



PEDESTRIAN WIND ENVIRONMENT STATEMENT

DARLINGTON ROAD TERRACES

WD433-01F02(REV0)- WS REPORT

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Prepared for:

The University of Sydney

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EXECUTIVE SUMMARY

This report is in relation to the proposed development known as the Darlington Road Terraces, located in Darlington, Sydney, and presents an opinion on the likely wind conditions affecting the various trafficable outdoor areas within and around the subject development. The effect of wind activity is examined for the three predominant wind directions for the Sydney region; north-easterly, southerly and westerly winds. The analysis of the wind effects relating to the subject development was carried out in the context of the local wind climate, building morphology and land topography.

The conclusions of this report are drawn from our extensive experience in this field and are based on an examination of the architectural drawings which have been prepared by the project architects Allen Jack+Cottier, received November 2016. No wind tunnel tests have been undertaken for the subject development, and hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection. Note that any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

The results of this study indicates that the subject development is expected to benefit from effective shielding of prevailing winds provided by the local neighbouring buildings. Similarly, as Buildings A, B, C and D of the proposed development are at a similar height to the existing terraces along Darlington Road, it is expected that the addition of these four buildings will not have a detrimental impact on the existing wind conditions surrounding the site. It is expected that suitable wind conditions can be achieved for all trafficable outdoor areas within and around the site with the inclusion of the following recommendations:

- Retention of the proposed 1.8m high privacy screens on the perimeter of the outdoor terrace on level 4 of Building A
- Inclusion of landscaping/foilage such as shrubs and small trees for the "planter" zones within the courtyard areas.

Hence, with the inclusion of the abovementioned recommendations within the final design of the development, it is expected the wind conditions for all outdoor trafficable within and around the development will be acceptable for its intended uses.

Note that tree planting should be of an evergreen variety to ensure effectiveness in wind mitigation throughout all seasons. The inclusion of additional densely foliating vegetation such as trees or shrubs/hedge planting is expected to further enhance the localised wind conditions within and around the subject development site.

1 DESCRIPTION OF THE PROPOSED DEVELOPMENT AND SURROUNDS

The proposed development site is located in Darlington, Sydney, within the bounds of the University of Sydney Camperdown/Darlington Campus. The site is situated between Darlington Road and Darlington Lane, with Codrington Street and Golden Grove Street to the east and west of the site respectively.

Situated within the University of Sydney Camperdown/Darlington Campus, the local terrain surrounding the subject development consists of a number of existing low to medium-rise buildings. To the north is the Merewether building, the Storie Dixon Wing, and the future Darlington College redevelopment to the immediate north-west. East of the site is the low-rise University Sports and Aquatic Centre. The medium-rise Business School building and the Codrington Building on the opposite side of Darlington Lane, occupies the majority of the southern aspect of the site, with Darlington public school to the immediate south-west. Immediately west of the site are a number of low-rise residencies populated with existing tree planting.

A survey of the local land topography indicates a downhill slop running west-to-east along the Darlington Road and Darlington Lane aspects of the site. A similar downhill gradient is also observed running north-to-south through the site. An aerial image of the site and the surroundings is shown in Figure 1.

The proposed development consists of four mixed-use student residency buildings, to be constructed along Darlington Lane, adjacent to the row of existing residential terraces on Darlington Road. The development site itself is sub-divided into 4 distinct lots, separated by existing residential terraces. Central courtyards which function as a pedestrian thoroughfare and student recreational spaces, span the gap between the existing terraces and the four proposed buildings.

The critical trafficable outdoor areas associated with the proposed development, which are the focus for pedestrian wind effects in this assessment, are detailed as follows:

- Pedestrian footpaths along the various frontages of the development.
- The level 4 outdoor terrace within Building A.
- The central courtyards between the existing terraces and the four proposed buildings.

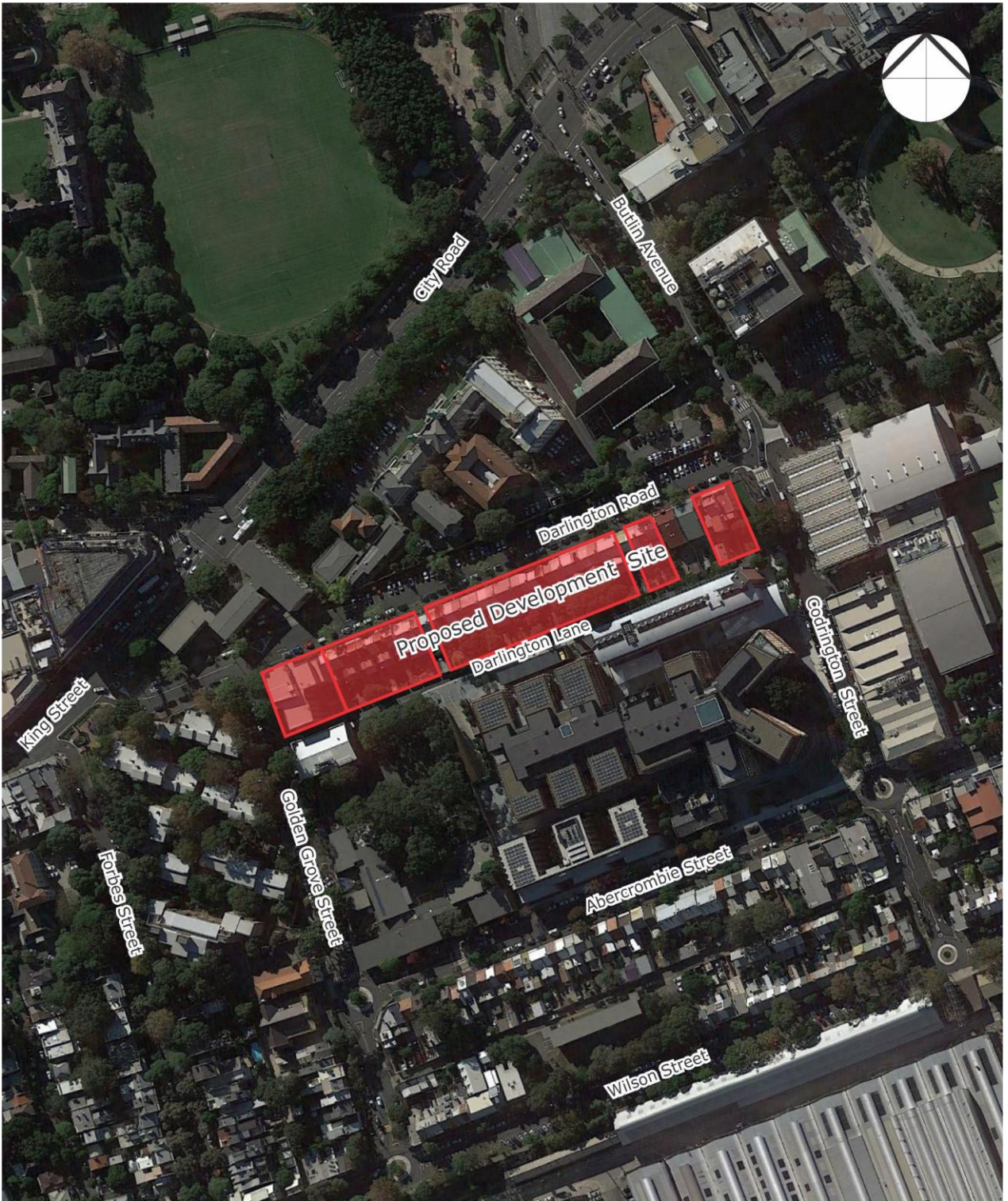


Figure 1: Aerial Image of the Site Location

2 WIND CLIMATE OF THE SYDNEY REGION

The Sydney region is governed by three principle wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south and west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. This summary is based on a detailed analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1939 to 2008). From this analysis, a directional plot of the annual and weekly recurrence winds for the Sydney region is also determined, as shown in Figure 2. The frequency of occurrence of these winds is also shown in Figure 2.

As shown in Figure 2, the southerly winds are by far the most frequent wind for the Sydney region, and are also the strongest. The westerly winds occur most frequently during the winter season for the Sydney region, and although they are typically not as strong as the southerly winds, they are usually a cold wind since they occur during the winter and hence can be a cause for discomfort for outdoor areas. North-easterly winds occur most frequently during the warmer months of the year for the Sydney region, and hence are usually welcomed within outdoor areas since they are typically not as strong as the southerly or westerly winds.

Table 1: Principle Time of Occurrence of Winds for Sydney

Month	Wind Direction		
	North-Easterly	Southerly	Westerly
January	X	X	
February	X	X	
March	X	X	
April		X	X
May			X
June			X
July			X
August			X
September		X	X
October	X	X	
November	X	X	
December	X	X	

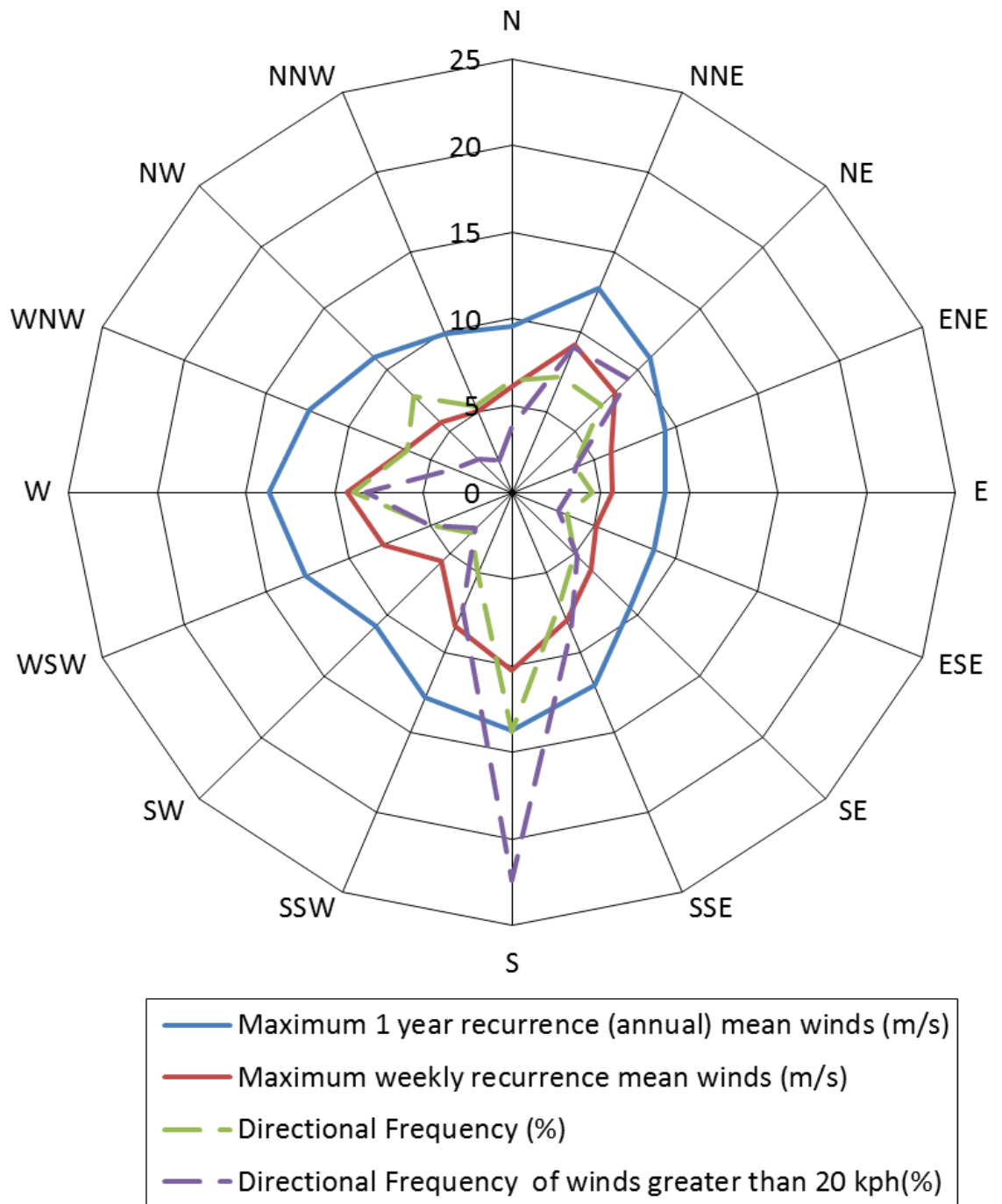


Figure 2: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10-minute mean observations from Kingsford Smith Airport from 1939 to 2008, corrected to open terrain at 10m)

3 WIND EFFECTS ON PEOPLE

The acceptability of wind in any area is dependent upon its use. For example, people walking or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as Davenport, Lawson, Melbourne, Penwarden, etc, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have also adopted elements of some of these into their planning control requirements in Australia. The following table is an example, which was developed by Penwarden in 1975, and describes the effects of various wind intensities on people. Note that the applicability column relates to the indicated wind conditions occurring frequently (exceeded approximately once per week on average). Higher ranges of wind speeds can be tolerated for rarer events.

Table 2: Summary of Wind Effects on People (Penwarden, 1975)

Type of Winds	Mean Wind Speed (m/s)	Effects	Applicability
Calm, light air	0 - 1.5	Calm, no noticeable wind.	Generally acceptable for Stationary, long exposure activities such as in outdoor restaurants, landscaped gardens and open air theatres.
Light breeze	1.6 - 3.3	Wind felt on face.	
Gentle breeze	3.4 - 5.4	Hair is disturbed, Clothing flaps.	
Moderate breeze	5.5 - 7.9	Raises dust, dry soil and loose paper. Hair disarranged.	Generally acceptable for walking & stationary, short exposure activities such as window shopping, standing or sitting in plazas.
Fresh breeze	8.0 - 10.7	Force of wind felt on body.	Acceptable as a main pedestrian thoroughfare
Strong breeze	10.8 - 13.8	Umbrellas used with difficulty, Hair blown straight, Difficult to walk steadily, Wind noise on ears unpleasant.	Acceptable for areas where there is little pedestrian activity or for fast walking.
Near gale	13.9 - 17.1	Inconvenience felt when walking.	
Gale	17.2 - 20.7	Generally impedes progress, Great difficulty with balance.	Unacceptable as a public accessway.
Strong gale	20.8 - 24.4	People blown over by gusts.	Completely unacceptable.

It should be noted that wind speeds can only be accurately quantified with a wind tunnel study. This assessment addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and the acceptability of the conditions for outdoor areas are determined based on their intended use (rather than referencing specific wind speeds). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

4 RESULTS AND DISCUSSION

The expected wind conditions are discussed in this section for the various outdoor areas within and around the subject development for each of the three predominant wind directions for the Sydney region. The interaction between the wind and the building morphology in the area was considered, and important features taken into account include the distances between the building form, their overall heights and bulk, as well as the landform. Note that only the potentially critical wind effects are discussed in this report.

4.1 Site Location

The subject development is expected to benefit from shielding of prevailing winds provided by the surrounding infrastructure. The eastern portion of the subject development will benefit from the shielding of the southerly winds by the Business School building and the Codrington Building immediately south of the development. The existing tree planting on the northern boundary of Darlington Public school is similarly expected to shield the western portion of the subject development from the prevailing southerly winds.

The existing tree planting on the eastern corner of the proposed development, as well as the tree planting situated further upstream between the School of Molecular Bioscience and the University Sports and Aquatic Centre, is expected to ameliorate the potential for adverse wind effects caused by incident north-easterly winds.

In addition, the extensive tree planting surrounding the low-rise residential dwellings to the west of the development will benefit wind conditions by slowing the prevailing westerly winds upstream of the development.

4.2 Footpaths Surrounding the Frontages of the Development

The heights of Buildings A, B, C and D which are proposed for construction, do not exceed the height of the existing terraces along Darlington Road. As such, it is expected that the addition of these structures will not have any detrimental impact on the existing wind conditions experienced by pedestrians travelling along the Darlington Road, Golden Grove Street and Codrington Street frontages of the development.

Darlington Lane is expected to be sufficiently shielded from any potentially adverse wind effects caused by prevailing winds and hence, wind conditions along this lane are expected to be suitable for its intended use. The set-back design of the entrance to Building A and associated overhead canopy will serve to further improve the local wind conditions in proximity to the Building A entrance.

4.3 Building A, Level 4 Outdoor Terrace

The Level 4 Outdoor Terrace within Building A is moderately exposed to the prevailing southerly winds. To ensure comfortable wind conditions within this outdoor area, it is recommended to retain the proposed 1.8m perimeter privacy screen as shown in Figure 3.

4.4 Central Courtyards

The open courtyard areas situated between the existing terraces and Buildings A, B, C and D will benefit from the shielding of prevailing winds provided by both of these adjacent structures. To ensure comfortable wind conditions within these areas for pedestrians, it is recommended that "planter" zones, as designated within the architecture plans, should include dense foliage such as shrubs and small tree planting. Such landscaping should be of an evergreen variety to ensure wind-mitigation throughout the entire year.

Treatments Legend

Retention of proposed 1.8m privacy screen



Figure 3: Recommended Treatments – Building A, Level 4 Terrace