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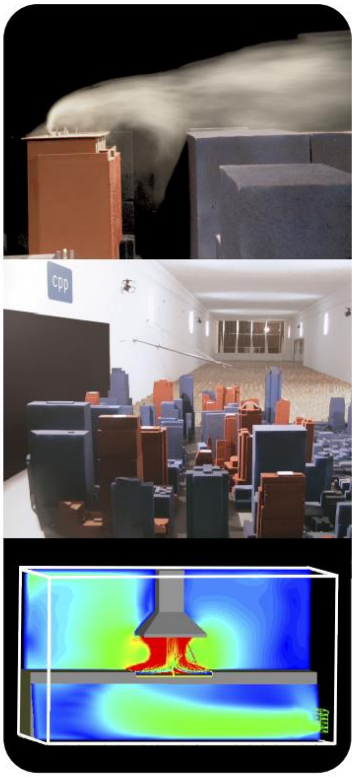
WIND ENGINEERING AND AIR QUALITY CONSULTANTS

FINAL REPORT



Wind Assessment for:

AUSTRALIAN TECHNOLOGY PARK

Sydney, Australia

Prepared for:

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

Client Provided Information

Introduction

This report supports a State Significant Development Application (SSDA) submitted to the Department of Planning and Environment pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Mirvac Projects Pty Ltd (Mirvac) is seeking to secure approval for the urban regeneration of the Australian Technology Park (ATP), including the redevelopment of three car parking lots within ATP for the purposes of commercial, retail and community purposes, along with an extensive upgrade to the existing public domain within ATP. Building heights of 4, 7 and 9 storeys are proposed across the 3 development lots.

Australian Technology Park (ATP) has been continuously developed since its establishment in 1996, but has been underutilised as a technology and business precinct for quite some time. UrbanGrowth NSW Development Corporation (UGDC) has actively encouraged new development and employment opportunities at the Park for the past 15 years, and Mirvac intends to continue upon this and deliver upon the precinct's full potential, with the development of circa 107,400sqm for employment uses, which will facilitate the employment homes of an extra 10,000 staff everyday within ATP by development completion.

Background

Mirvac has been announced by UrbanGrowth NSW as the successful party in securing ownership and redevelopment rights for the ATP precinct, following an Expression of Interest (EOI) and an Invitation to Tender (ITT) process which commenced in 2014. Mirvac has also secured the Commonwealth Bank of Australia (CBA) as an anchor tenant for the development and intends to immediately commence the urban regeneration of this precinct through the lodgement of this SSDA. CBA's commitment to the precinct is in the form of one of the largest commercial leasing pre-commitments in Australian history, occupying circa 95,000 square metres of commercial, retail, community and childcare NLA, which will house circa 10,000 technology focused staff by 2019 and 2020. Mirvac's redevelopment goes well beyond the development on the 3 development lots, as it includes the regeneration of the public domain within ATP, the addition of retail to activate the precinct and also the provision of community facilities such as a community centre, a gym and 2 x 90 child childcare facilities.

Site Description

The ATP site is strategically located approximately 5km south of the Sydney CBD, 8km north of Sydney airport and within 200m of Redfern Railway Station. The site, with an overall area of some 13.2 hectares, is located within the City of Sydney local government area (LGA). Refer to Figure 1 for a graphic representation of the site location and context.

Three key sites remain undeveloped within the ATP site and are presently used for at-grade worker and special event car parking. These sites are:

- Lot 8 in DP 1136859 – site area circa 1,937 m^2;
- Lot 9 in DP 1136859 – site area circa 8,299 m^2; and
- Lot 12 in DP 1136859 – site area circa 11,850 m^2.

Figure 2 provides an aerial image of the ATP site along with identifying the three development sites.

The SSDA works boundary excludes the Locomotive Workshop. Future development associated with the adaptive re-use of the Locomotive Workshop will be the subject of separate future applications.

Overview of Proposed Development

The development application seeks approval for the following components of the development:

- Site preparation works, including demolition and clearance of the existing car parking areas/ancillary facilities and excavation;
- Construction and use of a 9 storey building within Lot 9 (Building 1), comprising of parking, retail, commercial and childcare uses;
- Construction and use of a 7 storey building within Lot 12 (Building 2) comprising of parking, retail and commercial uses;
- Construction and use of a 4 storey community building within Lot 8 (Community Building) comprising of gym, retail, community, commercial and childcare uses;
- Extensive landscaping and public domain improvements throughout the precinct for the benefit of the local community; and
- Extension and augmentation of physical infrastructure/utilities as required.

A more detailed and comprehensive description of the proposal is contained in the Environmental Impact Statement (EIS) prepared by JBA.

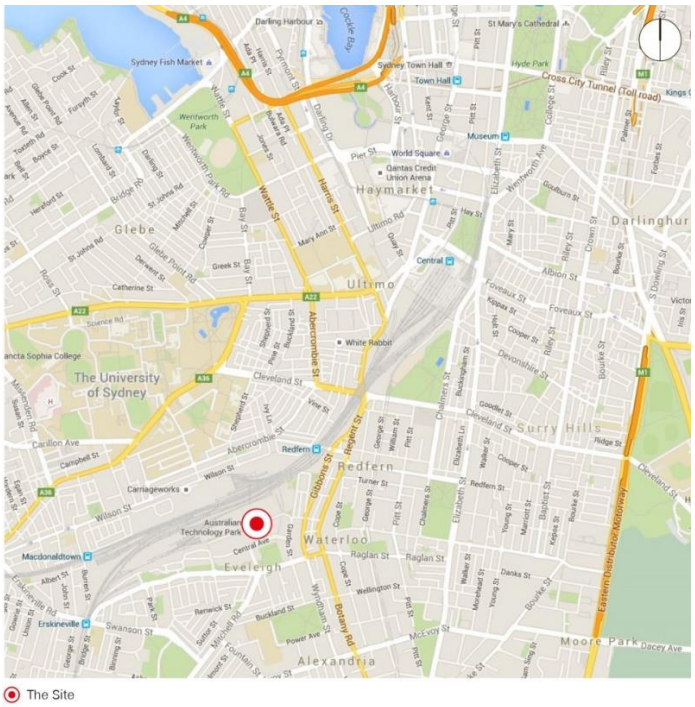

Figure 1: Location of proposed development site

Planning Framework

State Environmental Planning Policy (SEPP) Major Development 2005 is the principal environmental planning instrument applying to the ATP. Schedule 3, Part 5 of the Major Development SEPP sets out the zoning, land use and development controls that apply to development on the Site.

As the development has a capital investment value of more than $10 million it is identified as State Significant Development under the *State Environmental Planning Policy (State and Regional Development) 2011*, with the Minister for Planning the consent authority for the project.

Figure 2: Layout of the three proposed buildings within the development

Introduction

Cermak Peterka Petersen Pty. Ltd. has been engaged by Mirvac Projects Pty. Ltd. to provide an opinion based assessment of the impact of the proposed development at the Australian Technology Park, Sydney, on the pedestrian level local wind environment in and around the proposed development.

The Australian Technology Park is located to the south-west of the Sydney CBD, adjacent to Redfern railway station. The site is bounded by the open railway tracks to the north, and is surrounded by low to medium rise buildings, Figure 2. Topography surrounding the site is relatively flat in the north-south direction, with a significant rise to the east.

Sydney Wind Climate

To enable a qualitative assessment of the wind environment, the wind frequency and direction information measured by the Bureau of Meteorology at a standard height of 10 m at Sydney Airport from 1995 to 2014 have been used in this analysis, Figure 3. The anemometer is located about 6 km to the south of the site and is considered representative of the wind conditions at the site. It is noted from Figure 3 that strong prevailing winds are organised into three main groups which centre at about north-east, south, and west. This wind assessment is focused on these prevailing strong wind directions.

Strong summer winds occur mainly from the south quadrant and the north-east. Winds from the south are associated with large synoptic frontal systems and generally provide the strongest gusts during summer. Moderate intensity winds from the north-east tend to bring cooling relief on hot summer afternoons typically lasting from noon to dusk. These are small-scale temperature driven effects; the larger the temperature differential between land and sea, the stronger the breeze.

Winter and early spring winds typically occur from the south and west quadrants. West quadrant winds provide the strongest winds affecting the area throughout the year.

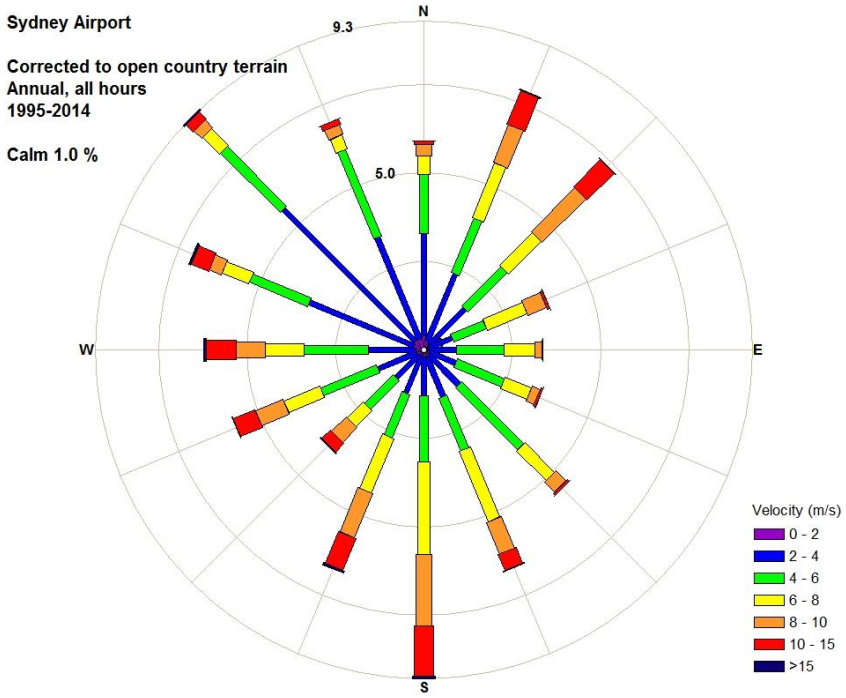

Figure 3: Wind rose of direction and speed for Sydney Airport

Wind Flow Mechanisms

When the wind hits a large isolated building, the wind is accelerated down and around the windward corners, Figure 4; this flow mechanism is called downwash and causes the windiest conditions at ground level on the windward and sides of the building. Downwash will occur on buildings of all heights, but the vertical component is dictated by the height to width ratio of the building. In Figure 4 smoke is being released into the wind flow to allow the wind speed, turbulence, and direction to be visualised. The image on the left shows smoke being released across the windward face, and the image on the right shows smoke being released into the flow at about third height in the centre of the face.

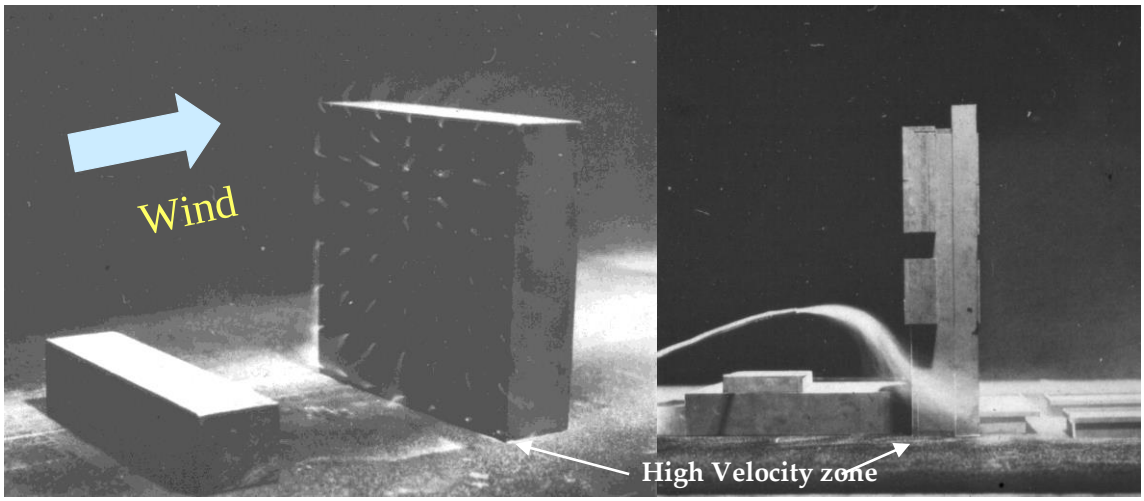

Figure 4: Flow visualisation around a tall building

Techniques to mitigate the effects of downwash winds on pedestrians include the provision of horizontal elements, the most effective being a podium to divert the flow away from pavements and building entrances. Awnings along street frontages perform a similar function and the deeper the horizontal element generally the more effective it will be in diverting the flow.

Channelling occurs when the wind is accelerated between two buildings or along straight streets with buildings on either side. For long buildings relative to their height the flow around the corners will generally be horizontal.

Environmental Wind Speed Criteria

It is generally accepted that wind speed and the rate of change of wind velocity are the primary parameters that should be used in the assessment of how wind affects pedestrians. Over the years, a number of researchers have added to the knowledge of wind effects on pedestrians by suggesting criteria for comfort and safety. Because pedestrians will tolerate higher wind speeds for a smaller period of time than for lower wind speeds, these criteria provide a means of evaluating the overall acceptability of a pedestrian location. A location can further be evaluated for its intended use, such as for an outdoor café or footpath.

The consent authority has no specific wind assessment criteria. The current City of Sydney (2012) DCP excludes the Australian Technology Park precinct, but specifies wind effects not to exceed 16 m/s, in neighbouring streets. There are few locations in Sydney that would meet this criterion without some shielding to improve the wind conditions. From discussions with Council this is a once per annum gust wind speed similar to the wind criteria in City of Sydney 2004 DCP, but is meant to be interpreted as a comfort level criterion and is not intended to be used as a distress requirement. The once per annum gust wind speed criterion used in the City of Sydney (2012) DCP is based on the work of Melbourne (1978), and the 16 m/s level is classified as generally acceptable for use as a main public accessway. This criterion gives the once per annum wind speed, and uses this as an estimator of the general conditions at a site, which may be more relevant to the success of the development. To combat this limitation, this study is based upon the criteria of Lawson (1990), which are described in Table 1 for both pedestrian comfort and distress. The limiting criteria are defined for both a mean and gust equivalent mean (GEM) wind speed. The criteria based on the mean wind speeds define when the steady component of the wind causes discomfort, whereas the GEM wind speeds define when the wind gusts cause discomfort.

From ongoing findings using the criteria and clients who have issues with strong wind, a more stringent criterion is required for outdoor dining style activities and a value of 2 m/s for 5% of the time is recommended for such intended use. As the 5% of the time wind speed recorded at the airport

is about 9 m/s, and even with the benefits of shielding from suburban buildings compared with the airport, most locations in the Sydney region require some level of shielding to meet the criterion.

Assessment using the Lawson criteria provides a similar classification as using the once per annum gust, which is the basis of the City of Sydney (2011) DCP, however also provides information regarding the serviceability wind climate.

Table 1: Pedestrian comfort criteria for various activities

Comfort (maximum of mean or gust equivalent mean ($GEM^{+\cdot}$) wind speed exceeded 5% of the time)	
< 4 m/s	Pedestrian Sitting (considered to be of long duration)
4 - 6 m/s	Pedestrian Standing (or sitting for a short time or exposure)
6 - 8 m/s	Pedestrian Walking
8 - 10 m/s	Business Walking (objective walking from A to B or for cycling)
> 10 m/s	Uncomfortable
Distress (maximum of mean or GEM wind speed exceeded 0.022% of the time)	
<15 m/s	not to be exceeded more than two times per year (or one time per season) for general access
<20 m/s	not to be exceeded more than two times per year (or one time per season) where only able bodied people would be expected; frail or cyclists would not be expected

The wind speed is either a mean wind speed or a gust equivalent mean (GEM) wind speed. The GEM wind speed is equal to the 3 s gust wind speed divided by 1.85.

Environmental Wind Assessment

The existing site is relatively undeveloped, with the neighbouring 12-storey Channel Seven building being the dominant structure, Figure 2. The proposed development comprises three buildings, Building 1, Building 2, and the Community Building, Figure 5, with heights above ground of 9, 7 and 4 storeys respectively. The site is surrounded predominantly by low-rise residential and commercial buildings, Figure 2, which will be unlikely to generate any significant shielding effects at the site. The sloping of the terrain to the east of the site will provide some shielding to Building 2 for winds from the north-east. The proposed buildings are broad relative to their height and will have an effect on the wind environment in the vicinity of each building with the channelling of flow along the façade and creating large calm areas in the lee of the building. The aligned nature of the buildings within the precinct will act to channel wind between the buildings for certain wind directions, however the staggered nature to the surrounding street grid pattern will minimise the impact.

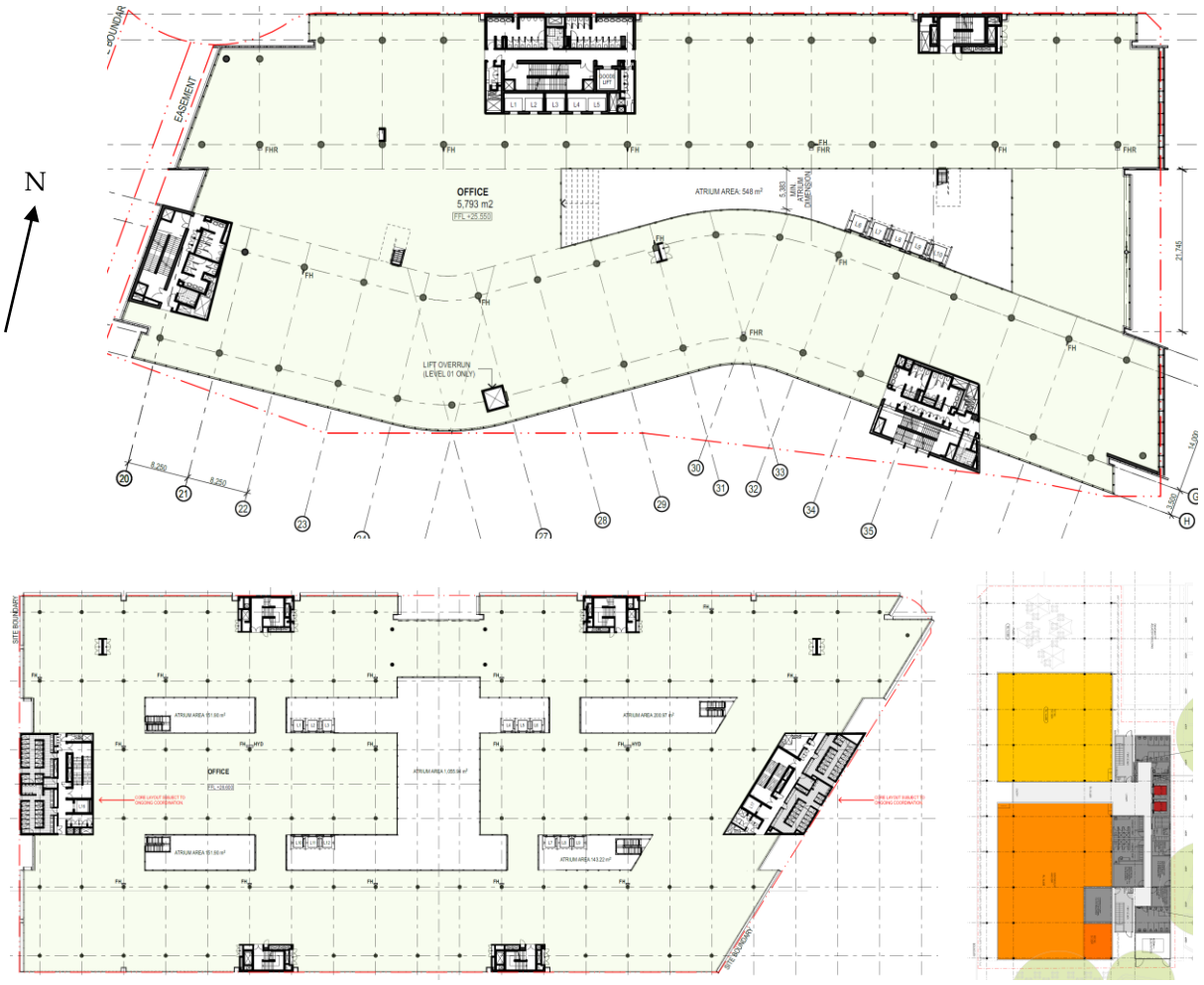

Figure 5: Plan view of Building 1 (T), Building 2 (BL) and Community Building (BR)

Winds from the west will impinge on the narrow faces of Building 1 and the Channel Seven building resulting in a small amount of downwash reaching ground level. The proximity of the two buildings will cause relatively strong channelling flow along Central Avenue. Compared with existing conditions, the additional massing of Building 1 will direct more flow around the west corner of the existing Channel Seven building.

A similar downwash effect would be expected for winds from the north-east impinging on Building 2, however the local topography is expected to ameliorate this effect.

Prevailing winds from the north and south quadrants are expected to generate relatively strong wind conditions at certain locations across this site. Winds from these directions will impinge on the broad faces of the proposed and existing buildings causing channelling flow along Davy Road. The fastest winds will be experienced at the upwind building corners. The existing Locomotive Building will provide some shielding to Davy Road for winds from both directions by blocking the flow, with slightly more flow being directed along Locomotive Street into Alexander Street.

Winds from the south will impact on the broad face of Building 1. The relative width of the building to height is expected to generate horizontal flow along the south façade. This flow will accelerate along the face of the building before discharging along Davy Road. Downwash flow generated from Building 2 to the south of the Locomotive Building will discharge along Davy Road. Wind conditions to the north of Davy Road would be expected to be less severe than for northerly winds due to the presence of the Locomotive Building, which will encourage flow away from the ground plane and over the roof, resulting in calmer conditions closer to this building.

Given the relative size of the Community Building to the other proposed and existing buildings, it is not expected to have a significant impact on the pedestrian level wind environment. The screen surrounding the Community Building is expected to produce accelerated flows under the screen, but reduce the wind speed with distance from the corner compared with a fixed colonnade by virtue of the flow expanding into the full-height cavity formed between the screen and the building.

The main pedestrian entrances to each building are well located away from building corners, and in the case of the Community Building recessed. It is expected that relatively high wind speeds will exist along Davy Road for winds from the north and south quadrants, thus the inclusion of a revolving door is astute.

Qualitatively integrating the expected directional wind conditions around the site with the wind climate, it is considered that wind conditions at the majority of locations around the site would be classified as suitable for pedestrian standing under the Lawson criterion from a comfort perspective and pass the distress criterion. At the windier locations close to building corners, the wind conditions are likely to be classified as suitable for pedestrian walking.

Conclusions

Cermak Peterka Petersen Pty. Ltd. has provided an opinion based assessment of the impact of the proposed development at Australian Technology Park, Sydney on the local wind environment. Our summary assessment of the proposed development is as follows:

Wind conditions around the site are expected to be affected by the addition of the proposed buildings with large areas improving in conditions and local areas of increased wind speed depending on the incident wind direction. On average the wind conditions around the site would be expected to be similar to existing conditions with the pedestrian level wind environment for most locations being classified as suitable for pedestrian standing or walking under the Lawson criterion, and that all locations would pass the distress criterion. It is considered that the design would meet the intended use of the space for pedestrian comfort and safety. Additional amelioration measures may be required for specific locations where a greater level of amenity is required, but this would be conducted during

detailed design. Wind-tunnel testing would be required to quantify the wind advice provided herein and for specific amelioration.

References

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