer flows to simulate the natural wind, has facilitated the prediction of wind speeds likely to be induced around a Development. To assess whether the predicted wind conditions are likely to be acceptable or not, some form of criteria are required. A discussion of criteria for environmental wind conditions has been made in a paper by Melbourne, Reference 1. This paper notes that it is the forces caused by the peak gust wind speeds and associated gradients which people feel most and criteria have been stated in terms of gust wind speeds. The probabilistic inference of these criteria in relation to hourly mean wind speeds and frequency of occurrence is discussed. The basic criteria can be summarised as follows:

In main public access-ways wind conditions are considered

(a) unacceptable if the peak gust speed during the hourly mean with a probability of exceedence of 0.1% in any 22.5^{o} wind direction sector exceeds 23ms^{-1} (the gust wind speed at which people begin to get blown over);

(b) generally acceptable for walking in waterfront locations if the peak gust speed during the hourly mean with a probability of exceedence of 0.1% in any 22.5^{o} wind direction sector does not exceed 20 ms^{-1} (which results in 75% of the wind pressure of a 23 ms^{-1} gust).

(c) generally acceptable for walking in urban and suburban areas if the peak gust speed during the hourly mean with a probability of exceedence of 0.1% in any 22.5^{o} wind direction sector does not exceed 16 ms^{-1} (which results in half the wind pressure of a 23 ms^{-1} gust).

For more recreational activities wind conditions are considered

(d) generally acceptable for stationary short exposure activities (window shopping, standing or sitting in plazas) if the peak gust speed during the hourly mean with a probability of exceedence of 0.1% in any 22.5^o wind direction sector does not exceed 13 ms^{-1};

(e) generally acceptable for stationary, long exposure activities (outdoor restaurants, theatres) if the peak gust speed during the hourly mean with a probability of exceedence of 0.1% in any 22.5^o wind direction sector does not exceed 10 ms^{-1}.

The probability of exceedence of 0.1% relates approximately to the annual maximum mean wind speed occurrence for each wind direction sector. These criteria can be developed in terms of hourly mean wind speed versus frequency of occurrence as shown in References 1 and 2.

For the purpose of comparison, or integrating with local wind data, it is necessary to be able to relate the local velocity measurement to a reference velocity well clear of the influence of buildings. Because the wind force is related to wind velocity squared, it is often more convenient to express criteria in terms of velocity ratio squared, or velocity pressure ratio as this becomes. To this end, two velocity pressure ratios referenced to conditions at 300m height (as a convenient reference) are defined as,

mean velocity pressure ratio $\left|\frac{\overline{V}_{local}}{\overline{V}_{300m}}\right|^2$

and

peak velocity pressure ratio $\left|\frac{\widehat{V}_{local}}{\overline{V}_{300m}}\right|^2$

where the peak velocity is the 3-second mean maximum gust wind speed in full scale conditions.

For wind conditions in Melbourne these criteria can be expressed in terms of velocity pressure ratios, calculated from hourly mean wind speed data as per the methodology given in Reference 1.

The criteria in terms of peak velocity pressure ratios are illustrated in Figure 2 and appear in subsequent figures to enable immediate assessment of the wind conditions as measured on the model.

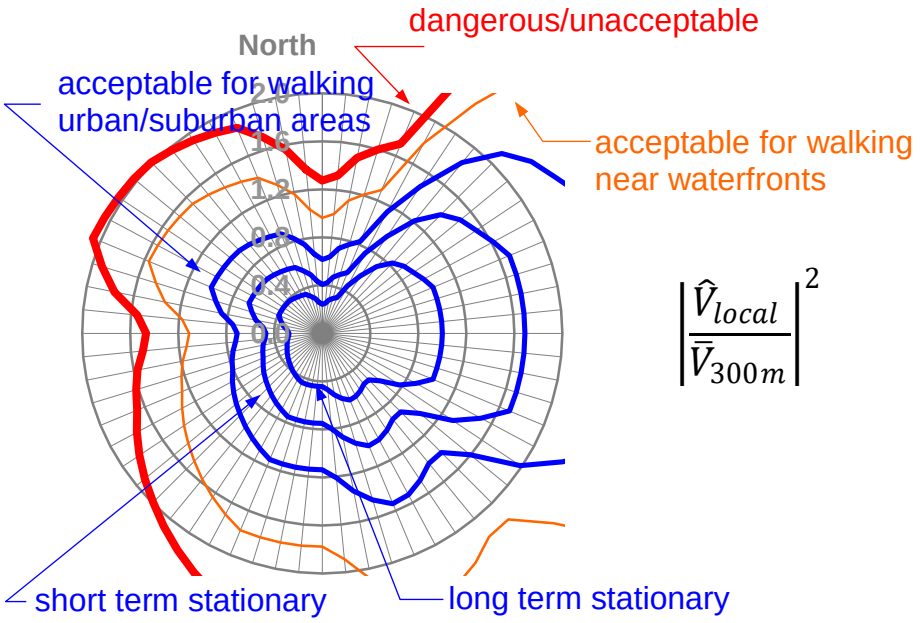


Figure 2 - Environmental wind criteria for the Melbourne region expressed in terms of peak velocity pressure ratios

The velocity pressure ratio values considered as unacceptable in Figure 2 are equivalent to conditions which have existed in some areas in Australian capital cities where people have been blown over by the wind. The velocity pressure ratios considered as acceptable for walking in urban and suburban areas are equivalent to conditions existing at corners in these areas before high rise development commenced.

The velocity pressure ratios considered as acceptable for walking near waterfronts are typical of waterfront wind conditions in southern Australia.

3. MODEL AND EXPERIMENTAL TECHNIQUES

A 1/400 scale model of the 11-17 Dorcas Street Development was constructed from digital information provided by Wood/Marsh Pty Ltd Architecture dated up to 14th June 2019.

The 1/400 scale model of the 11-17 Dorcas Street Development was inserted into a proximity model with significant surrounding buildings out to a minimum radius of 300m. The building model was tested in a model of the natural wind generated by flow over roughness elements augmented by vorticity generators at the beginning of the wind tunnel working section. The basic natural wind model was for flow over suburban terrain, the characteristics of which are given in Figure 3. The surrounding wind tunnel model modified the approach wind model for the presence of the surrounding buildings.

The techniques used to investigate the environmental wind conditions and the method of determining the local criteria are given in detail in Reference 2. In these tests measurements in the Development areas are inside separated regions and peak velocity squared ratios were required to make conclusions about likely wind conditions. In summary, measurements were made of the peak gust wind velocity with a hot wire anemometer at various stations and expressed as a squared ratio with the mean wind velocity at a scaled reference height of 300m. This gives the peak velocity squared ratio

$$\left|\frac{\hat{V}_{local}}{\bar{V}_{300m}}\right|^2$$

as defined in Section 2. This peak velocity squared ratio can then be compared with the velocity squared ratio criteria for Melbourne given in Figure 2. Wind tunnel velocity measurements were made for the an equivalent 1 hour period in full scale and filtered to provide an equivalent full scale 3 second gust wind speed. Photographs of the model as tested in the wind tunnel are shown in Figures 4 and 5.

4. DISCUSSION OF RESULTS

Velocity measurements were made at various locations around the 11-17 Dorcas Street Development for different wind directions at 22.5° intervals. The results of these measurements are presented on polar diagrams against a background plot of the various criteria for each Test Location as a function of wind direction. The Test Locations are shown in Figures 6a to 6d for locations around the development in the pedestrian realm and terraces.

The Proposed Configuration, for the 11-17 Dorcas Street Development is as outlined in the digital information provided by Wood/Marsh Pty Ltd Architecture dated up to 14th June 2019. The Proposed Configuration did not include any landscaping features.

The following Sections detail the results for the various areas tested.

4.1 Summary of discussion (Figures 7 to 10)

To assist with the assessment of the wind conditions, summaries of the highest wind conditions at all Test Locations, ground, and balconies/terraces have been summarised in the following figures

- Figure 7a Existing Configuration
- Figure 7b Proposed Configuration
- Figure 8 Level 5 Terrace
- Figure 9 Level 11 Balconies
- Figure 10 Level 18 Balconies

The summaries are for all wind directions (i.e. 0°→ 360°) and different colours have been used to represent the wind criteria achieved at the respective Test Locations.

4.2 Dorcas Street (Figures 11 to 13)

Along Dorcas Street (Test Locations 2 to 11) the wind conditions are shown to be within the criterion for Walking Comfort for both the Existing and the Proposed Configurations for all wind directions, with many wind directions achieving the criteria for stationary activities. At the recessed entrance to the development (Test Location 8), the wind conditions are shown to achieve the criteria for stationary activities for all wind directions.

4.3 Middleton Lane (Figures 14 and 15)

The wind conditions in Middleton Lane (Test Locations 12 to 18, excluding 17) are shown to be within the criterion for Walking Comfort for all wind directions for both the Existing and the Proposed Configurations.

4.4 Wells Street (Figure 16)

In Wells Street (Test Location 17) the wind conditions are shown to be within the criterion for Walking Comfort for all wind directions for both the Existing and Proposed Configurations.

4.5 Anthony Lane (Figure 17)

In Anthony Lane (Test Location 1) the wind conditions for both the Existing and Proposed Configurations are shown to be well within the criterion for Walking Comfort for all wind directions.

4.6 St Kilda Road (Figure 18)

In St Kilda Road (Test Location 19) the wind conditions are shown to meet the criterion for Walking Comfort for all wind directions for both the Existing and the Proposed Configurations, with many wind directions achieving the criteria for stationary activities.

4.7 Balconies and Terraces (Figures 19 to 22)

At the Level 5 Terrace, Test Locations 20 to 22 are shown to meet the criterion for Sitting Comfort for all wind directions. Test Locations 23 and 24 are shown to be within the criterion for stationary activities for most wind directions except for the west-southwest wind direction. For the west-southwest wind direction, the wind conditions are shown to be above the criteria for stationary activities, however meet the criterion for Walking Comfort.

At Level 11, the wind conditions on the northwest facing balcony (Test Location 25) are shown to meet the criteria for stationary activities for many wind directions, with the exceptions of the west southwest through to west wind directions and the north and north-northeast wind directions. For these wind directions, the wind conditions are either on or above the criterion for Walking Comfort, but are within the unacceptable criterion. The wind conditions on the northeast facing balcony (Test Location 26) are shown to be either on or within the criteria for stationary activities.

At Level 18, the wind conditions on the northwest balcony (Test Location 27) are shown to meet the criteria for stationary activities for most wind directions with the exception of the west wind direction. The wind conditions are shown to exceed the criteria for stationary activities for the west wind direction, however meets the criterion for Walking Comfort. The wind conditions for the northeast facing balcony (Test

Location 28) are shown to meet the criteria for stationary activities for many wind directions to the south and east. However, the wind conditions for the northeast facing balcony are shown to exceed the criterion for stationary activities for the west southwest through to north wind directions. The wind conditions for the west, west-northwest and north wind directions are shown to exceed the criterion for Walking Comfort, however are well within the Unacceptable criterion.

5. CONCLUSIONS

Wind tunnel tests have been conducted on a 1/400 scale model of the 11-17 Dorcas Street, South Melbourne. The model of the Development within surrounding buildings was tested in a simulated upstream boundary layer of the natural wind to determine likely environmental wind conditions. These wind conditions have been related to the freestream mean wind speed at a reference height of 300m and compared with criteria developed for the Melbourne region as a function of wind direction.

The wind conditions for the Proposed Configuration surrounding the development site have been shown to achieve the Walking Comfort criterion for all Test Locations for all wind directions, with many Test Locations shown to achieve the criteria for stationary activities.

The wind conditions for the Proposed Configuration on the elevated balconies/terraces are shown to range from above the Walking Comfort criterion to the Long-Term Stationary criterion depending on the location on the tower faces and exposure to the prevailing wind directions for Melbourne.

The wind conditions at all Test Locations have been shown to meet the Safety Criteria for all wind directions.

MEL CONSULTANTS

July 2019

REFERENCES

1. W. H. Melbourne, Criteria for environmental wind conditions, Journal of Industrial Aerodynamics, Volume 3, 1978, pp. 241-249
2. W. H. Melbourne, Wind environment studies in Australia, Journal of Industrial Aerodynamics, Volume 3, 1978, pp. 201-214

FIGURES

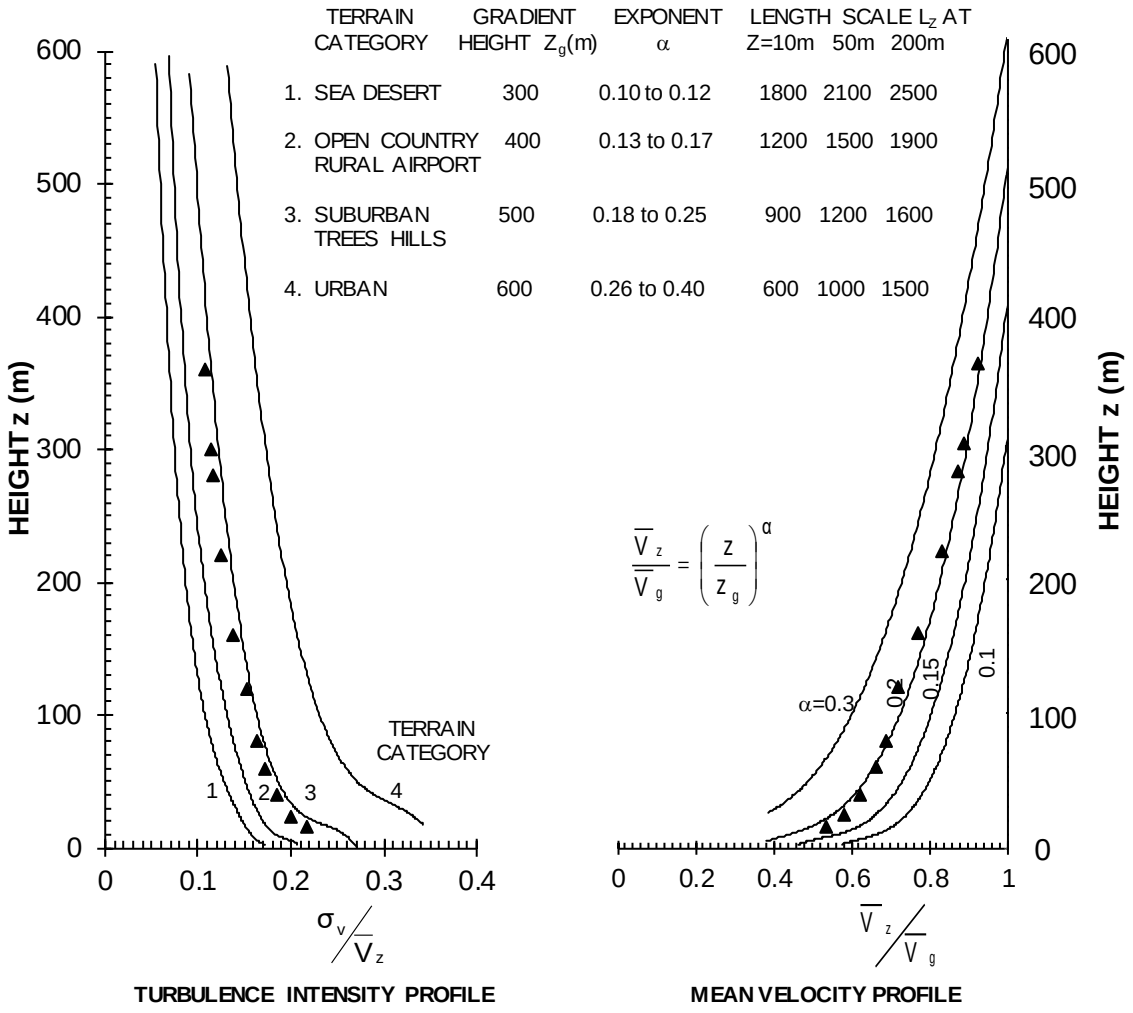


Figure 3 – 1/400 scale Terrain Category 3 boundary layer turbulence intensity and mean velocity profiles and spectra in the MEL Consultants Boundary Layer Wind Tunnel 4.8m x 2.4m working section, scaled to full scale dimensions

Figure 4 – View from the southeast of the 1/400 scale model of the 11-17 Dorcas Street Development in the wind tunnel.

Figure 5 – View from the northeast of the 1/400 scale model of the 11-17 Dorcas Street Development in the wind tunnel.

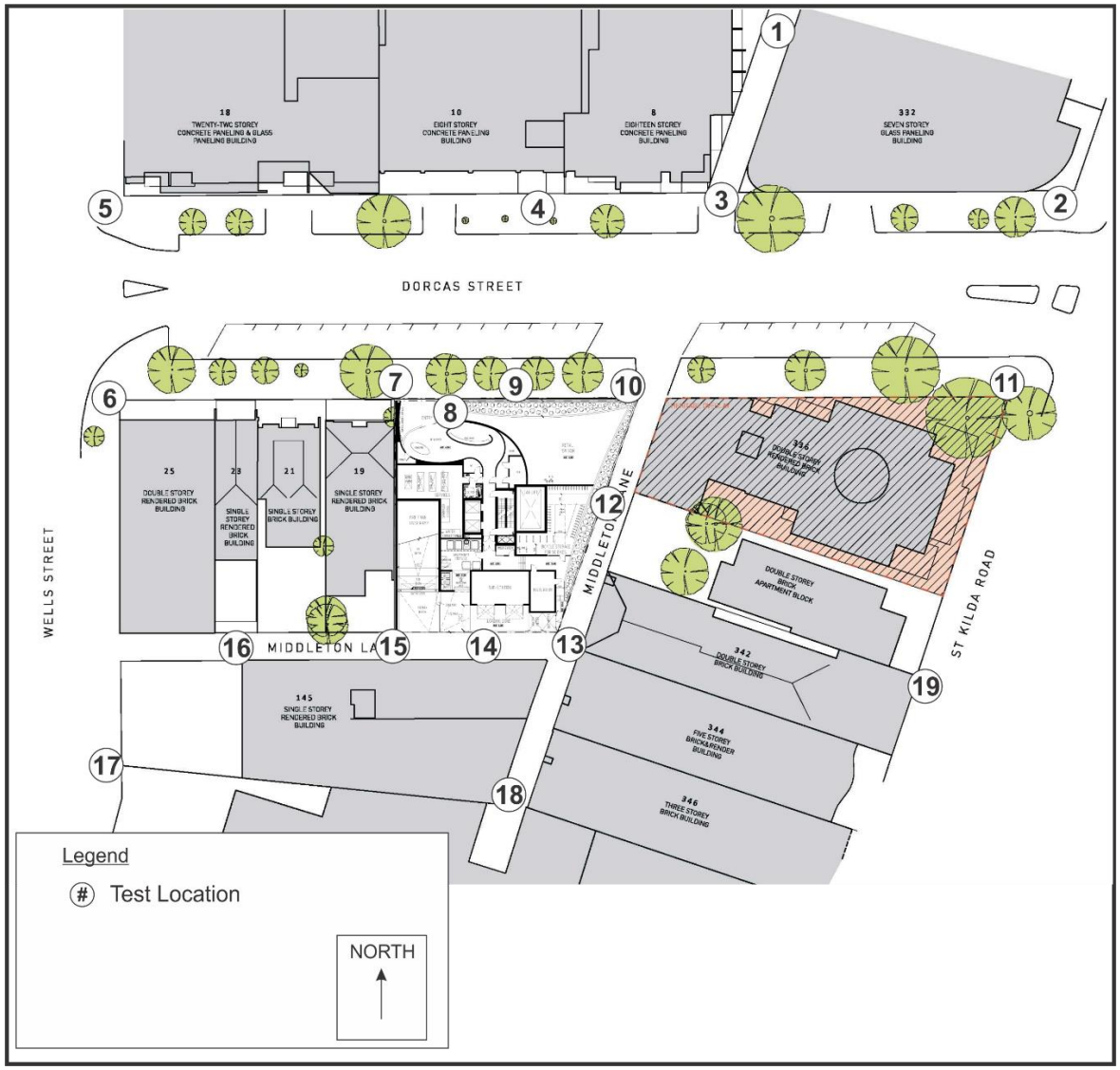


Figure 6a - Ground Level Test Locations of the proposed 11-17 Dorcas Street Development for the Proposed Configuration.

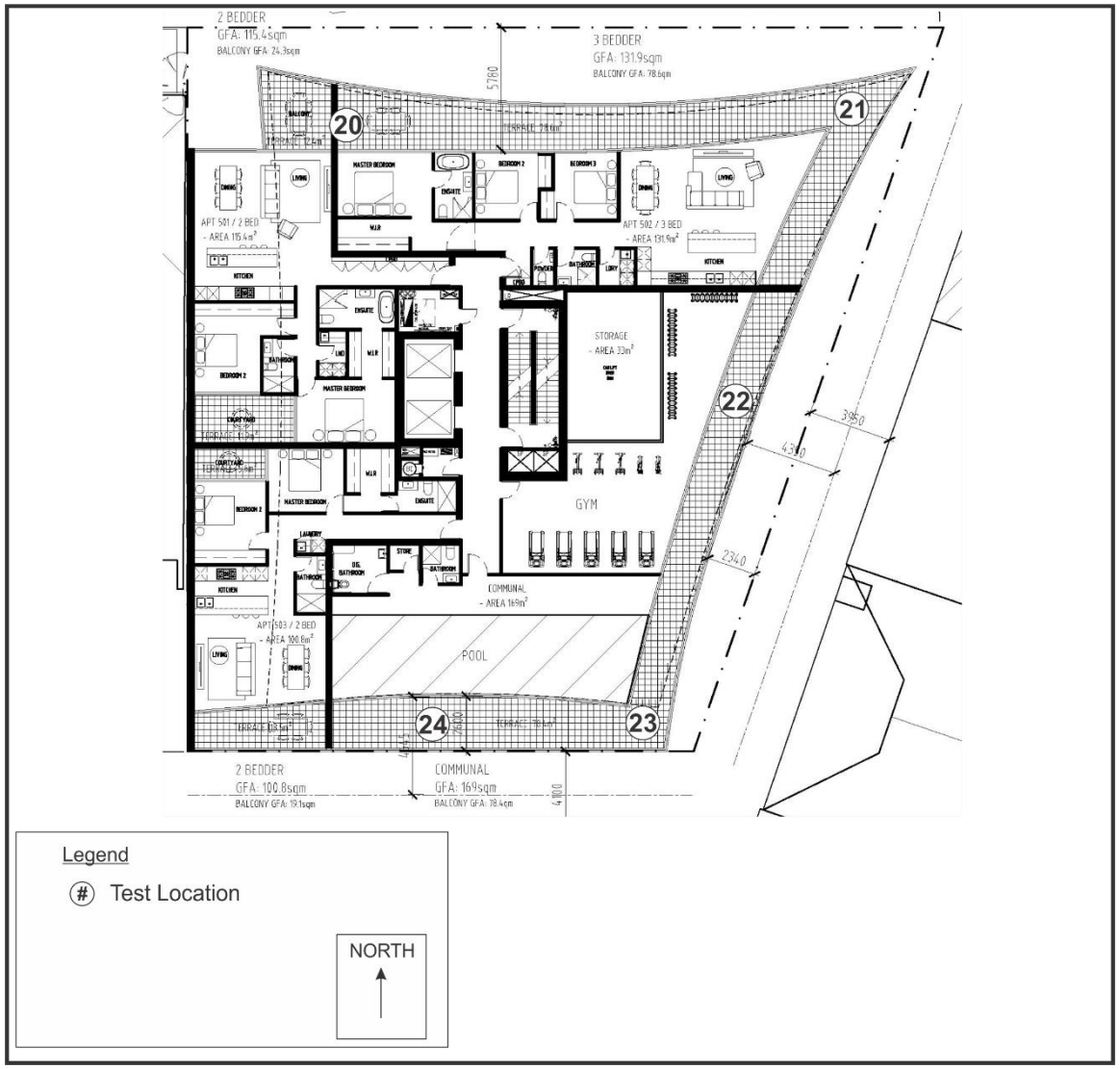


Figure 6b - Level 5 Test Locations of the proposed 11-17 Dorcas Street Development for the Proposed Configuration.

Figure 6c - Level 11 Test Locations of the proposed 11-17 Dorcas Street Development for the Proposed Configuration.

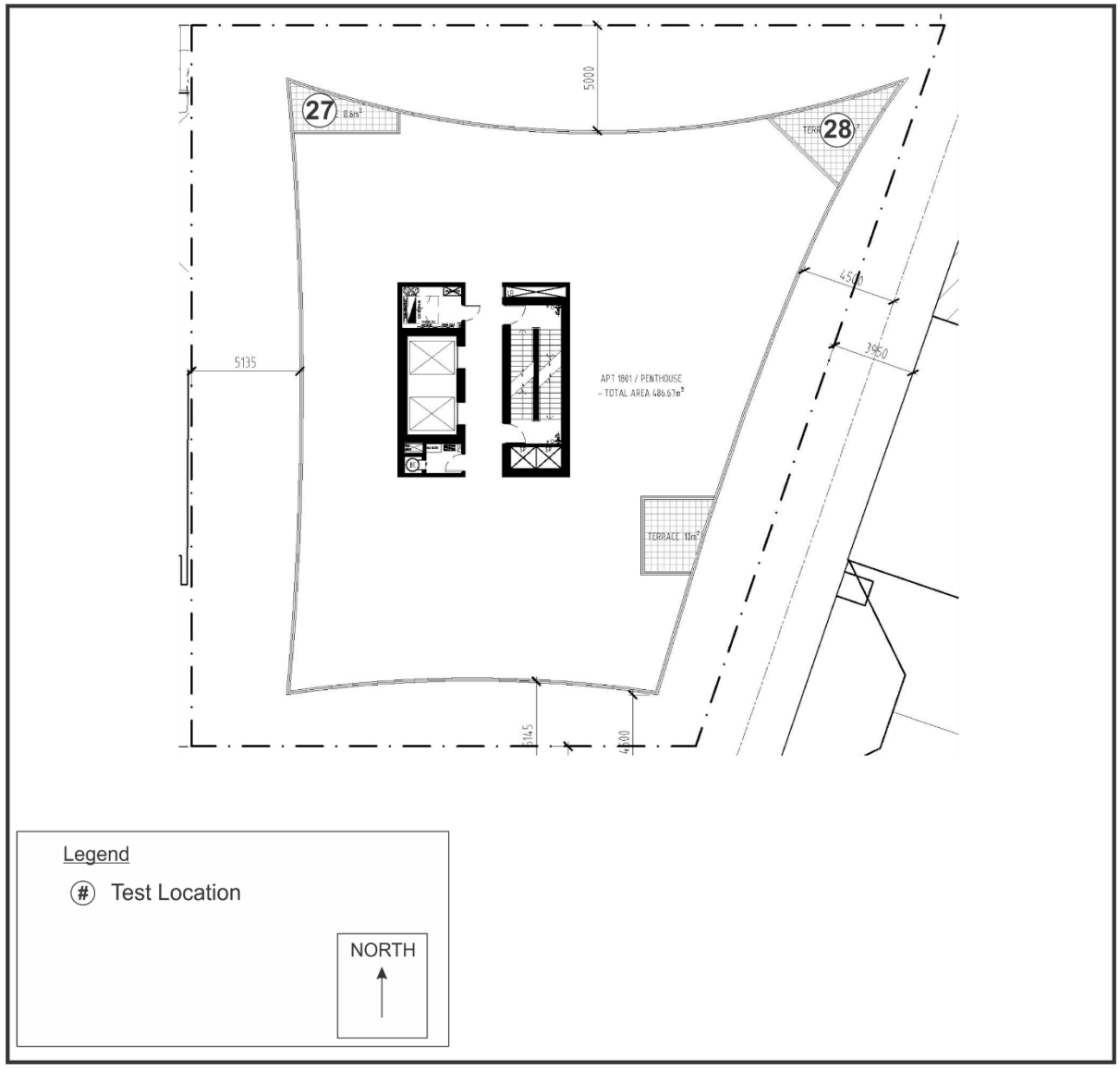


Figure 6d - Level 18 Test Locations of the proposed 11-17 Dorcas Street Development for the Proposed Configuration.

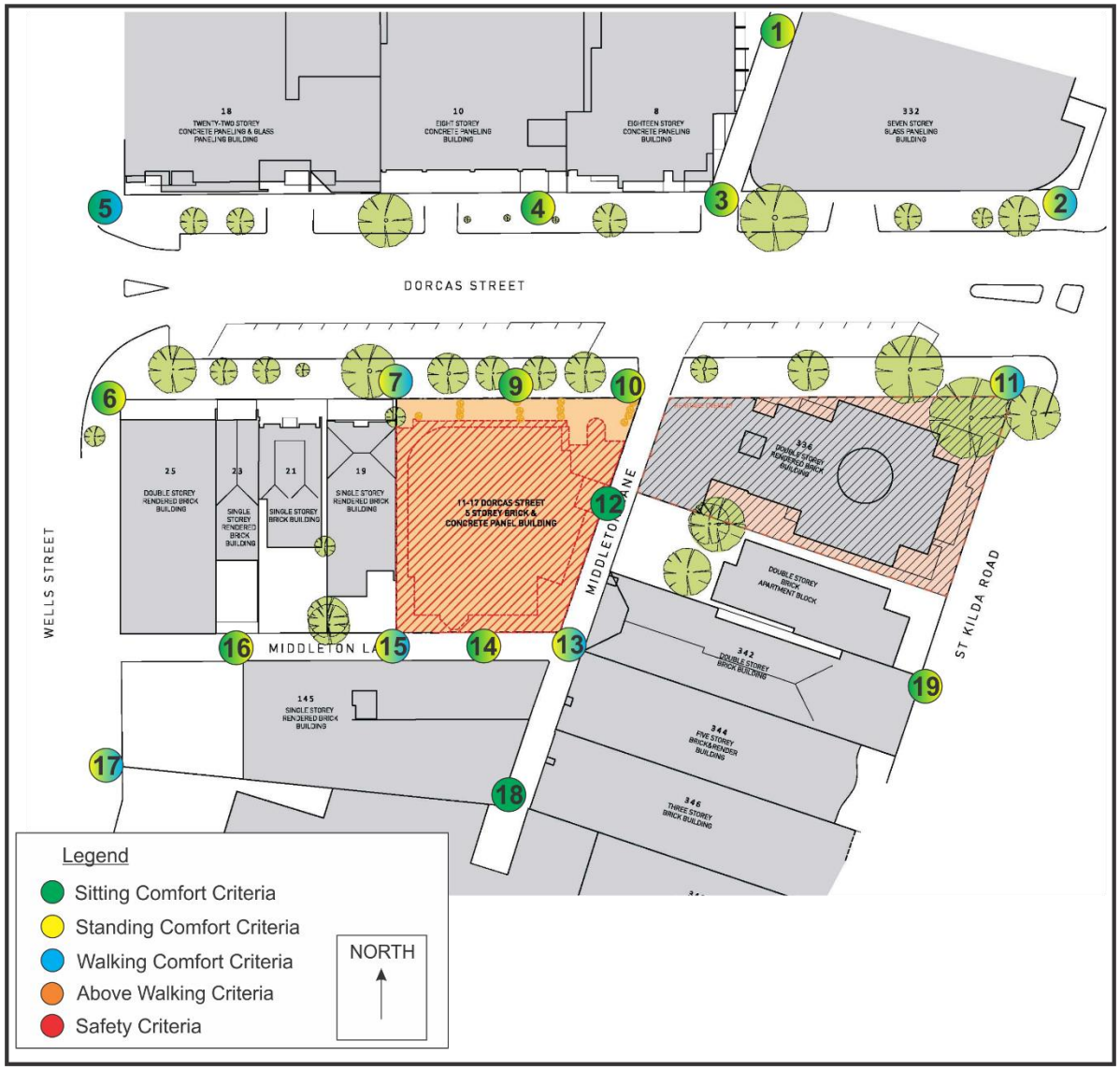


Figure 7a – Summary of ground level wind conditions for the Existing Configuration for 360° of wind direction.

Figure 7b – Summary of ground level wind conditions for the Proposed Configuration for 360° of wind direction.

Figure 8 – Summary of level 5 wind conditions for the Proposed Configuration for 360° of wind direction

Figure 9 – Summary of level 11 wind conditions for the Proposed Configuration for 360° of wind direction

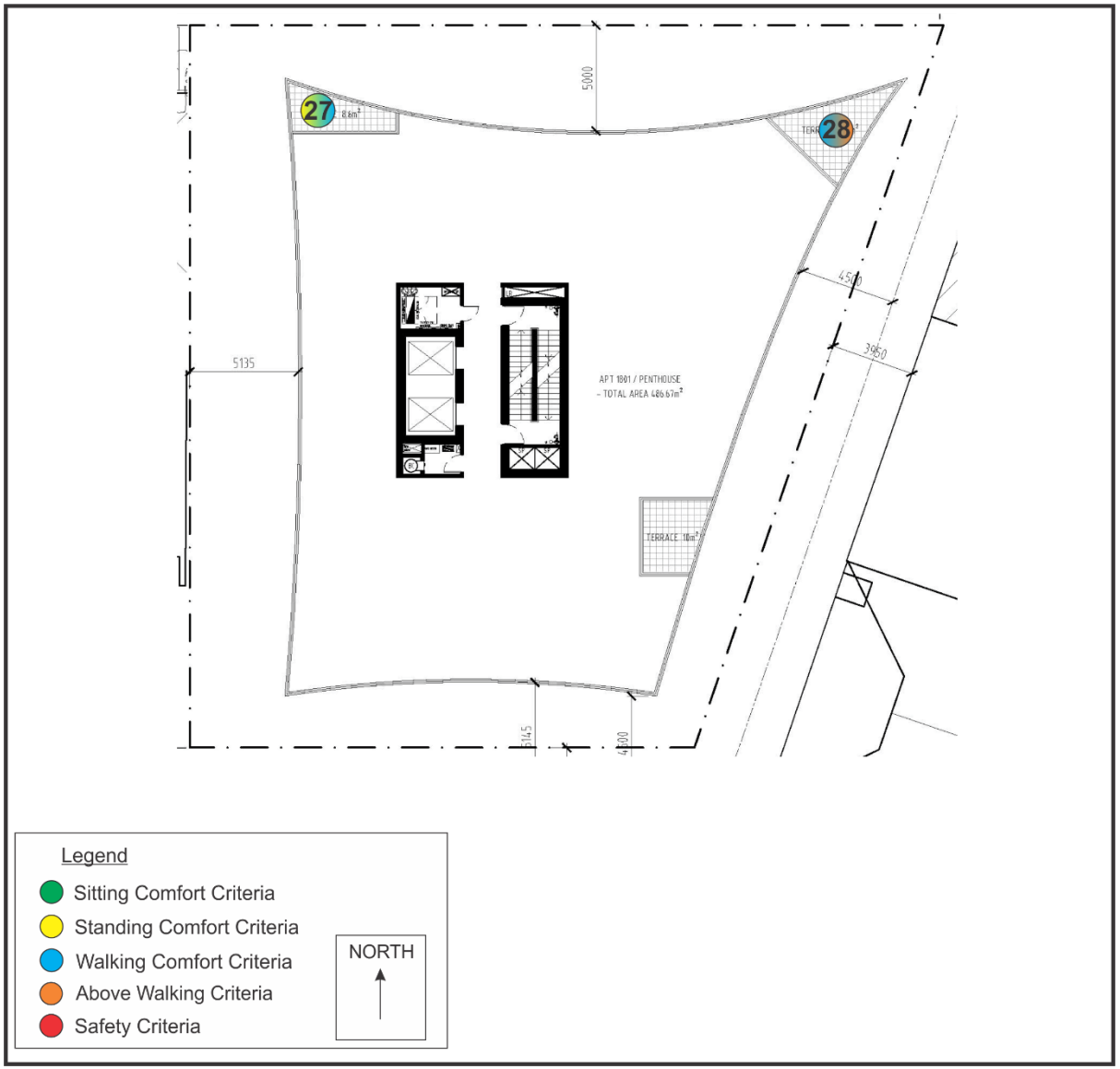


Figure 10 – Summary of level 18 wind conditions for the Proposed Configuration for 360° of wind direction

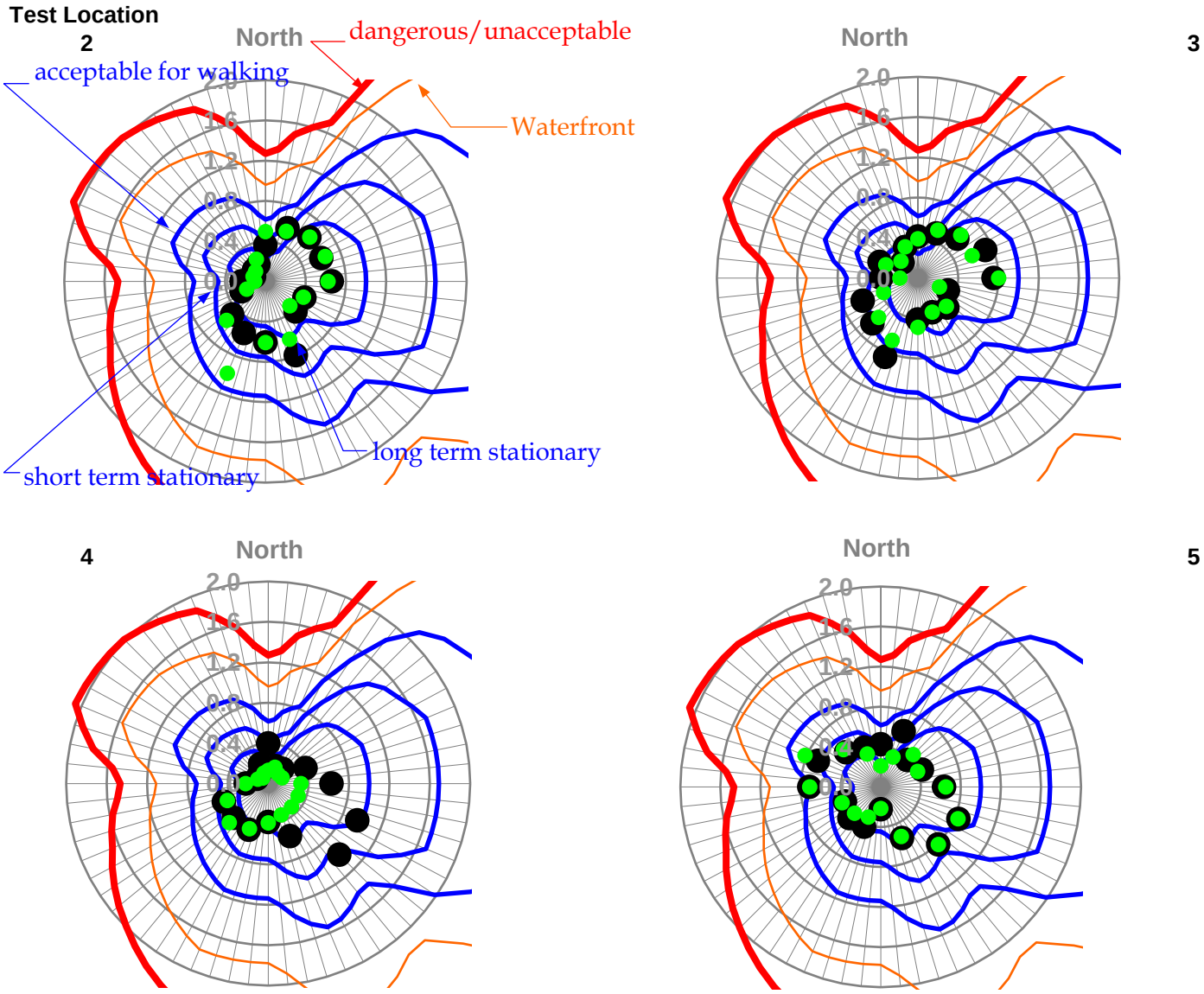


Figure 11 - Dorcas Street

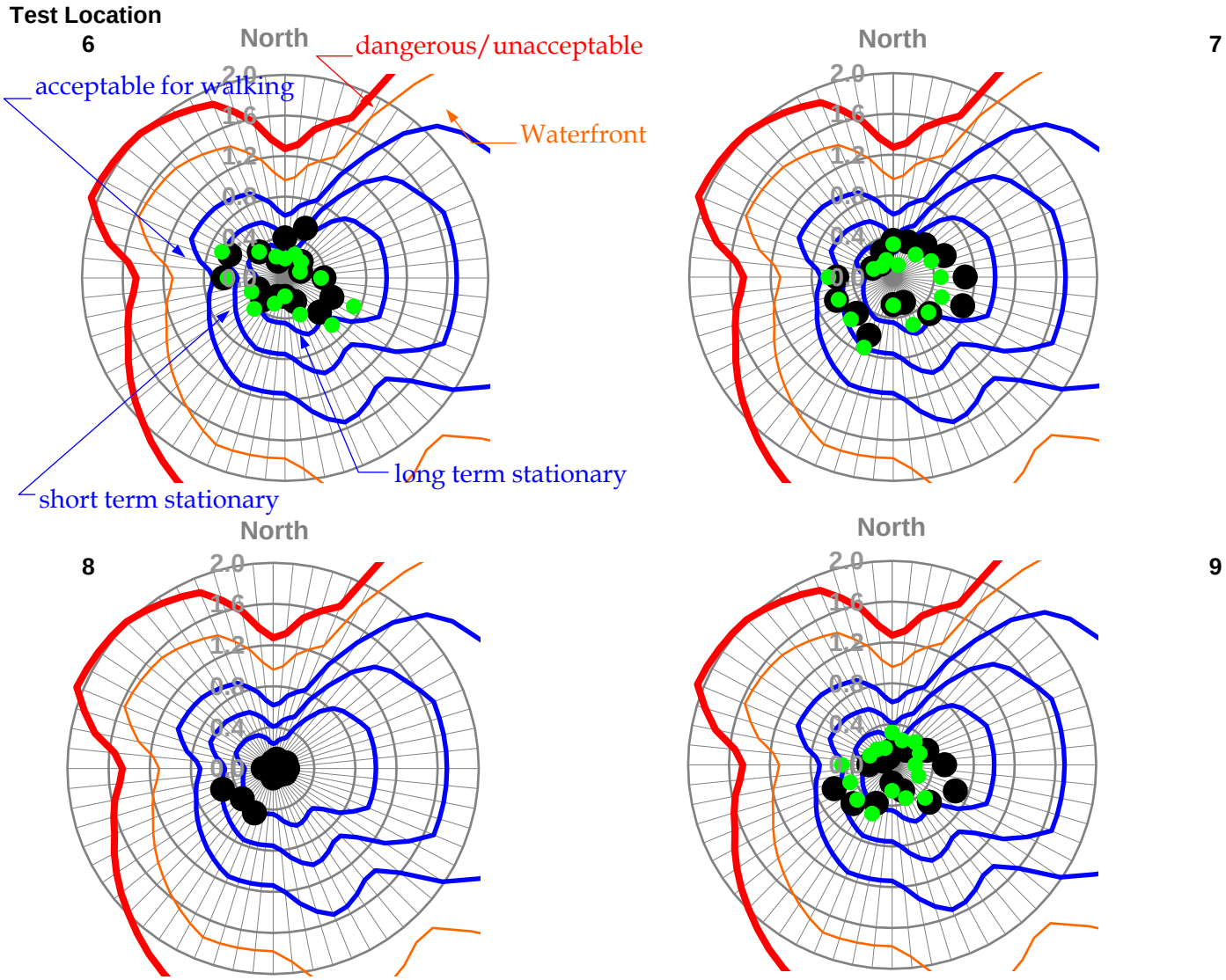


Figure 12 - Dorcas Street - continued

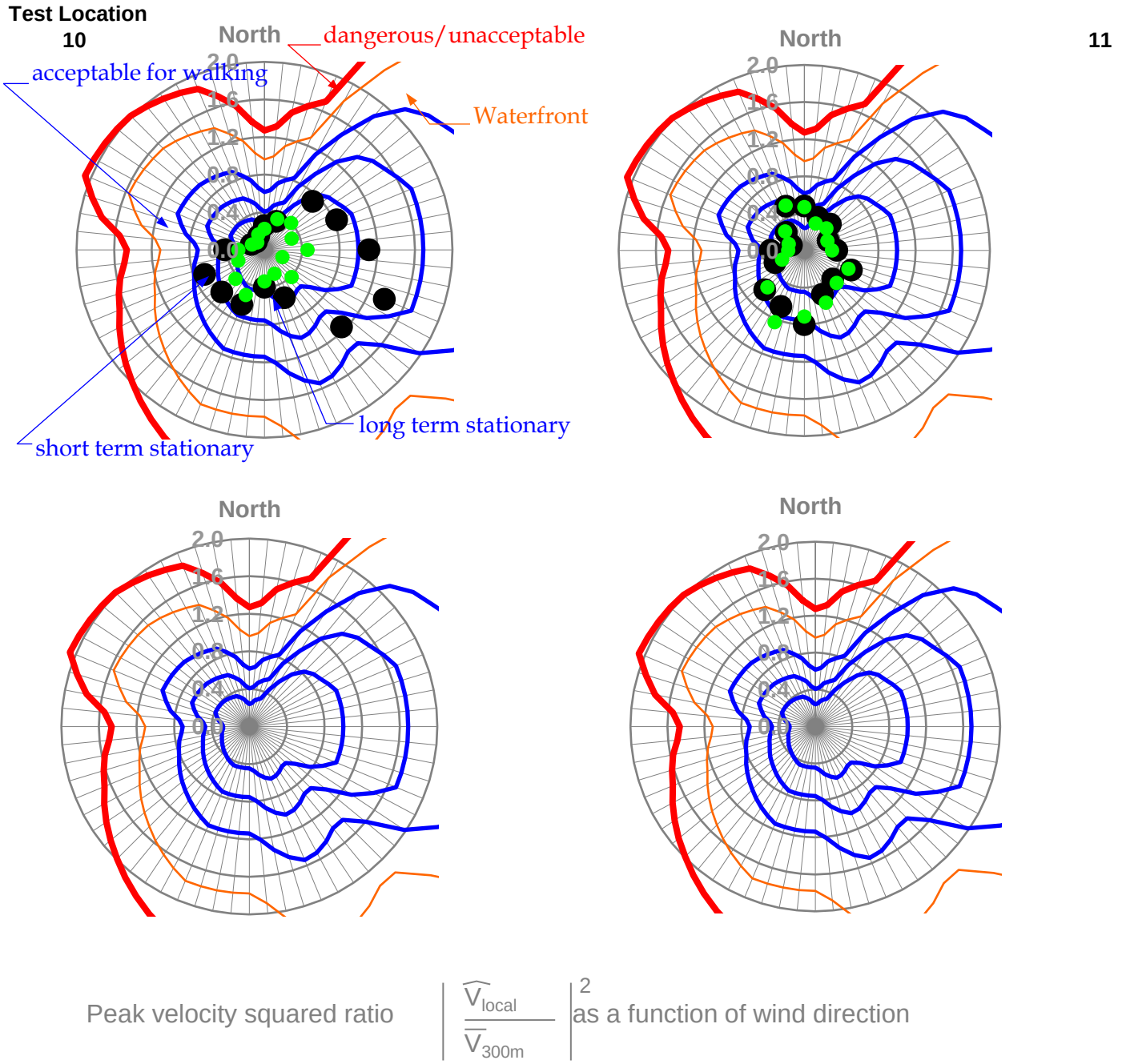


Figure 13 - Dorcas Street - continued

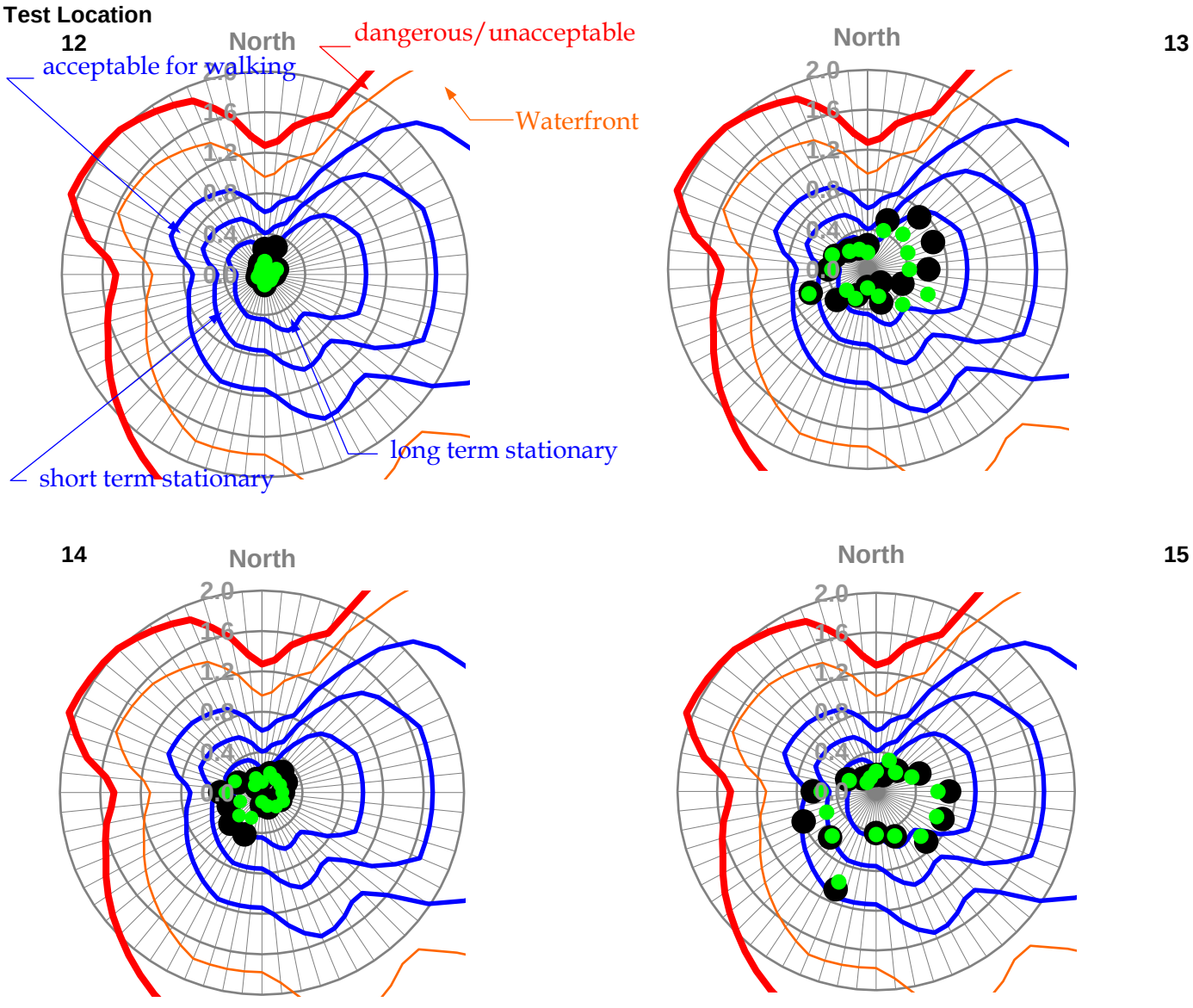


Figure 14 - Middleton Lane

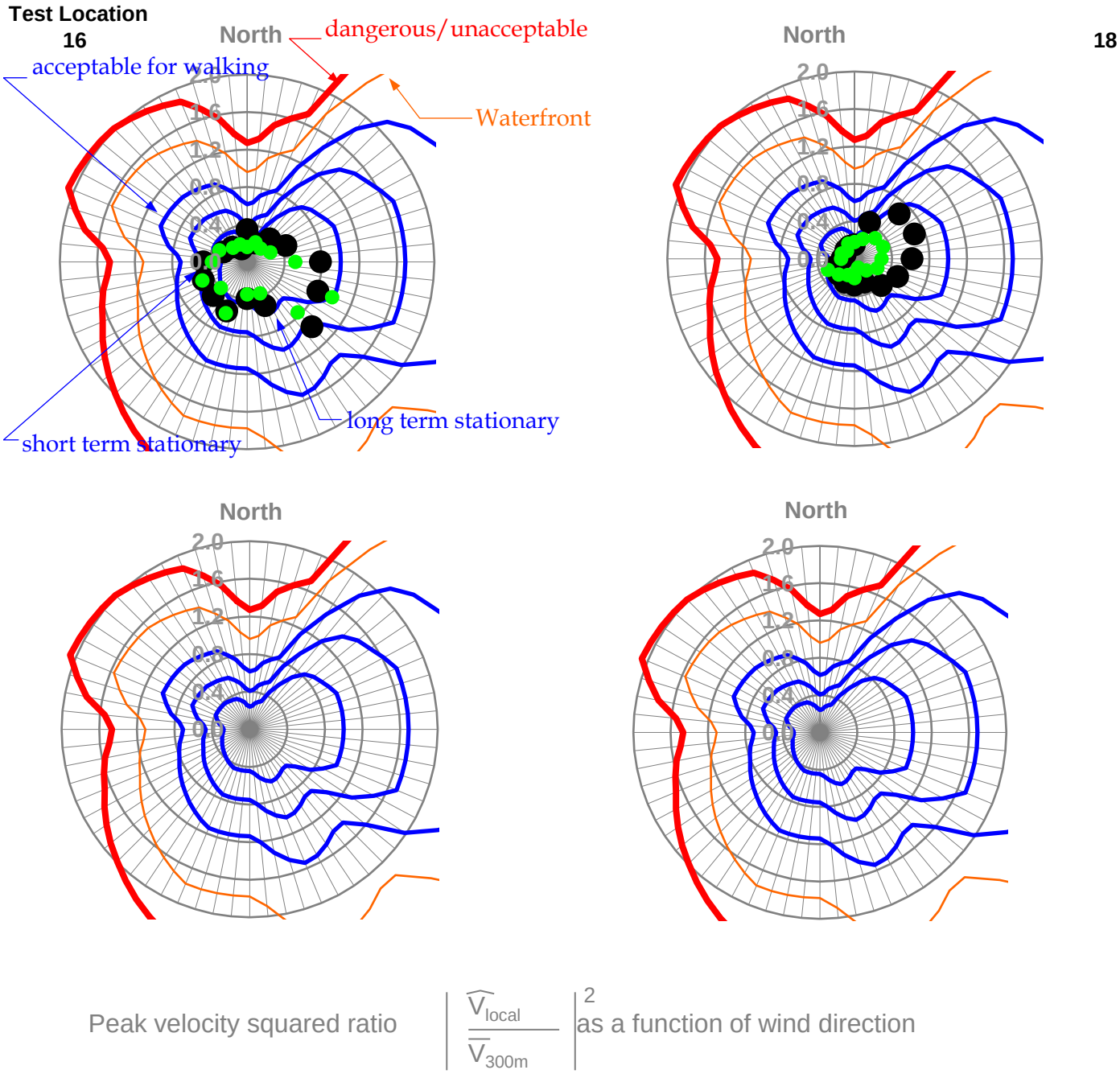


Figure 15 - Middleton Lane - continued

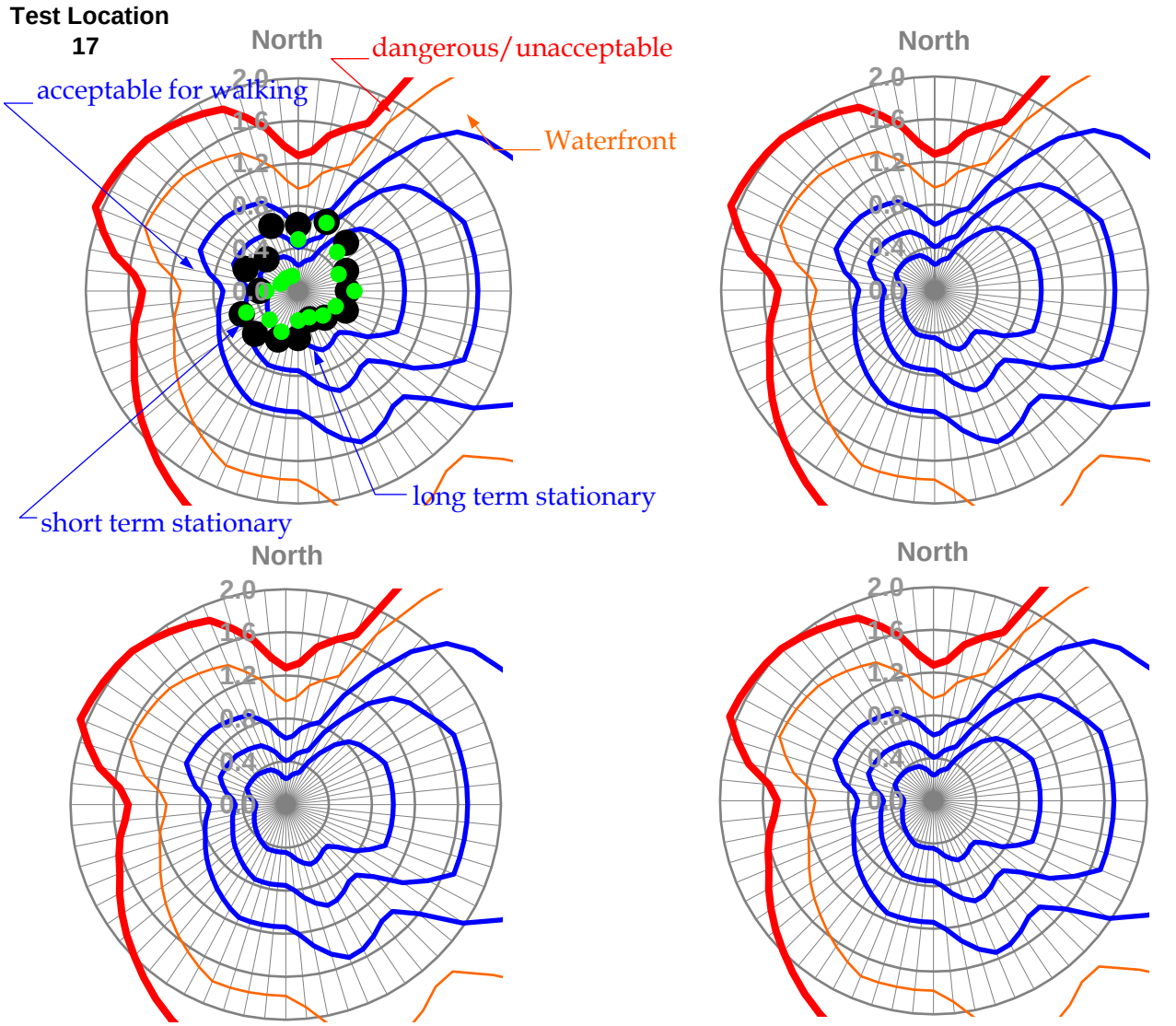


Figure 16 - Wells Street

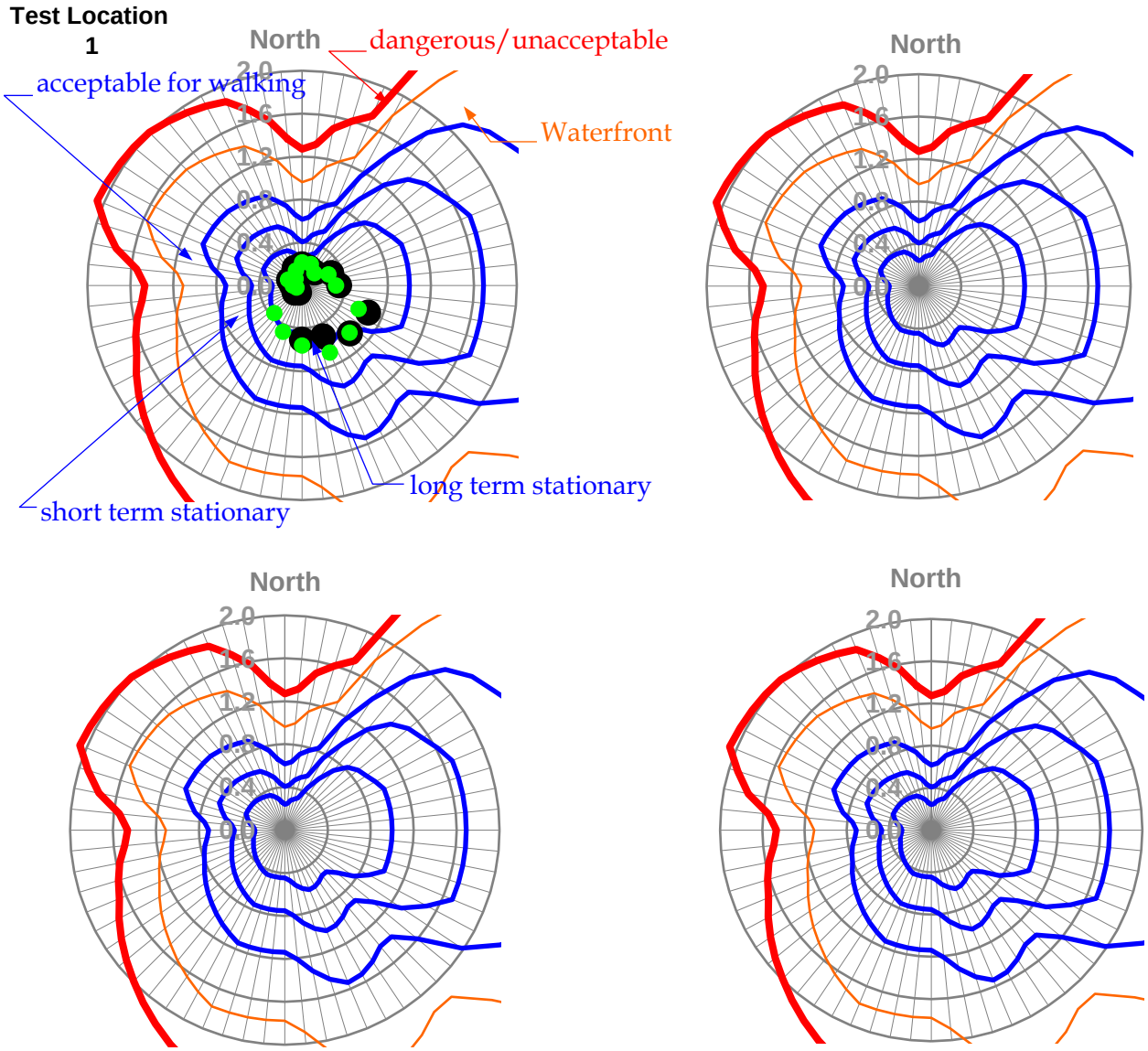


Figure 17 - Anthony Lane

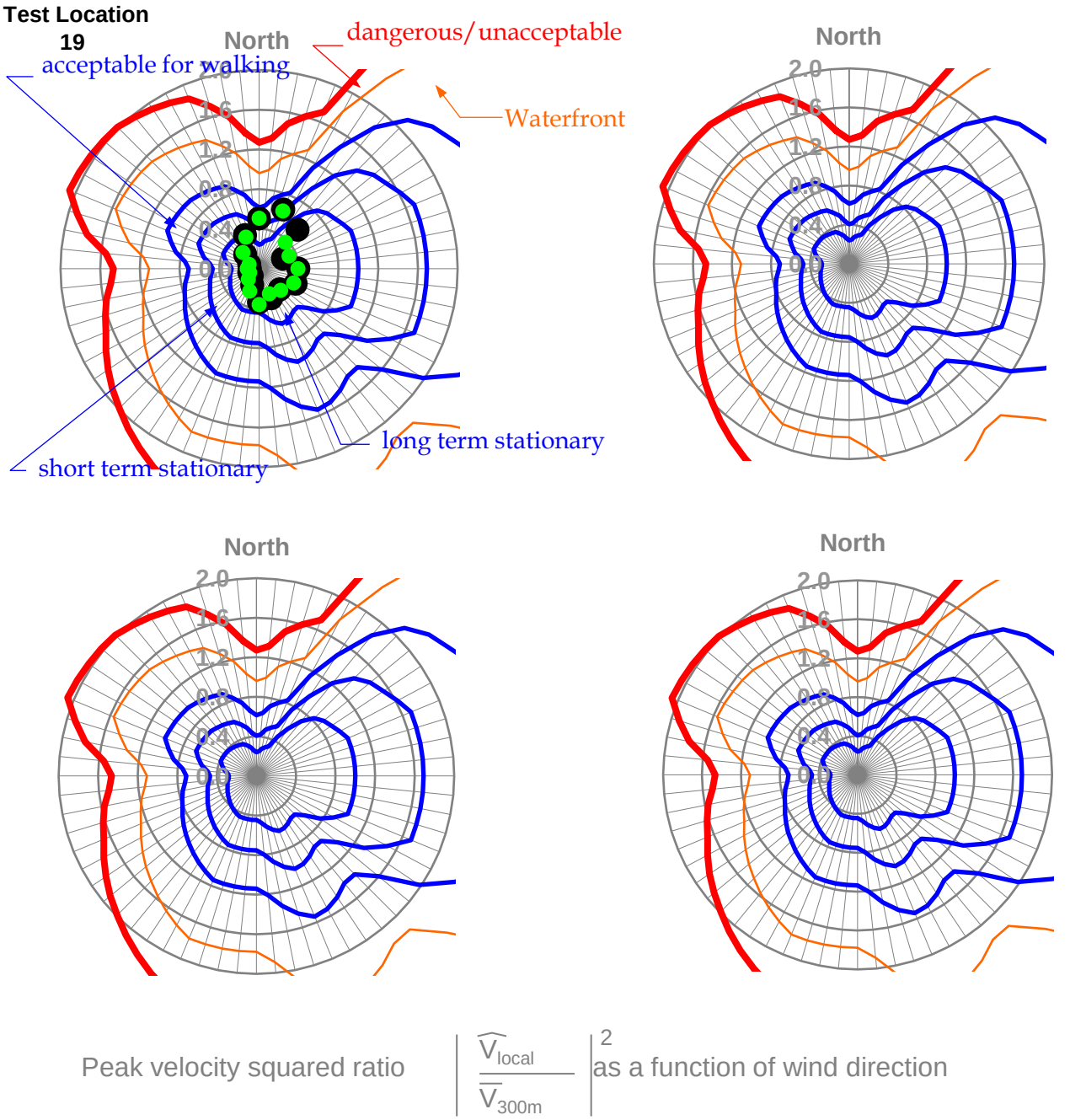


Figure 18 - St Kilda Road

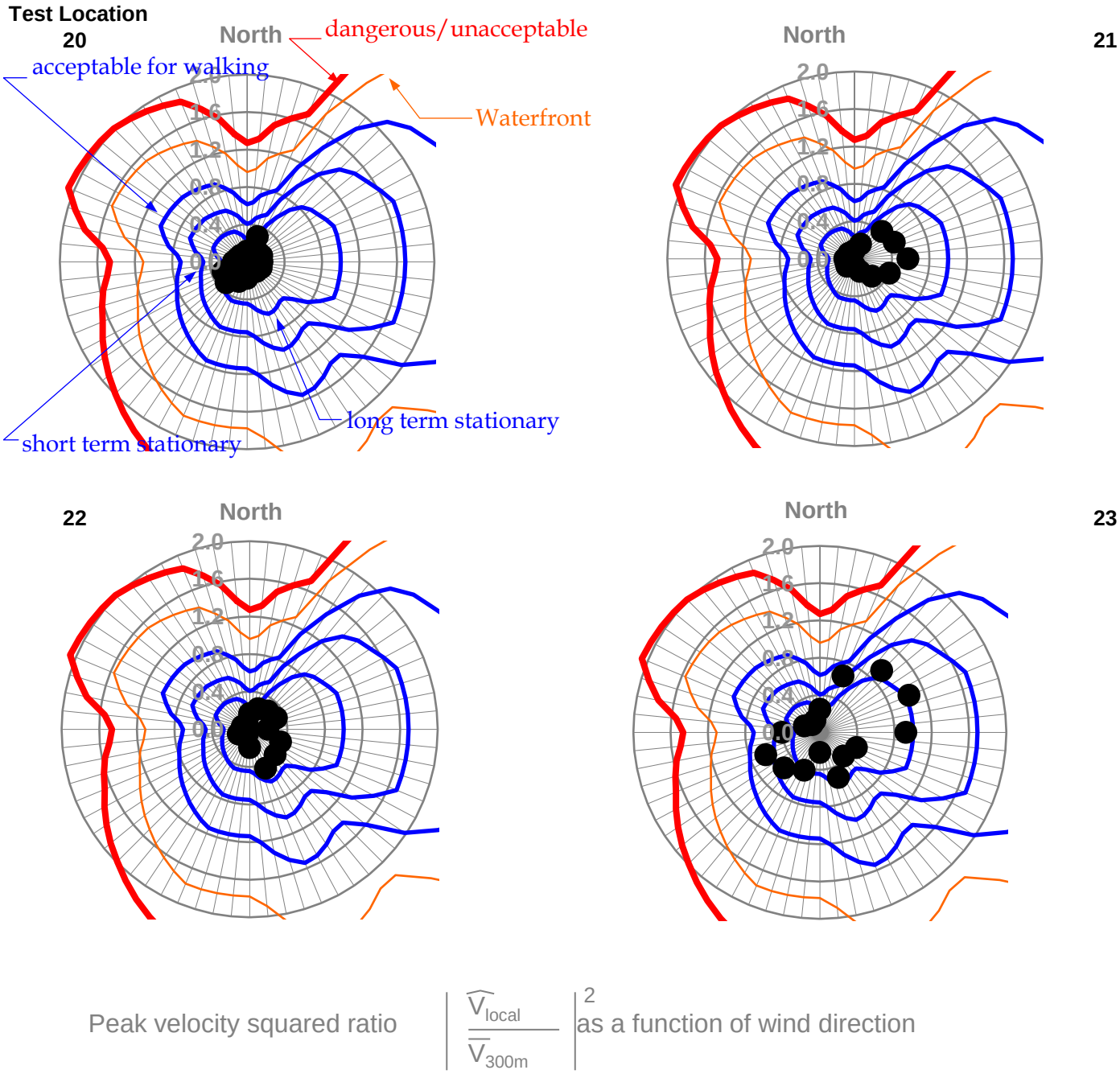
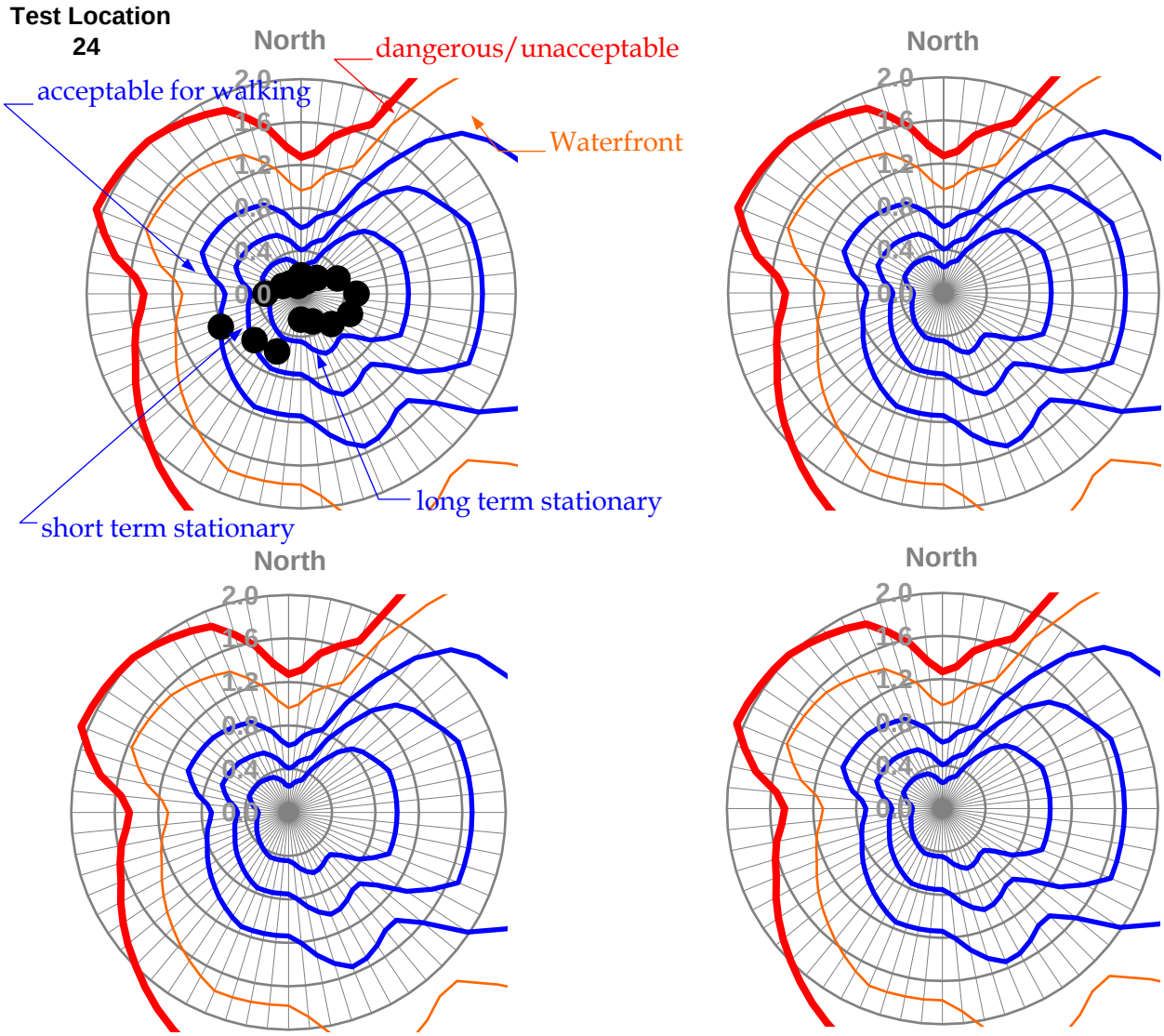


Figure 19 - Level 5 - Terrace



Peak velocity squared ratio $\left|\frac{\widehat{V}_{local}}{\overline{V}_{300m}}\right|^2$ as a function of wind direction

Proposed Configuration ●

Figure 20 - Level 5 - Terrace - continued

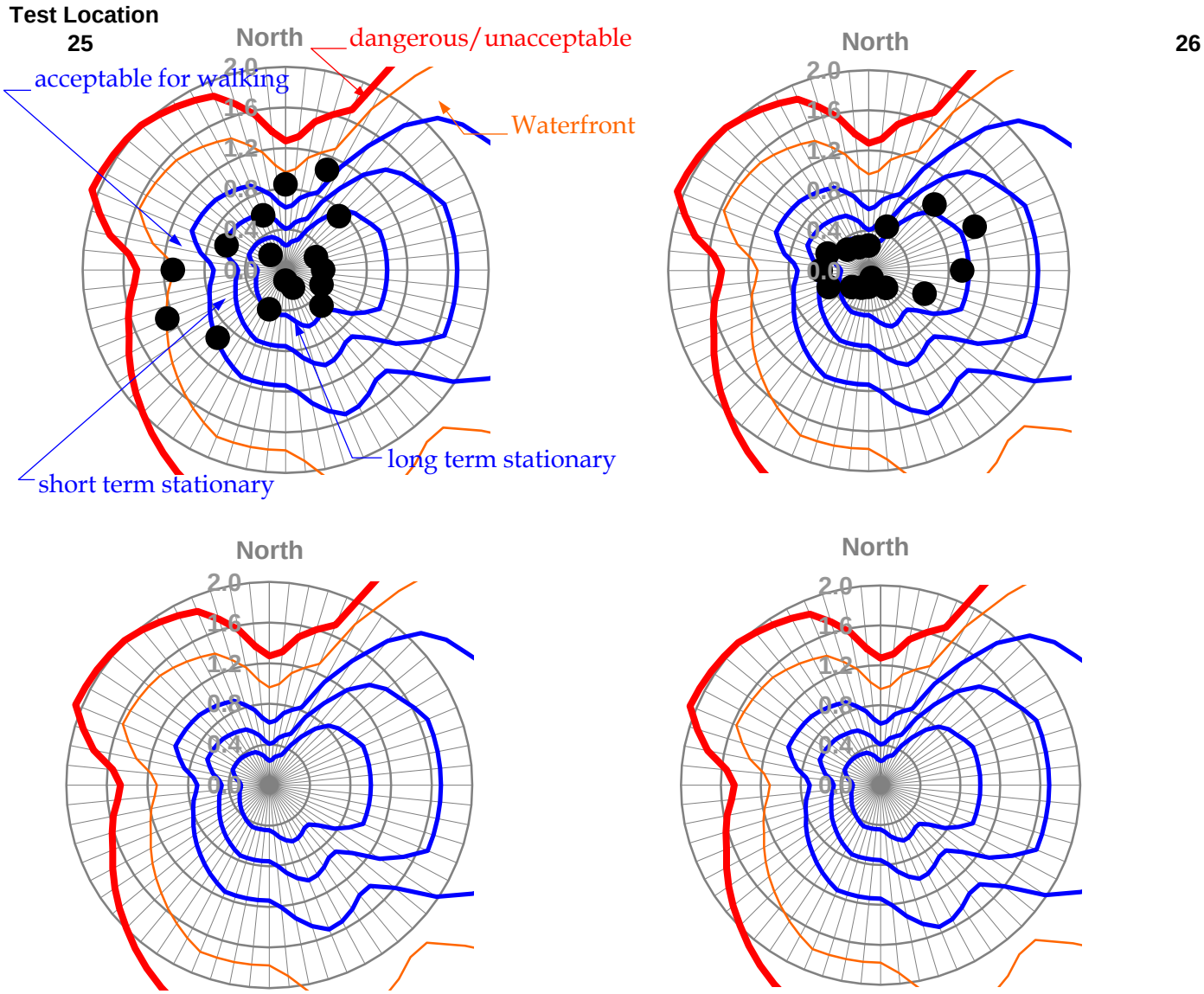


Figure 21 - Level 11 - Terraces

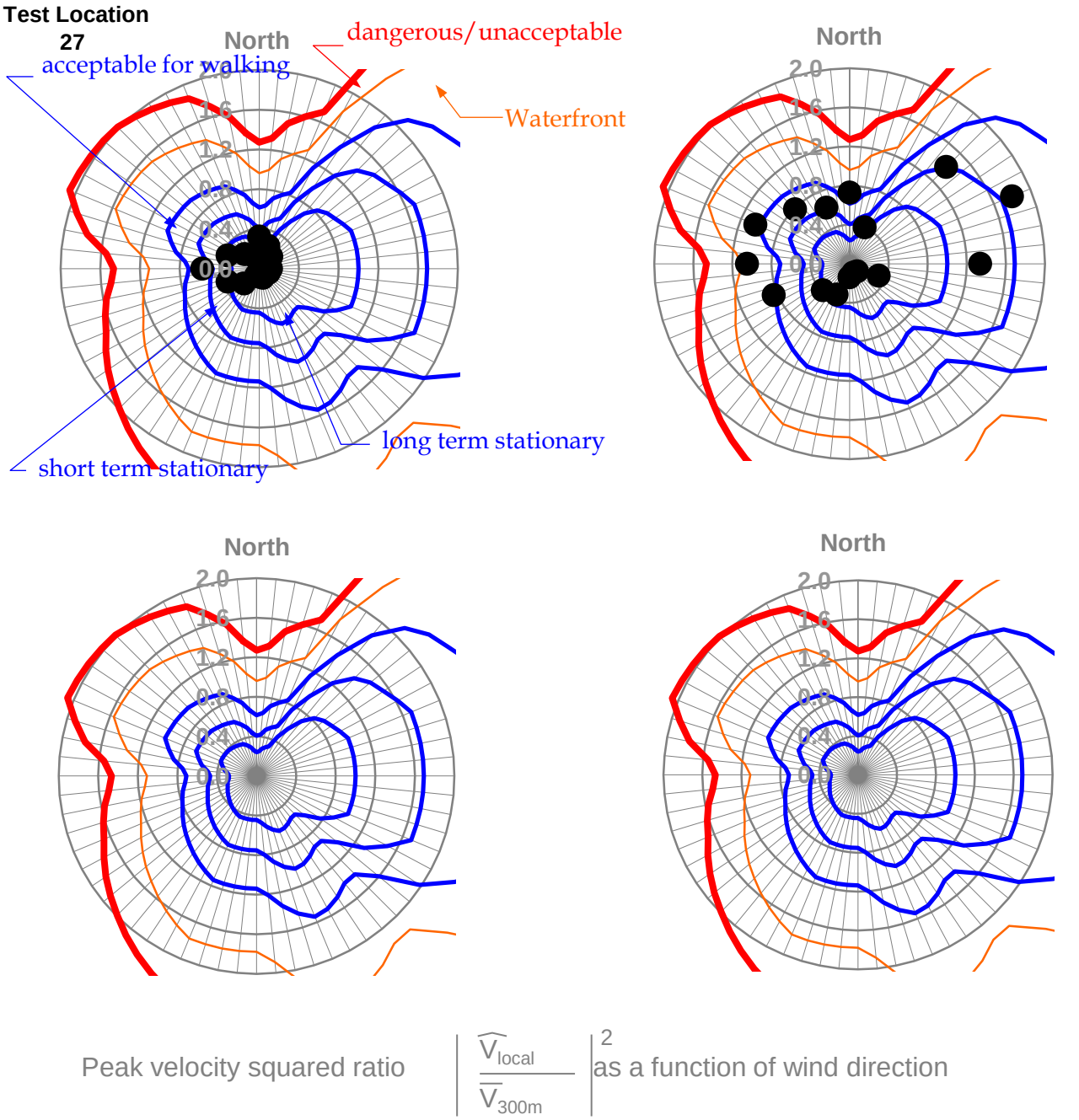


Figure 22 - Level 18 - Terraces