PEDESTRIAN WIND ENVIRONMENT STATEMENT

ALEXANDRIA PARK COMMUNITY SCHOOL

WD711-03F03(REV0)- WS REPORT

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Prepared for:

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DOCUMENT CONTROL

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EXECUTIVE SUMMARY

This report is in relation to the proposed Alexandria Park Community School and presents an opinion on the likely impact of the proposed design on the local wind environment at the critical outdoor areas within and around the subject development. The effect of wind activity is examined for the three principal wind directions for the Sydney region; namely the north-easterly, southerly and westerly winds. The analysis of the wind effects relating to the proposed 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 TKD Architects, "Issue for Test of Adequacy" issued and received December 1, 2017. No wind tunnel testing has 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. 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 site benefits from shielding from the prevailing southerly and westerly winds particularly on the ground level due to the mix of low to mid-rise buildings that are apparent in these directions. However, the site is exposed to the prevailing northerly-easterly winds due to the minimal shielding of winds travelling over Alexandria Park.

The conditions along the pedestrian footpath areas along Buckland Street, Belmont Street and Park Road are expected to be equivalent to or slightly better than existing site conditions. Areas that have the potential to experience adverse wind conditions include the thoroughfare area between Buildings B1 and B2 and the Ground Floor outdoor communal courtyard. Similarly, there is the potential for adverse wind conditions within the outdoor areas on the Second, Third and Fourth Floors, as well as the outdoor communal spaces on the Second and Third Floors. To improve wind conditions in these areas, it is recommended to include the following in-principle treatments:

- Densely foliating evergreen shrubs capable of growing to a height of at least 1.2-1.5m above the ground floor slab situated along the thoroughfares or thoroughfare entrances between Buildings B1 and B2 on the Ground Floor.
- Retention of proposed densely foliating evergreen trees at the southern end of the sports field. These trees should be capable of growing to a height of 3-5m, with a canopy width of 3-5m.
- Retention of proposed densely foliating evergreen shrub planting and tree layout at the southern extent of the development site situated around and between Buildings C and D. The shrubs should be capable of growing to a height of 1.2-1.5m above the floor

slab. The trees should be capable of growing to a height of 2-3m, with a canopy width of 2-3m.

- Retention of the impermeable awning on First Floor, located on the western aspect of the conjoined Building A and B1.
- Retention of the impermeable awning on the Second Floor along the western aspect of Building B1 and B2, situated directly above the entrance walkway.
- Recommended inclusion of 1.2-1.5m high impermeable balustrade along the north-eastern First Floor balcony of Building E.
- Retention of 1.8m high louvered screens around the perimeter of the Second Floor Staff and Administration Area of Building E.
- Retention of impermeable screens around the perimeter of the outdoor rooftop sport zone located at the north-west of the Second Floor of Building A. The screens should be of a minimum height of 2m.
- Retention of 1.2-1.5m high impermeable balustrades along the Second, Third and Fourth Floor outdoor areas located on the eastern aspects of Building A and B.
- Retention of impermeable screens around the perimeter of the outdoor rooftop recreation area on the Third Floor of Building C, D and E. The screens should be a minimum height of 2m.

With the inclusion of the above recommended in-principle treatments it is expected that all areas within and around the development will experience suitable wind conditions. Wind tunnel testing is recommended to be undertaken as part of the detailed design phase of the subject development. This will provide a quantitative analysis of the wind conditions and determine the size and extent of the treatments required to ensure suitable wind conditions are achieved at all outdoor accessible locations within and around the development.

1 DESCRIPTION OF THE DEVELOPMENT AND SURROUNDINGS

The Alexandria Park Community School development is located at 7 Park Road, Alexandria. The site is bounded by Buckland Street to the north, Park Road to the east and a mix of low-rise and mid-rise buildings to the south and west. To the north of the site are low-rise residential buildings, to the east is Alexandria Park, as well as a mix of low-rise to mid-rise commercial buildings. To the south and west of the site there is a mix of low-rise and mid-rise commercial buildings.

A survey of the local land topography indicates that the terrain within the site region is relatively flat. An aerial image of the subject site and the local surroundings is shown in Figure 1.

The proposed Alexandria Park Community School development consists of multiple buildings. These buildings are referred to and labelled as Building A, B1, B2, C, D and E. Buildings A and B1 are joined at Ground Floor and Buildings B1 and B2 are joined at the Second Floor. Buildings A and B consist of 5 levels inclusive of the Ground Floor. Buildings C, D and E consist of 3 Floor levels inclusive of the Ground Floor.

The entire development has a unique planform, consisting of curves, setbacks and rooftop campus regions. The critical trafficable areas associated with the proposed development, which are the focus of this assessment with regards to wind effects, are detailed as follows:

- Ground Floor pedestrian footpaths along Buckland Street, Park Road and Belmont Street.
- Ground Floor communal open spaces to the south of the Sports Field.
- The multiple outdoor learning spaces throughout the development.
- Staff and Administration Area located on the Second Floor and the Roof Top Play Area located on the Third Floor.

Figure 1: Aerial Image of the Site Location

2 WIND CLIMATE OF THE SYDNEY REGION

The Sydney region is governed by three principal 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 1995 to 2016). 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: Principal 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	

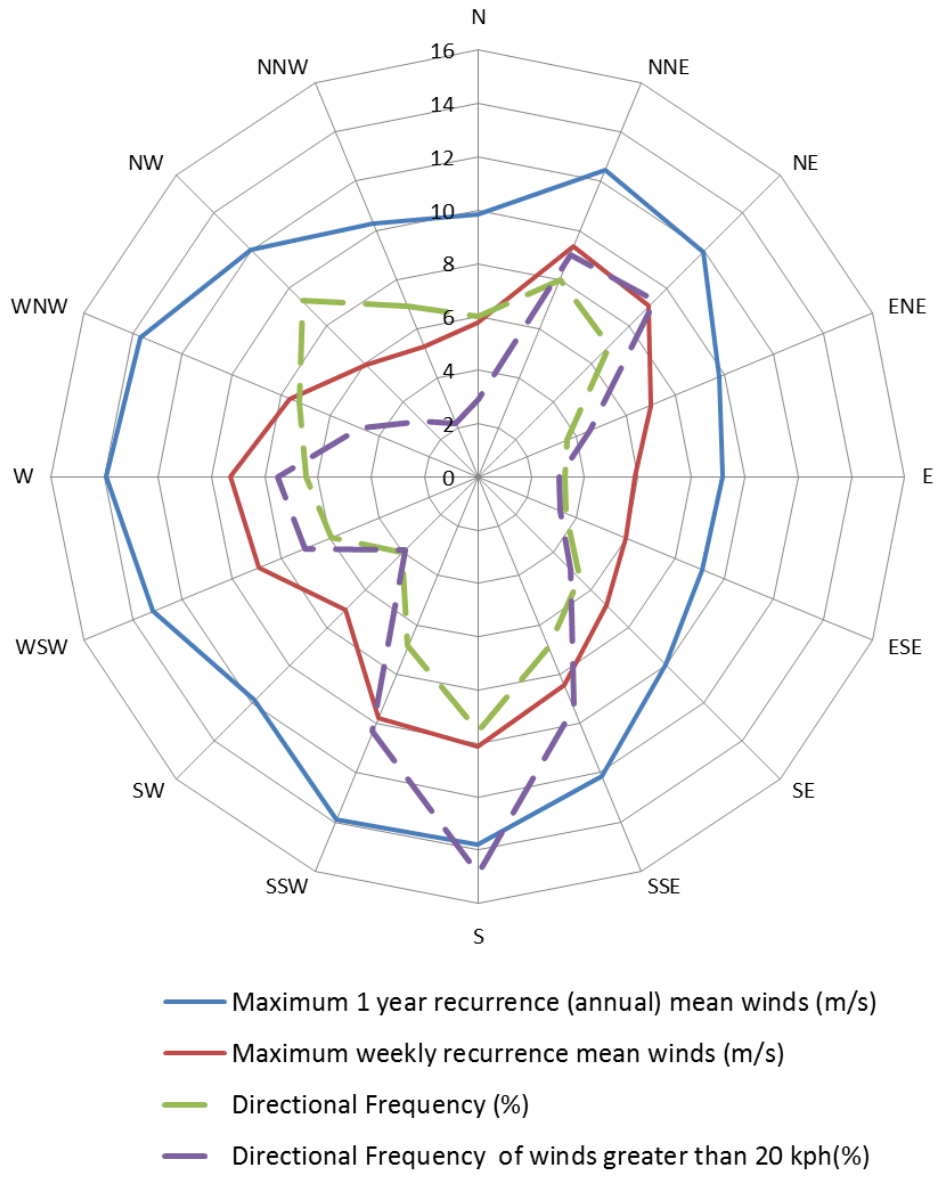

Figure 2: Annual and Weekly Recurrence Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on 10-minute mean observations from Kingsford Smith Airport from 1995 to 2016, corrected to open terrain at 10m)

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 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 the following sub-sections of this report 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 is considered and important features are taken into account including the distances between the surrounding buildings and the proposed building form, their overall heights and bulk, as well as the surrounding landform. Note that to be effective in wind mitigation, trees and planting should be densely foliating with interlocking canopies where possible. Note that only the potentially critical wind effects are discussed in this report. It should be noted that no wind tunnel testing has 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. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

4.1 Ground Floor Pedestrian Accessible Areas

The site is generally shielded from the prevailing winds approaching from the south and west due to the low to mid-rise buildings. The prevailing winds for the Sydney region are the north-easterly, southerly and westerly winds. The north-easterly winds have the potential to impact the site due to the limited shielding from these directions.

The wind conditions of the pedestrian footpath area along Buckland Street are expected to benefit from the existing trees located along Buckland Street as well as the shielding from the low to mid-rise buildings to the north and west. The conditions along the footpath areas of Buckland Street are expected to be equivalent to or slightly better than existing site conditions.

The wind conditions of the footpath area along Belmont Street is expected to benefit from the shielding to the south and west due to the low to mid-rise buildings. There is the potential for the prevailing north-easterly and westerly winds to cause adverse wind conditions to be experienced within the thoroughfare area between Buildings B1 and B2 due to the orientation of the thoroughfare resulting in the funnelling of winds. The entry area to the thoroughfare may also be exposed to adverse wind conditions due to prevailing westerly winds down washing off the western building facade.

It is recommended to include densely foliating evergreen shrubs capable of growing to a height of 1.2-1.5m above the ground floor slab situated along the thoroughfares or thoroughfare entrances between Buildings B1 and B2 on the Ground Floor. It is also recommended to retain the awnings along the western aspect of the development on the First and Second Floor.

4.2 Ground Floor Communal Spaces

The outdoor communal courtyard space on the Ground Floor may potentially be exposed to adverse wind conditions due to pressure driven flow from the prevailing southerly and westerly winds as they travel between the open building spaces on the southern side of the school. Similarly, the prevailing north-easterly winds have the potential to impact this area due to minimal shielding from that direction.

To mitigate these adverse wind conditions, it is recommended to retain the proposed densely foliating evergreen shrub planting and tree layout at the southern extent of the development site situated around Buildings C and D. The shrubs should be capable of growing to a height of 1.2-1.5m above the floor slab. The trees should be capable of growing to a height of 2-3m, with a canopy width of 2-3m.

Similarly, it is recommended to retain the proposed densely foliating evergreen trees at the southern end of the sports field. These trees should be capable of growing to a height of 3-5m, with a canopy width of 3-5m.

4.3 Outdoor Spaces

The First Floor outdoor space located at the north-eastern corner of Building E may potentially be exposed to adverse wind conditions due to the prevailing north-easterly winds. It is recommended to include a 1.2-1.5m high impermeable balustrade along the perimeter of this space.

The outdoor spaces along the eastern aspect of Building A and B located on the Second and Third and Fourth Floor may potentially be exposed to adverse wind conditions from the prevailing north-easterly winds directly impacting the area. It is recommended to retain the 1.2-1.5m high impermeable balustrades along the Second, Third and Fourth Floor outdoor areas located on the eastern aspects of Building A and B.

4.4 Rooftop Communal Spaces

The Second Floor outdoor rooftop sport zone located at the north-west of the Second Floor of Building A is potentially exposed to the prevailing north-easterly, southerly and westerly winds. There is the potential for the north-easterly winds to wrap around the north-western corner of Building A onto the rooftop area. It is recommended to retain the impermeable screens around the perimeter of the outdoor rooftop sport zone. The screens should be of a minimum height of 2m.

The Second Floor Staff and Administration Area located on Building E may potentially be exposed to adverse wind conditions as a result of the direct impact of the prevailing north-easterly winds. To mitigate the adverse wind conditions within the area, it is recommended to retain the proposed 1.8m high louvered screens around the perimeter of the Second Floor Staff and Administration Area of Building E.

The Third Floor rooftop play area may potentially be exposed to adverse wind conditions as a result of the direct impact of the prevailing north-easterly, southerly and westerly winds. Nearby buildings provide minimal shielding. To mitigate these adverse wind conditions, it is recommended to retain the 2-3-metre-high screens along the perimeter of the area. The proposed canopies located on the Third Floor shall assist in mitigating the north-easterly and southerly winds. To further enhance the conditions it is recommended to include densely foliating evergreen shrubs situated in 0.5m high planter boxes capable of growing to a height of at least 1.5 metres.

With the inclusion of the above recommended in-principle treatments it is expected that all areas within and around the development will experience suitable wind conditions. Wind tunnel testing is recommended to be undertaken as part of the detailed design phase of the subject development. This will provide a quantitative analysis of the wind conditions and determine the size and extent of the treatments required to ensure suitable wind conditions are achieved at all outdoor accessible locations within and around the development.