# PEDESTRIAN WIND ENVIRONMENT STATEMENT

## HASTINGS SECONDARY COLLEGE, PORT MACQUARIE CAMPUS REDEVELOPMENT, 16 OWEN STREET, PORT MACQUARIE

WF896-01F02(REV4)- WS REPORT

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Prepared for:

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# EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the Hastings Secondary College Port Macquarie Campus redevelopment, located in Port Macquarie, on the local wind environment at the critical outdoor areas within and around the subject site to support a State Significant Development Application (SSDA). Whilst the TAS building and surrounds do not form part of this SSDA, they do form part of the overall campus and are therefore addressed in this report. The effect of wind activity has been examined for the two predominant wind directions for the region, namely the north-easterly and southerly winds. The analysis of the wind effects relating to the proposed development have been 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 latest architectural drawings. 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 of the architectural drawings provided (received 16 April 2021). 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 assessment indicate that the development has incorporated several design features and wind mitigating strategies and is expected to be suitable for the intended use for the majority of the outdoor trafficable areas. However, there are some areas that are likely to be exposed to stronger winds. It is expected that the wind effects identified in the report can be ameliorated with the consideration of the following treatment strategies into the design of the development:

- TAS Building and Surrounds (not part of SSDA):
    - Inclusion of the proposed densely foliating trees along the TAS Forecourt.
    - Additional densely foliating landscaping around the north-east and south-east entrances.
- CAPA Building and Surrounds (Stage 2):
    - Retention of the densely foliating existing landscaping along Owen Street.
    - Inclusion of the proposed 3m height porous screening to the east of the outdoor theatre.
    - Inclusion of the proposed densely foliating trees around the outdoor theatre.
- PCYC Building and Surrounds (Stage 5):
    - Retention of the densely foliating existing landscaping to the south of the PCYC building.

With the inclusion of the abovementioned recommendations in the final design, it is expected that wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses, and that the wind speeds will satisfy the applicable criteria for pedestrian comfort and safety.

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# 1 INTRODUCTION

Windtech Consultants has been commissioned by School Infrastructure NSW (SINSW) on behalf of the Department of Education (DOE) to prepare a pedestrian wind environment statement to accompany a State Significant Development Application (SSDA) to the NSW Department of Planning, Industry and Environment (DPIE) for proposed upgrades to Hastings Secondary College (Port Macquarie Campus), previously known as Port Macquarie High School.

Hastings Secondary College consists of two campuses, being Westport and Port Macquarie. This report has been prepared for proposed works at the Port Macquarie Campus, which consists of two properties, the main campus and the Ag Plot.

The works subject to this proposal are to be carried out on the main Port Macquarie campus which is located at 16 Owen Street, Port Macquarie (the site). The site has a secondary street frontage to Burrawan Street and adjoins Oxley Oval along the eastern boundary.

On 23 December 2020, the Secretary of the DPIE issued Secretary's Environmental Assessment Requirements (SEARs) for SSD Application No. 11920082. This report has been prepared in accordance with the SEARs requirements.

An opinion on the likely impact of the proposed design on the local wind environment affecting pedestrians within the critical outdoor areas within and around the subject development is presented in this report. The analysis of wind effects relating to the proposed development has been carried out in the context of the predominant wind directions for the region, building morphology of the development and nearby buildings, and local land topography. The conclusions of this report are drawn from our extensive experience in the field of wind engineering and studies of wind environment effects.

No wind tunnel testing has been undertaken for this assessment. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made only in-principle.

# 2 DESCRIPTION OF DEVELOPMENT AND SURROUNDINGS

The site is located approximately 1.2km south east of the Port Macquarie town centre, with access from Oxley Highway (Gordon Street) via Owen Street to the centre, William Street via Owen Street to the north and Burrawan Street via Owen Street to the south. A maintenance access road exists to the east of the site along Burrawan Street.

The site is located at 16 Owen Street, Port Macquarie and is legally known as Lot 111 in DP 1270315. The Port Macquarie Campus site is located within a coastal setting (east), with residential (single two storey and residential flat buildings) located to the west and south and Port Macquarie Bowling Club to the north. The surrounding street network provides on-street parking. Maintenance vehicular access is located off Burrawan Street.

No natural watercourses are mapped as traversing the site. Scattered vegetation is located throughout the site, with a small area of vegetation concentrated towards the pedestrian access area.

The Port Macquarie Campus site is gently sloping downwards in three general 'platforms' towards the north, with distinct views out towards the ocean and the Hastings River. There is potential for the wind to accelerate up the hill from north to south. It also has a distinct view line to the row of Norfolk pine trees along the coastline. The siting of the campus provides many opportunities for ongoing cultural connection to Country. Current built form has an established language of two (2) story, face brick, low pitched metal roof buildings.

An aerial image of the subject site and the local surroundings is shown in Figure 1, with the frequency and magnitude of the prevailing winds is superimposed for each wind direction.

The upgrades will support high-quality educational outcomes to meet the needs of students within the local community and deliver innovative learning and teaching spaces as follows:

- Demolition works to accommodate new works;
- Upgrade to school entry;
- Construction of new two (2) storey Creative and Performing Arts (CAPA) building;
- Construction of new Police Citizens Youth Club (PCYC);
- Partial refurbishment of Building L;
- Refurbishment and alteration to Building B;
- Removal of Building S and demountable buildings;
- New lift connections, covered outdoor learning area (COLA) and covered walkways;
- Associated earthworks, landscaping, stormwater works, service upgrades; and
- Tree removal/ tree safety works.

The critical outdoor trafficable areas associated with the proposed redevelopment, which are the focus of this assessment with regards to wind effects, are listed as follows:

- TAS Building and Surrounding areas (not part of SSDA)
- CAPA Building and Surrounding areas (Stage 2)
- PCYC Building and Surrounding areas (Stage 5)


Figure 1: Aerial Image of the Site Location and Prevailing Wind Directions

# 3 REGIONAL WIND

The Port Macquarie region is governed by two principal wind directions that can potentially affect the subject development. These winds prevail from the north-east and south. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained from the meteorological station located at Port Macquarie Airport by the Bureau of Meteorology (recorded from 1995 to 2016). The data has been corrected to represent winds over standard open terrain at a height of 10m above ground level. The results of this analysis are presented in Figure 2 in the form of a directional plot of the annual and 5% exceedance mean winds for the region. The frequency of occurrence of these winds is also shown in Figure 2.

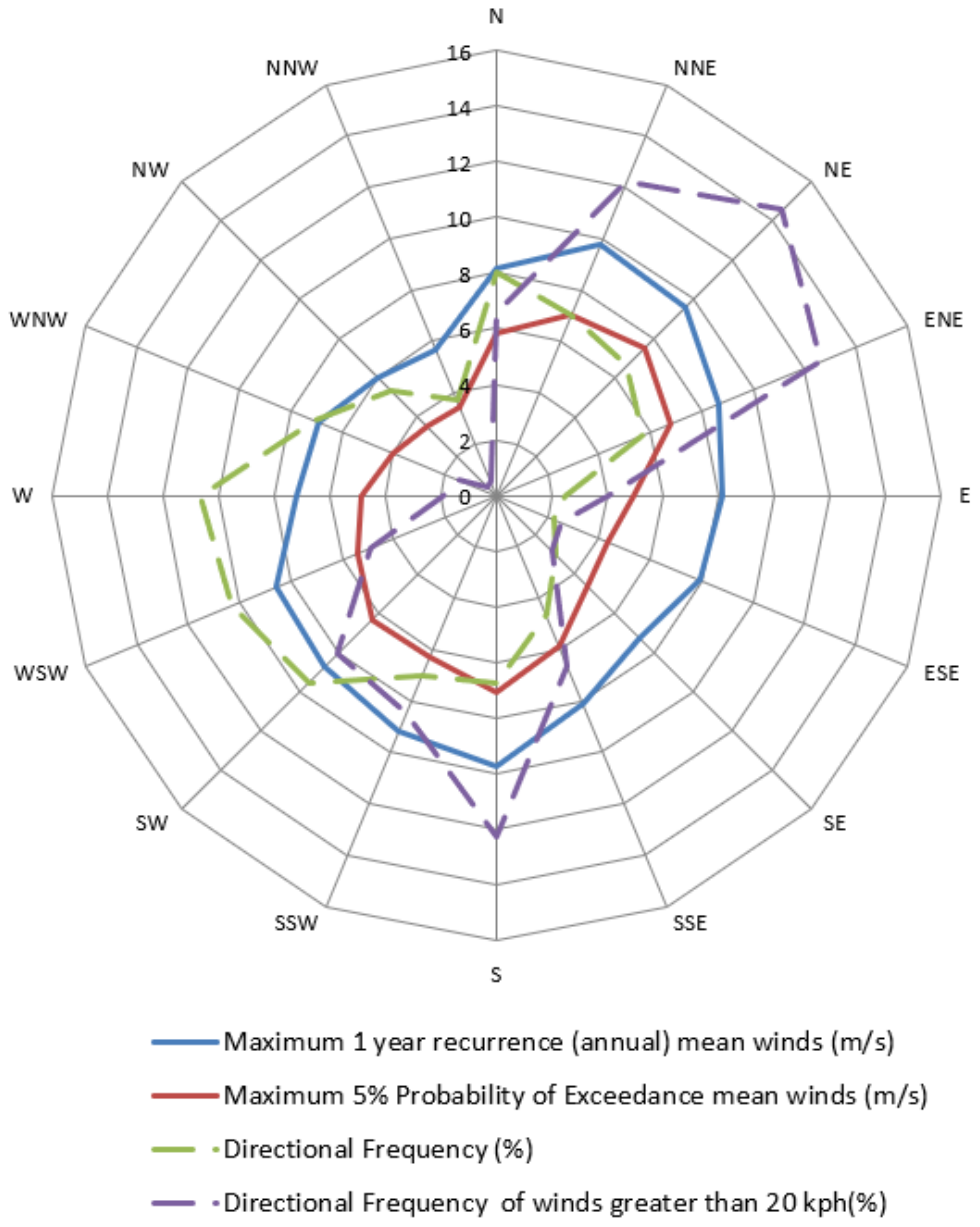


Figure 2: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for the Port Macquarie Region

# 4 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 A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, 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.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 1 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 1: Summary of Wind Effects on People (A.D. Penwarden, 1973)

| Type of Winds | Beaufort Number | Mean Wind Speed (m/s) | Effects |
|---|---|---|---|
| Calm | 0 | Less than 0.3 | Negligible. |
| Calm, light air | 1 | 0.3 – 1.6 | No noticeable wind. |
| Light breeze | 2 | 1.6 – 3.4 | Wind felt on face. |
| Gentle breeze | 3 | 3.4 – 5.5 | Hair is disturbed, clothing flaps, newspapers difficult to read. |
| Moderate breeze | 4 | 5.5 – 8.0 | Raises dust, dry soil and loose paper, hair disarranged. |
| Fresh breeze | 5 | 8.0 – 10.8 | Force of wind felt on body, danger of stumbling |
| Strong breeze | 6 | 10.8 – 13.9 | Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant. |
| Near gale | 7 | 13.9 – 17.2 | Inconvenience felt when walking. |
| Gale | 8 | 17.2 – 20.8 | Generally impedes progress, difficulty balancing in gusts. |
| Strong gale | 9 | Greater than 20.8 | People blown over. |

It should be noted that wind speeds affecting this particular development 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. Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind environment effects.

# 5 RESULTS AND DISCUSSION

The expected wind conditions affecting the development are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report. A glossary of the different wind effects described in this report included in Appendix A.

For this assessment, the wind speed criteria for pedestrian comfort that are considered are listed as follows:

- Comfortable Walking Criterion (7.5m/s with a 5% probability of exceedance)
  for general circulation and pedestrian thoroughfares, e.g. footpaths, elevated walkways and sporting fields etc.

- Short Exposure Criterion (5.5m/s with a 5% probability of exceedance)
  for stationary activities generally less than an hour, e.g. waiting areas, seating areas, main entries, and amphitheatres etc.

Although this assessment is qualitative in nature, the abovementioned criteria for pedestrian comfort are considered when assessing the wind environment impacts. However, all areas are also assessed with consideration to a pedestrian safety criterion of 23m/s for the annual maximum gust.

## 5.1 TAS Building and Surrounding areas

Construction of the TAS Building and refurbishment to Building T and surrounds were approved under separate Planning Pathway and do not form part of the current SSDA works however they do form part of the overall campus and are therefore assessed by this report.

The TAS building is exposed to the prevailing north-easterly and southerly winds. It is expected that the walkways between Buildings A and T and the TAS Building may experience a funnelling effect from the southerly winds, affecting the surrounding wind environment.

The prevailing north-easterly winds to flow through the existing sports court and TAS Forecourt and funnel between the TAS building and Building L, affecting the New Covered Walkway, and potentially sidestream along the northern façade of the TAS Building and Building A. The inclusion of the new landscaping in the form of densely foliating evergreen trees and other vegetation along the TAS Forecourt is expected to assist in mitigating the effects of the north-easterly winds. With the inclusion of this new landscaping, the proposed development is expected to be equivalent to the existing wind conditions.

The eastern demountables are expected to be demolished under a separate planning pathway and is expected to further open up the site to the prevailing north-easterly winds and create further adverse wind conditions around the TAS Building. The prevailing north-easterly wind is expected to have a direct path across the sports courts and TAS Forecourt, creating further adverse wind conditions in the area. Furthermore, there is the potential for the prevailing southerly winds to directly impact the area between the TAS building and

building T and create adverse wind conditions for the TAS forecourt area with the demolition of the existing demountable building. It is suggested to add landscaping at the north east and south east entrances of the school in place of the removed demountable building.

Due to the low-rise nature of the proposed TAS building, it is expected that there will be no major impacts on the wind comfort of the sporting field to the south. With the inclusion of the aforementioned treatments, it is expected the eastern areas of the proposed development within will be equivalent to the existing wind conditions and suitable for its intended use.

## 5.2 CAPA Building and Surrounding areas (Stage 2)

Prevailing north-easterly and southerly winds are expected to be the primary influences on the wind environment for the CAPA Building. Southerly winds can be expected to adversely impact the New Covered Western Walkway, and potentially funnel between the CAPA building and Building B. Furthermore, with the addition of the CAPA Building, prevailing southerly winds are expected to sidestream along its western aspect, impacting the pedestrian footpath along Owen Street. The retained existing vegetation and proposed planting around the CAPA Building is expected assist in mitigating the impact of the southerly wind in this area.

North-easterly winds are expected to directly impact the outdoor terrace and accompanying covered walkway to the north of the CAPA building. Funnelling between the CAPA Building and MPC Hall is also a possibility from the north-easterly wind. The addition of the proposed 3m height porous screening to the east of the outdoor terrace is expected to mitigate the effect of the north-easterly wind on the area. Furthermore, the addition of the proposed densely foliating trees at the northern perimeter of the outdoor terrace is expected to further assist in mitigating adverse wind conditions in the area.

With the inclusion of the aforementioned treatments, it is expected the areas of the proposed development within stage 2 will be equivalent to the existing wind conditions and suitable for its intended use.

## 5.3 PCYC Building and Surrounding areas (Stage 5)

The PCYC building and surrounds are exposed to the prevailing north-easterly and southerly winds. Southerly winds are expected to sidestream along the western façade of the PCYC building, directly impacting the wind environment of the pedestrian footpath on Owen Street. Retention of the existing densely foliating landscaping along Owen street to the south of the PCYC building adjacent to MPC Hall and the proposed CAPA building is expected to slow down winds flowing along Owen Street and assist mitigate the adverse wind conditions along the pedestrian footpath on Owen Street.

Furthermore, the north-easterly winds are expected to sidestream along the eastern aspect of the PCYC building and the MPC Hall, potentially increasing the prevailing wind's effect on the new outdoor terrace adjacent to the CAPA building. The retention of the proposed 3m high wall to the east of the outdoor terrace is expected to reduce the effect of the north-easterly wind on the area.

Due to the low-rise nature of the proposed PCYC building, it is expected that there will be no major impacts on the wind comfort of the sporting field to the east. With the inclusion of the aforementioned treatments, it is expected the areas of the proposed development within stage 5 will be equivalent to the existing wind conditions and suitable for its intended use.

# 6 REFERENCES


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# APPENDIX A WIND EFFECTS GLOSSARY

## A.1 Downwash and Upwash Effects

The downwash wind effect occurs when wind is deflected down the windward face of a building, causing accelerated winds at pedestrian level. This can lead to other adverse effects as corner acceleration as the wind attempts to flow around the building, as seen in Figure A.1.

This can also lead to recirculating flow in the presence of a shorter upstream building, causing local ground level winds to move back into the prevailing wind.

The upwash effect occurs near upper level edge of a building form as the wind flows over the top of the building. This has the potential to cause acceleration of winds near the leading edge, as well as potentially reattaching onto the roof area. This effect causes wind issues particularly near the leading edges of tall building and on the rooftop areas if there is sufficient depth along the wind direction. Upwash is more apparent in taller towers and podia.

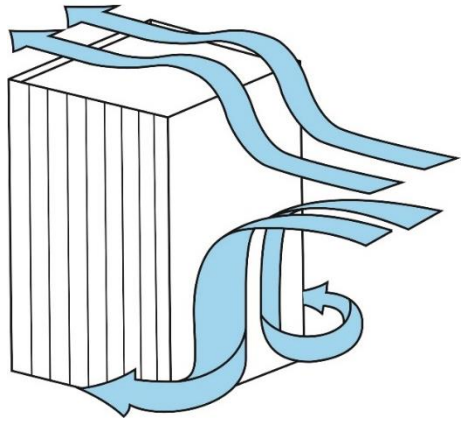

Figure A.1: Downwash Leading to Corner Wind Effect, and Upwash Effects

## A.2 Funnelling/Venturi Effect

Funnelling occurs when the wind interacts with two or more buildings which are located adjacent to each other, which results in a bottleneck, as shown in Figure A.2. This causes the wind to be accelerated through the gap between the buildings, resulting in adverse wind conditions and pedestrian discomfort within the constricted space. Funnelling effects are common along pedestrian links and thoroughfares generally located between neighbouring buildings that have moderate gaps between them.

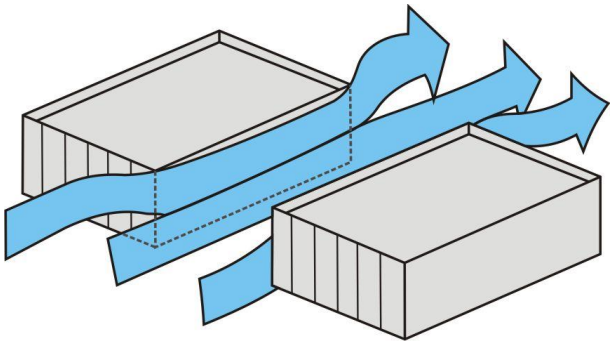

Figure A.2: Funnelling/Venturi Wind Effect

## A.3 Gap Effect

The gap effect occurs in small openings in the façade that are open to wind on opposite faces, as seen in Figure A.3. This can involve a combination of funnelling and downwash effects. Presenting a small gap in the façade on the windward aspect as the easiest means through which the wind can flow through can result in wind acceleration through this gap. The pressure difference between the windward façade and the leeward façade also tends to exacerbate the wind flow through this gap.

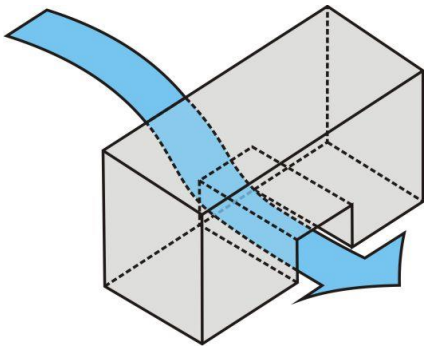

Figure A.3: Gap Wind Effect

## A.4 Sidestream and Corner Effects

The sidestream effect is due to a gradual accumulation of wind shearing along the building façade that eventuates in an acceleration corner effect. The flow is parallel to the façade and can be exacerbated by downwash effects as well, or due to corner effect winds reattaching on the façade.

This is shown in Figure A.4. The corner refers to the acceleration of wind at the exterior vertical edge of a building, caused by the interaction of a large building massing with the incident wind, with the flow at the corner being accelerated due to high pressure differentials sets up between the windward façade and the orthogonal aspects. It can be further exacerbated by downwash effects that build up as the flow shears down the façade.

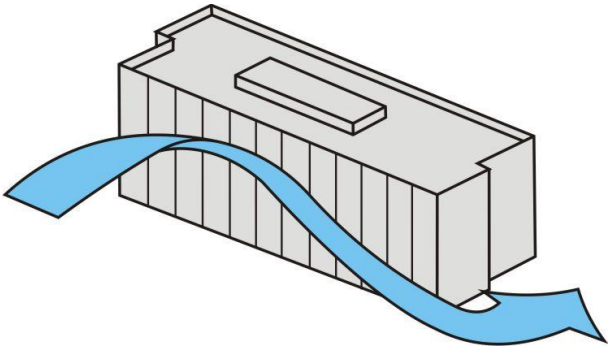

Figure A.4: Sidestream and Corner Wind Effect

## A.5 Stagnation

Stagnation in a region refers to an area where the wind velocity is significantly reduced due to the effect of the flow being impeded by the bluff body. For a particular prevailing wind direction, this is typically located near the middle of the windward face of the building form or over a short distance in front of the windward face of a screen or fence. Concave building shapes tend to create an area of stagnation within the cavity, and wind speeds are generally low in these areas.