

# **Wind Impact Assessment**

Detailed State Significant Development Application  
**Site C, Crows Nest over station development**

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**Division:** Division  
**Review date:** April 2021

# 1 Introduction

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## 1.1 Purpose of the report

This Wind Impact Assessment Report supports a State Significant Development (SSD) Application for the detailed design, construction and use of over station development (OSD) on Site C of the Crows Nest Station precinct. It is submitted to the Department of Planning, Industry and Environment (DPIE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The detailed SSD Application for Site C OSD is classified as SSD pursuant to Clause 12 of *State Environmental Planning Policy (State and Regional Developments) 2011* (SRD SEPP). Under Clause 12 of the SRD SEPP, any development application that is pursuant to a concept SSD Application is also classified as SSD whether or not that part of the development exceeds the minimum capital investment value specified in the relevant schedule of the SRD SEPP. In this regard, the proposed development on Site C is pursuant to the approved concept SSD Application and has not been delegated to Council under Section 4.37 of the EP&A Act. The proposed development is therefore, classified as SSD and is submitted to DPIE for assessment and determination.

## 1.2 Overview of Sydney Metro in its context

Sydney Metro is Australia's biggest public transport project (**Figure 1**). There are four core components:

- **Metro North West Line (formerly the 36 kilometre North West Rail Link)** - Services started in May 2019 in the city's North West between Rouse Hill and Chatswood, with a metro train every four minutes in the peak. The project was delivered on time and \$1 billion under budget.
- **Sydney Metro City & Southwest** – The Sydney Metro City & Southwest project includes a new 30km metro line extending metro rail from the end of the Metro North West Line at Chatswood, under Sydney Harbour, through new CBD stations and southwest to Bankstown. It is due to open in 2024 with the ultimate capacity to run a metro train every two minutes each way through the centre of Sydney. Sydney Metro City & Southwest will deliver new metro stations at Barangaroo, Crows Nest, Victoria Cross, Martin Place, Pitt Street, Waterloo and new underground metro platforms at Central Station. In addition it will upgrade and convert all 11 stations between Sydenham and Bankstown to metro standards.
- **Sydney Metro West** – Sydney Metro West is a new underground railway connecting Greater Parramatta and the Sydney CBD. This once-in-a-century infrastructure investment will transform Sydney for generations to come, doubling rail capacity between these two areas, linking new communities to rail services and supporting employment growth and housing supply between the two CBDs. Sydney Metro West stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and the Sydney CBD. Further planning is underway to determine the locations of the Pyrmont and Sydney CBD stations.
- **Sydney Metro - Western Sydney Airport** – Metro rail will also service Greater Western Sydney and the new Western Sydney International (Nancy Bird Walton) Airport. The new railway line will become the transport spine for the Western Parkland City's growth for generations to come, connecting communities and travellers with the rest of Sydney's public transport system

with a fast, safe and easy metro service. Six new stations will be delivered at St Marys, Orchard Hills, Luddenham, Airport Business Park, Airport Terminal and Western Sydney Aerotropolis. The Australian and NSW governments are partners in the delivery of this new railway.

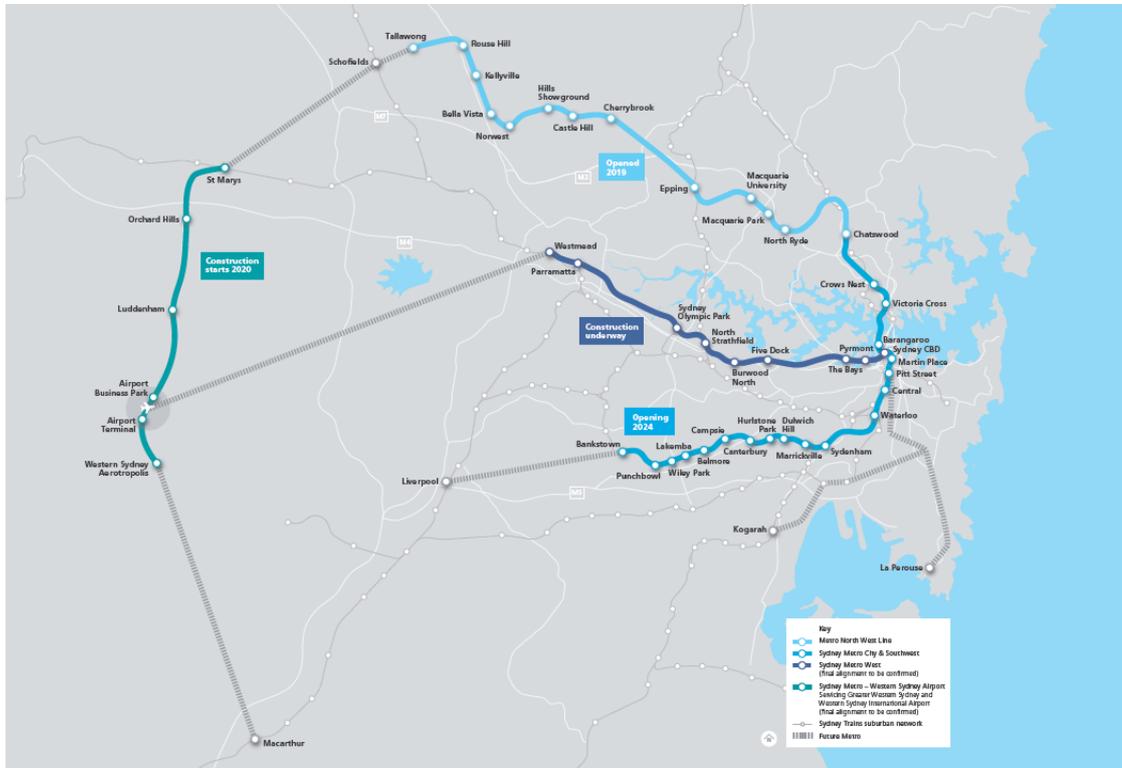


Figure 1: Sydney Metro network

### 1.3 Background and Concept Approval

Sydney Metro is seeking to deliver OSD above the approved Crows Nest Station. On 23 December 2020, the Minister for Planning and Public Spaces granted consent to the concept proposal for OSD at the Crows Nest Station including building envelopes, development parameters and strategies for a future development above the approved Crows Nest Station, and the use of the OSD spaces approved within the station under the CSSI Approval.

While the Crows Nest Station and OSD will form a single integrated station development (ISD), the planning pathways defined under the EP&A Act requires separate assessment for each component of the development. In this regard, the approved station works (CSSI Approval) are subject to the provisions of Part 5.1 of the EP&A Act (now referred to as Division 5.2) and the OSD component is subject to the provisions of Part 4 of the EP&A Act.

The concept proposal for Crows Nest OSD complements the St Leonards commercial core and seeks to minimise overshadowing and amenity impacts and integrate with the broader Crows Nest village including Willoughby Road. It provides an opportunity for a mixed-use development that capitalises on its immediate access to Australia’s biggest public transport project that delivers significant improvements to the amenity of the local area. This aligns with the vision for the area, as outlined in key strategic planning documents, including the Greater Sydney Commission’s (GSC) *North District Plan* and the St Leonards and Crows Nest 2036 Plan prepared by DPIE.

In October 2018, DPIE released a draft Rezoning Proposal for the Crows Nest metro site. The Rezoning Proposal sought to increase the relevant planning controls applying to the site to be commensurate with the built form proposed in the concept SSD Application.

The release of the Rezoning Proposal was simultaneous to the release of the (then) draft strategic planning documents including the *St Leonards and Crows Nest 2036 Draft Plan* (2036 Draft Plan). The *2036 Draft Plan* recommended significant changes to the planning controls for the immediate area surrounding the Crows Nest OSD site subject to consideration of community feedback to its exhibition.

The 2036 Plan and the associated Special Infrastructure Contribution (SIC) scheme were finalised by DPIE on 29 August 2020. The Rezoning Proposal was also finalised, and new planning controls gazetted, on 31 August 2020 applying new planning controls to the Crows Nest metro site.

## 1.4 Site description

The Crows Nest Station precinct is located between the Pacific Highway and Clarke Street (eastern side of the Pacific Highway) and Oxley Street and south of Hume Street, Crows Nest. It is wholly located within the North Sydney local government area (LGA). It is also near the boundary of both the Willoughby and Lane Cove LGAs.

The Crows Nest Station OSD site comprises three sites (**Figure 2**). The following building envelopes and land uses were approved for each of the sites in the concept SSD Application:

- **Site A (497-521 Pacific Highway, Crows Nest):** 21 storey (RL 180m including a 4.4m rooftop building services zone) commercial office building with a maximum floor space of 40,300m<sup>2</sup>
- **Site B (477-495 Pacific Highway, Crows Nest):** 17 storey (RL 155m) residential accommodation building with a maximum floor space of 13,000m<sup>2</sup>
- **Site C (14 Clarke Street, Crows Nest):** 9 storey (maximum RL 132m including a 5m rooftop building services zone) commercial office building with a maximum floor space of 3,100m<sup>2</sup>

This SSD Application relates only to the detailed design and delivery of Site C, with applications for Sites A and B to be undertaken separately in the future.



**Figure 2: Aerial photograph of Site C within the greater Crows Nest Station precinct**

Site C is located at the north-western corner of Hume Street and Clarke Street, and comprises one allotment with the address of 14 Clarke Street, Crows Nest. It is legally described as Lot 1 in DP1123850.

The site is roughly rectangular in shape, and being located within the Crows Nest village centre. Adjoining Site C is a seven storey residential building (known as 'Wyndel Apartments') at 22-26 Clarke Street and a five storey commercial building at 20 Clarke Street.

The existing buildings on the site have been demolished to facilitate the construction of Crows Nest Station under the CSSI Approval. The demolition works are now complete, and the site is vacant and surrounded by construction hoarding. Once the station is completed as per the CSSI Approval, the entry within Site C will provide connection to the east towards Willoughby Road.

## 1.5 Overview of the proposed development

This detailed SSD Application will seek consent for the construction of a commercial office building on the site. It will be highly integrated with the approved Crows Nest Station under construction below.

Specifically, consent is sought for the following works:

- Construction, use and fitout of a new commercial building with the following parameters:
  - A total gross floor area (GFA) of 3,100m<sup>2</sup>
  - A maximum building height of RL 127m, with an additional 5m 'building services zone' to accommodate rooftop plant and equipment, lift overruns and services (RL 132m total)
  - Nine storeys, comprising:
    - Building entrance lobby on the ground level
    - Bicycle parking and end of trip facilities on level 1
    - Commercial offices on levels 2 – 8
    - An accessible garden on part of level 9 for use by tenants

- Rooftop plant and service areas
- Associated building servicing and building landscaping elements.
- Signage zones for building / business identification.
- No vehicle parking will be provided on site.

The CSSI Approval for the metro station includes space provisioning on the ground level (building entrances) and level 1 (bicycle parking and EoT) for the Site C OSD. The use and fit-out of these OSD spaces requires approval under Part 4 while the actual station structure itself is approved as part of the Sydney Metro City & Southwest project.

## 1.6 Assessment requirements

DPIE has issued the Secretary’s Environmental Assessment Requirements (SEARs) for the preparation of an Environmental Impact Statement for the proposed development. This report has been prepared having regard to the SEARs as follows:

SEARs Requirement	Where addressed
<p><i>Public Space</i></p> <p><i>Demonstrate how the development:</i></p> <ul style="list-style-type: none"> <li>• <i>ensures public spaces have excellent amenity, suitable for their intended use, such as through adequate facilities, solar access, shade and wind protection.</i></li> </ul>	Section 3
<p><i>Environmental amenity</i></p> <ul style="list-style-type: none"> <li>• <i>Assess amenity impacts on the surrounding locality, including lighting impacts, solar access, visual privacy, visual amenity, view loss and view sharing, overshadowing, wind impacts and acoustic impacts. A high level of environmental amenity for any surrounding residential land uses must be demonstrated.</i></li> </ul>	Section 3

## 1.7 Project Objectives

The objective of the study was to assess the effect of the proposed development on local wind conditions in pedestrian areas on and around the study site and provide recommendations to minimise adverse effects, where necessary. This quantitative assessment was based on wind speed measurements on a scale model of the development and its surroundings in one of RWDI’s boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to appropriate criteria for gauging wind comfort and safety in pedestrian accessible areas. The assessment focused on critical pedestrian areas, including walkways and sidewalks around the project site, building entrances and amenity spaces.

For this stage of the development, testing has been undertaken with the inclusion of the Metro Station built form components on Site A, B and C, as well as the OSD built form on Site C. The southern end of Site A has been considered vacant at this stage with this and the remainder of Site A being the location of a future OSD built form. There is also provision for a future OSD built form on Site B, however this hasn’t been considered at this stage. The overall heights of the built forms considered for the study were Site A of approximately 18 m, Site B approximately 17 m and Site C approximately 43 m above the ground level.

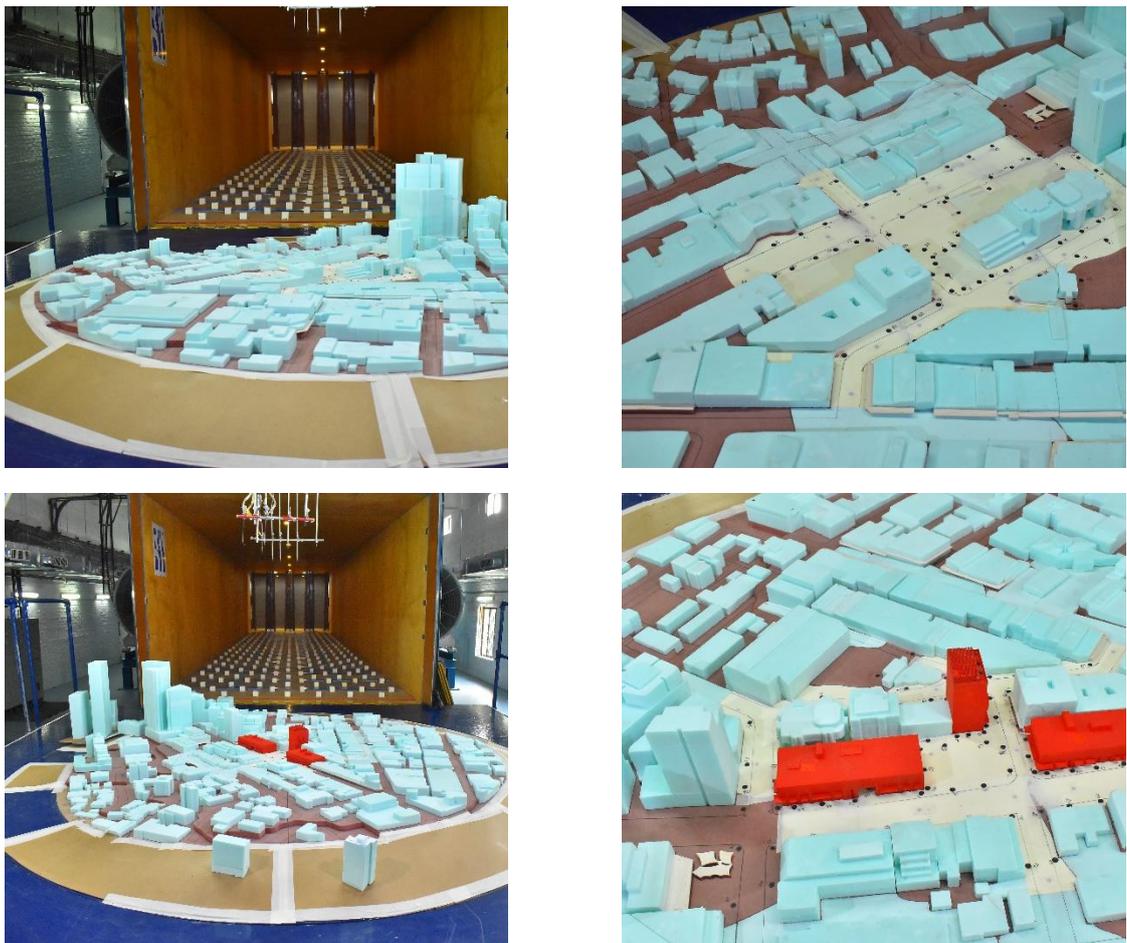
## 2 Background and approach

### 2.1 Wind Tunnel Study model

To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests for the following configurations:

- A - Existing: Existing site with existing surrounding built form, and,
- B - Proposed: Proposed Development (Site A, B and C) with the existing surrounding built form.

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 360 m radius of the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel. The wind tunnel model was instrumented with 99 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 1.5 m above local grade in pedestrian areas throughout the study site and terrace levels. Wind speeds were measured for 36 directions in 10-degree increments. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site and reviewed by the project team.

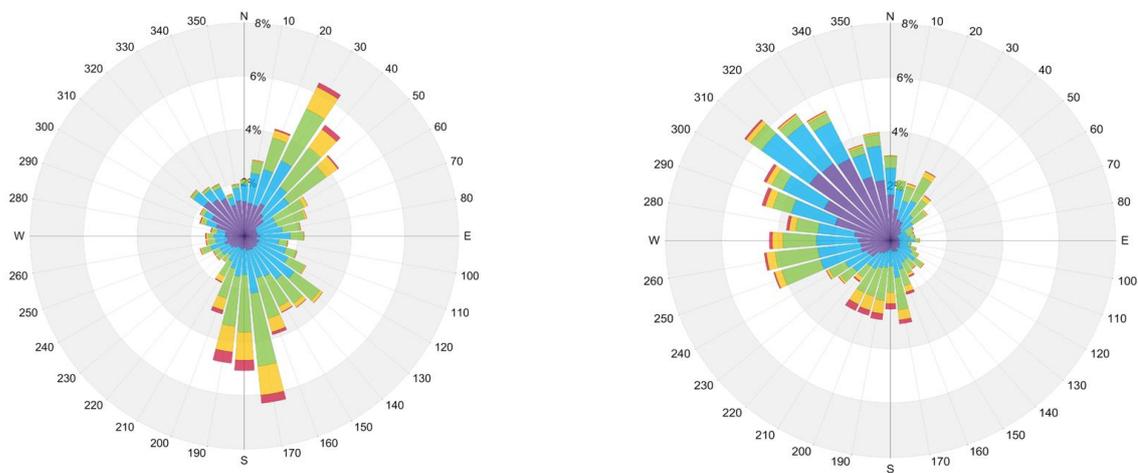


**Figure 3: Wind tunnel Study Model – Proposed configuration**

## 2.2 Meteorological Data

Wind statistics recorded at Sydney International Airport between 1995 and 2018, inclusive, were analysed for the summer (November to April) and winter (May to October) seasons. Figure 2-3 graphically depicts the directional distributions of wind frequencies and speeds for these two seasons. Winds from the north-northeast and south-southeast are predominant during the summer season while winter winds tend to originate from the northwest, west-southwest and south-southwest directions as indicated by the wind roses. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 10.6 % and 8 % of the time during the summer and winter seasons, respectively.

Wind statistics were combined with the wind tunnel data to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the wind criteria for pedestrian comfort and safety.



Summer (November to April)

Winter (May to October)

Wind Speed (km/h)	Probability (%)	
	Summer	Winter
Calm	0.3	0.2
1-10	30.0	38.0
11-20	30.3	31.9
21-30	28.7	21.8
31-40	8.5	6.0
>40	2.1	2.0

**Figure 4: Directional Distribution of Winds Approaching Sydney International Airport from 1995 to 2018**

## 2.3 Pedestrian Wind Criteria

### 2.3.1 Safety

Excessive gust speeds can adversely affect the balance and footing of a pedestrian. The Australasian Wind Engineering Society (AWES) recommended annual gust wind speed of 23 m/s (83 km/h) is considered in this present study. If the gust wind speeds exceeds 83 km/h for more than 9 hours or 0.1% of the time on an annual basis, the wind conditions are considered severe. Wind control measures are typically required at locations where winds exceed the wind safety criterion.

### 2.3.2 Comfort

The RWDI pedestrian wind criteria, which have been developed by RWDI through their research and consulting practice since 1974, are used to assess comfort conditions in the current study. These criteria have been widely accepted by municipal authorities as well as by the building design and city planning community. Regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can affect a person's perception of the wind climate. Comparisons of wind speeds for the existing and proposed building configurations are the most objective way in assessing the impact of a subject development on the local pedestrian wind conditions. In general, the combined effect of mean and gust speeds on pedestrian comfort can be quantified by a Gust Equivalent Mean (GEM).

Comfort Category	GEM Speed (km/h)	Description
Sitting	< 10	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	< 14	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
Strolling	< 17	Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park
Walking	< 20	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 20	Strong winds of this magnitude are considered a nuisance for all pedestrian activities, and wind mitigation is typically recommended

#### Notes:

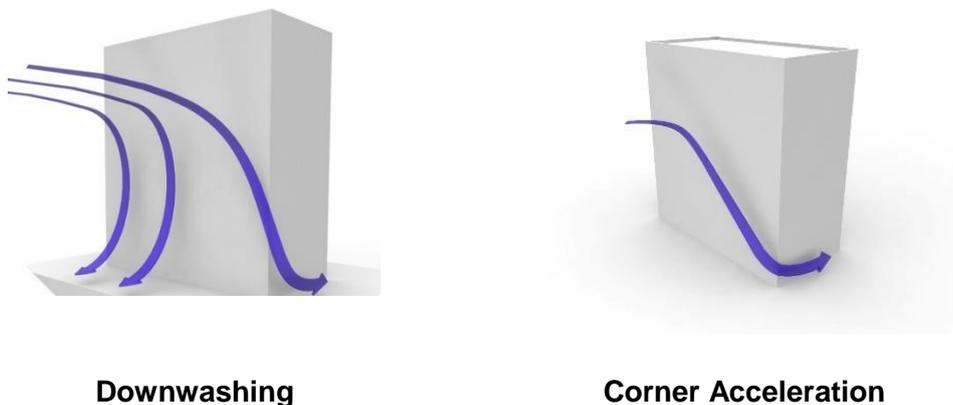
- (1) GEM speed = max (mean speed, gust speed/1.85);
- (2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00. Nightly hours between 0:00 and 5:00 are excluded from the wind analysis for comfort since limited usage of outdoor spaces is anticipated; and,
- (3) Instead of standard four seasons, two periods of summer (November to April) and winter (May to October) are adopted in the wind analysis, because in a sub-tropical climate such as that found in Sydney, there are distinct differences in pedestrian outdoor behaviours between these two-time periods.

### 3 Results and discussion

The predicted wind conditions are shown on site plans in Figures 1A through 2B located in the “Figures” section of this report. These conditions and the associated wind speeds are also presented in Table 1, located in the “Tables” section of this report. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest.

In the discussion of the anticipated wind conditions, references will be made to the following generalised wind flow patterns (Figure 5). If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity.

- Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level which is called downwashing
- When winds approach at an oblique angle to a tall façade and are deflected down, a localised increase in the wind activity, or corner acceleration, can be expected around the exposed building corners at pedestrian level



**Figure 5: General Wind Flow Mechanisms**

The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest.

#### 3.1 Wind Safety

It's expected that the wind speeds at all areas assessed on and around the development site will meet the recommended safety criterion.

#### 3.2 Wind Comfort – Grade Level (Locations 01 through 94)

Wind conditions comfortable for walking are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at main entrances where pedestrians are likely to linger. Wind speeds comfortable for sitting are preferred for areas intended for passive activities.

##### 3.2.1 Existing Configuration

The wind conditions around the Site during the summer period are considered to be comfortable for sitting, standing or strolling at most of the locations. Localised areas of higher wind speeds comfortable for walking (Location 76) are found north of Oxley

Street due to the prevailing northeasterly and south-southeasterly winds. These conditions are considered acceptable for active pedestrian use.

The wind speeds during the winter season at the grade level are generally calmer overall, and considered to be comfortable for sitting or standing at the majority of the locations around the site.

### **3.2.2 Proposed Configuration**

With the addition of the Proposed Development (Site A, B and C), wind speeds immediately around the built forms associated with Sites A and C, on Oxley Street and Hume Street, are expected to increase as the prevailing winds downwash and accelerate around the respective corners. The resulting conditions are expected to be generally comfortable for standing, strolling or walking in the summer period, while conditions suitable for sitting, standing or strolling are expected during the winter period.

Wind conditions at the main entrances to Site A (Locations 33, 35, 36 and 40) and Site B (Locations 48, 52 and 53) are predicted to be comfortable for sitting or standing, which is appropriate for an entrance use. The OSD Building entrance to Site C off Hume Street (Location 4) is likely to experience slightly windier conditions, comfortable for strolling.

Conditions comfortable for walking in the summer, and strolling in the winter, are expected along the Oxley Street footpath (Locations 77 and 76) and along Hume street (Location 7 and 8), near Sites A and C, respectively. These conditions will be suitable for active pedestrian use.

Consideration should be given to extending the awnings on Site C to wrap around the corner of Clarke Street and Hume Street. Street trees with large crowns, similar to those in the current streetscape along Clarke Street (Figure 6) would be beneficial in reducing wind activity along the footpaths, and to some extent, the Hume Street entrance of Site C. Additional tree planting is being explored as part of the Station Design and Precinct Plan, which forms part of the CSSI Approval and governs the design of all public domain areas associated with the Crows Nest Station precinct outside of this proposed SSD Application. Incorporation of additional street trees may reduce the need for a wrap-around awning at the corner of Clarke Street and Hume Street.

Examples of the suggested measures are shown in Figure 7.



**Figure 6: Existing Planter and Street Trees on Hume and Clarke Streets**



**Figure 7: Examples of Corner Canopy and Wind Control Features at Building Entrances**

### **3.3 Wind Comfort – Above Grade (Locations 95 through 99)**

It is generally desirable for wind conditions on terraces intended for passive activities to be comfortable for sitting more than 80% of the time during appropriate weather conditions. The design of the Site C OSD building includes a rooftop space intended to be trafficked by the occupants of the building. The wind conditions on the rooftop space are expected to be comfortable for standing for most of the time during the year which is appropriate for its intended usage.

Wind speeds on the roof are higher in the summer months than in the winter. The terrace would benefit from wind control features like large plantings and wind screens interspersed throughout the area to help buffer these winds. These features should be capable of growing to 1.5 – 2m in height to enable them to provide good wind control. Some examples are provided in Figure 8. The currently proposed landscaping plan is expected to be suitable for this purpose. The current design of this area illustrated in the April 2021 Architectural Design Report are in line with these concepts, as such we anticipate improvement to wind conditions on the roof terrace when compared to the results shown on Figures 1B and 2B of this report.

**Figure 8**      **Examples of Rooftop Landscaping Treatment for Wind Control**



## 4 Applicability of results

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The drawings and information listed below were received from SMEC and were used to construct the scale model of the proposed Crows Nest OSD. The wind conditions presented in this report pertain to the proposed as detailed in the architectural design drawings listed in the table below. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
SMCSWSCN-SMC-SCN-AT-MOD-110101-Detached	Revit Model	20/01/2020
SMCSWSCN-SMC-SCN-AT-MOD-410101-Detached	Revit Model	14/01/2020

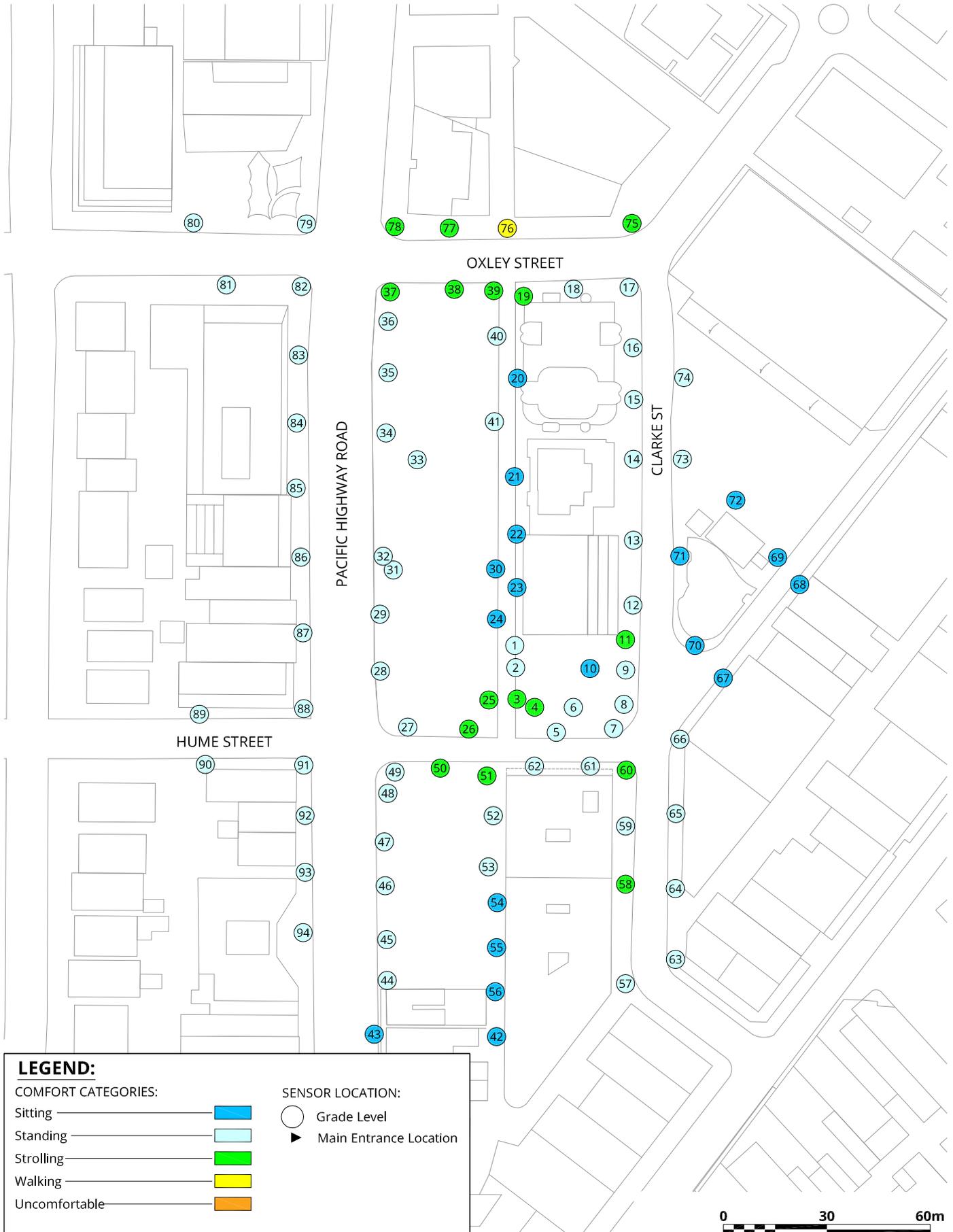
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# FIGURES



**Pedestrian Wind Comfort Conditions**  
 Existing  
 Summer (November to April, 6:00 to 23:00)

Crow's Nest OSD Site C - North Sydney NSW

True North



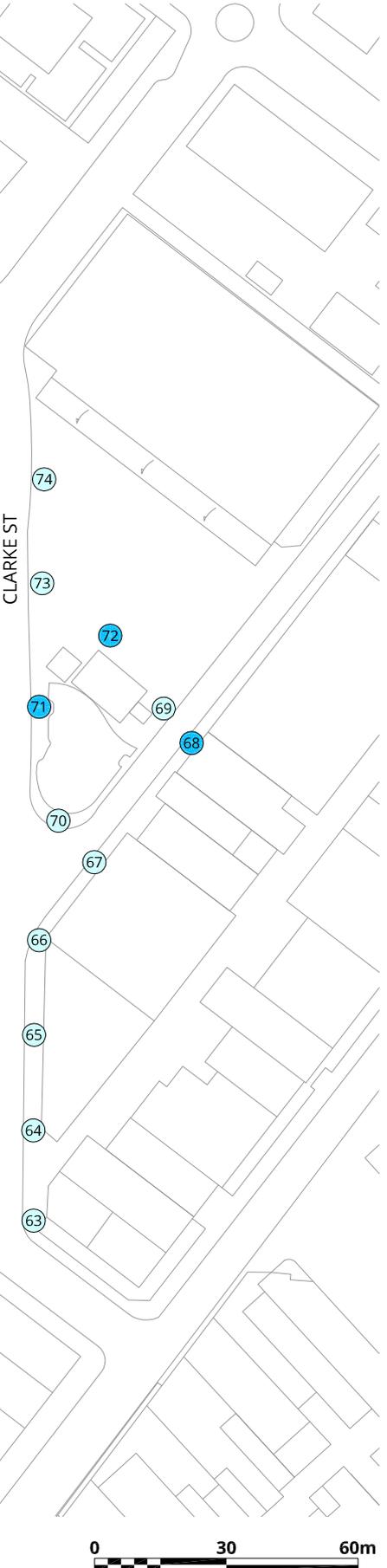
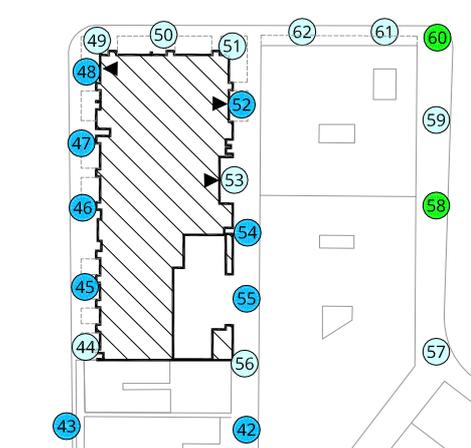
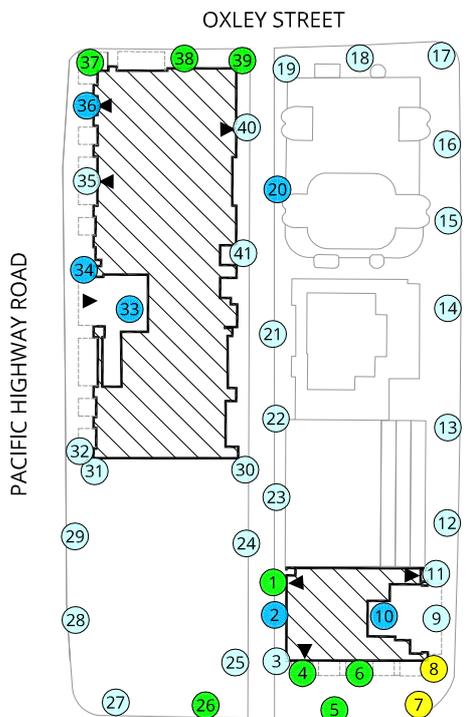
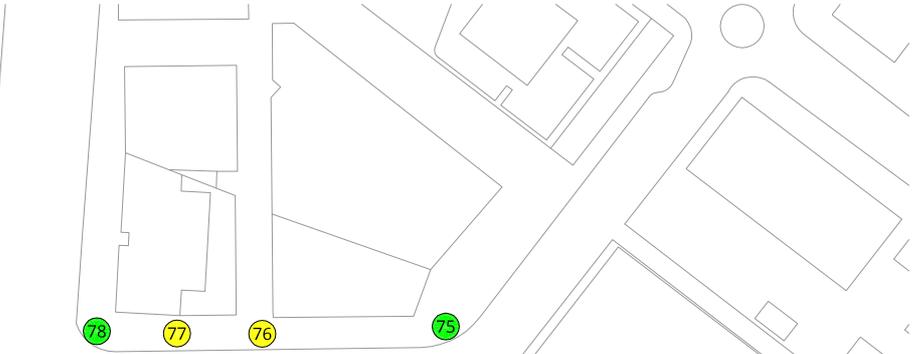
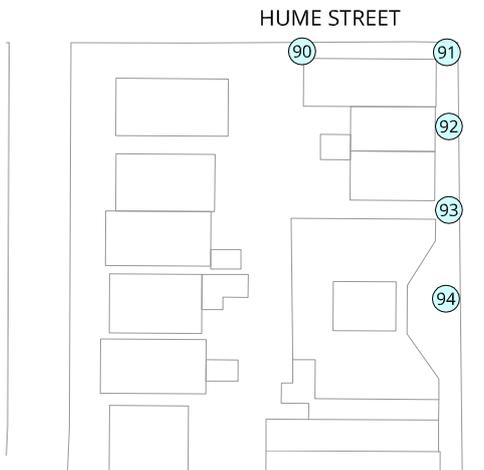
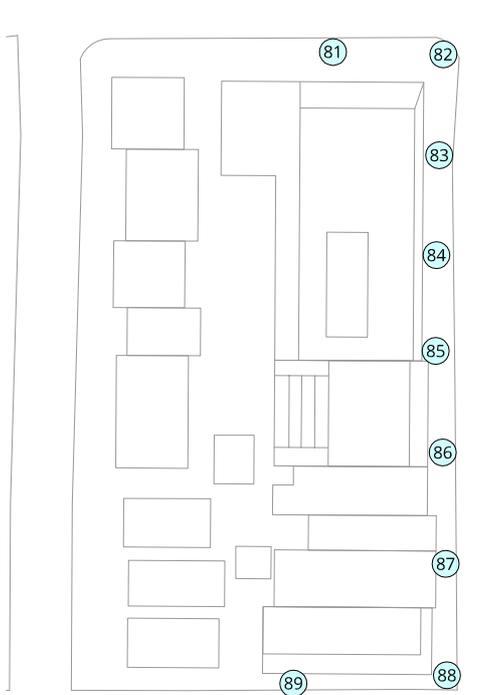
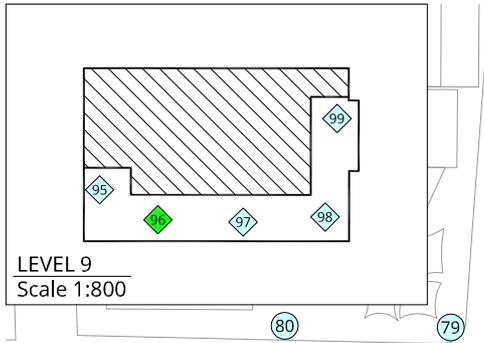
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Drawn by: SSU Figure: 1A

Approx. Scale: 1:1500

Date Revised: Feb. 10, 2020





**LEGEND:**

COMFORT CATEGORIES:

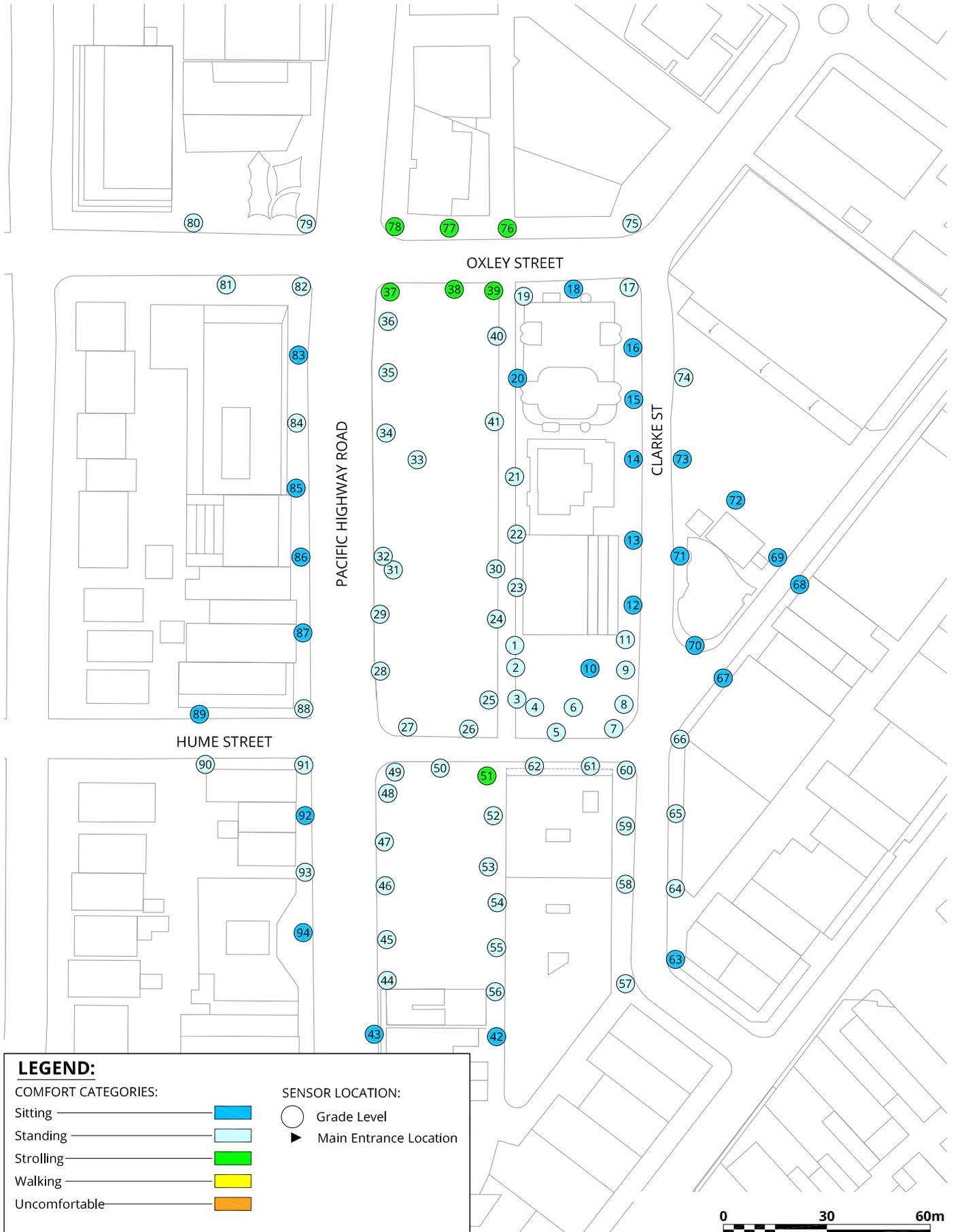
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:

- Grade Level
- Roof Level
- Main Entrance Location



<p><b>Pedestrian Wind Comfort Conditions</b> Proposed Summer (November to April, 6:00 to 23:00)</p> <p>Crow's Nest OSD Site C - North Sydney NSW</p>	<p>True North</p>	Drawn by: SSU	Figure: 1B	
		Approx. Scale: 1:1500		
		Date Revised: Feb. 10, 2020		
Project #1903880				



**Pedestrian Wind Comfort Conditions**  
 Existing  
 Winter (May to October, 6:00 to 23:00)

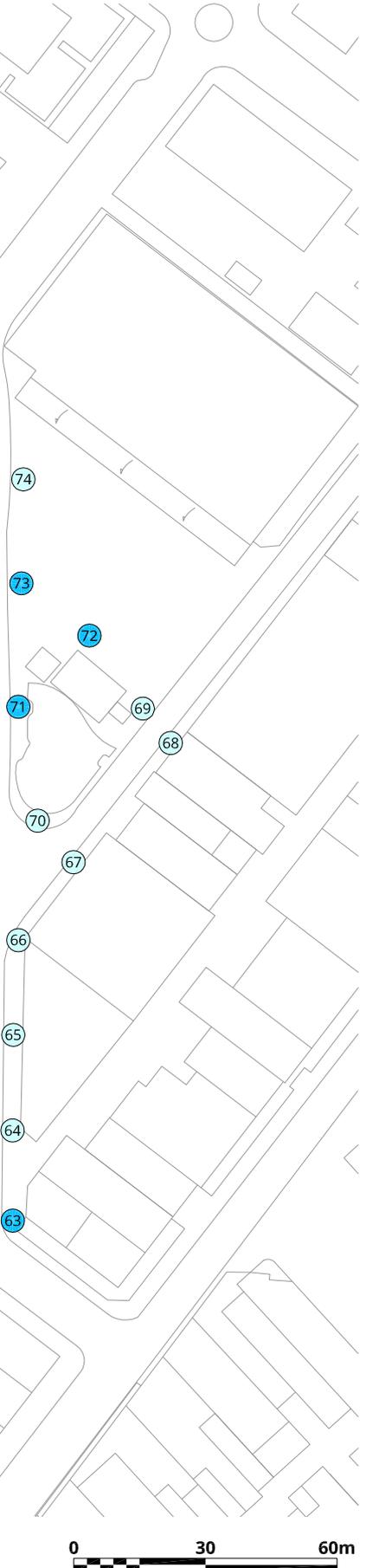
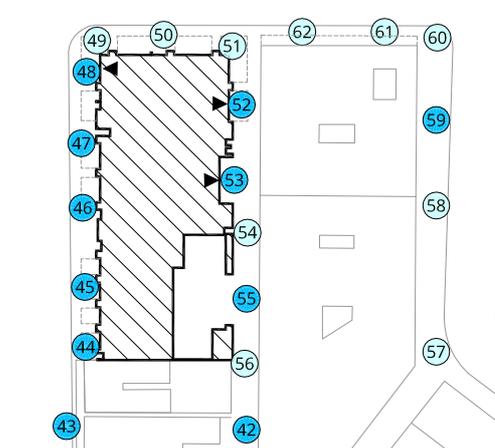
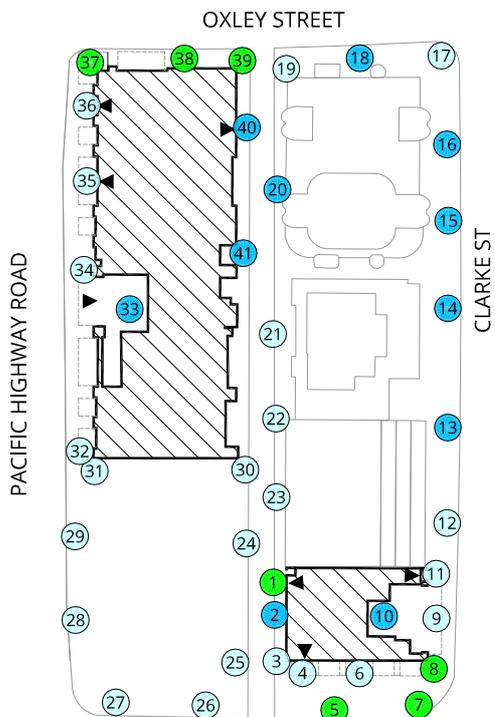
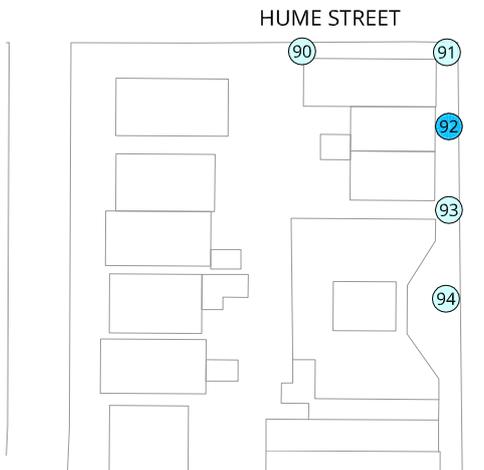
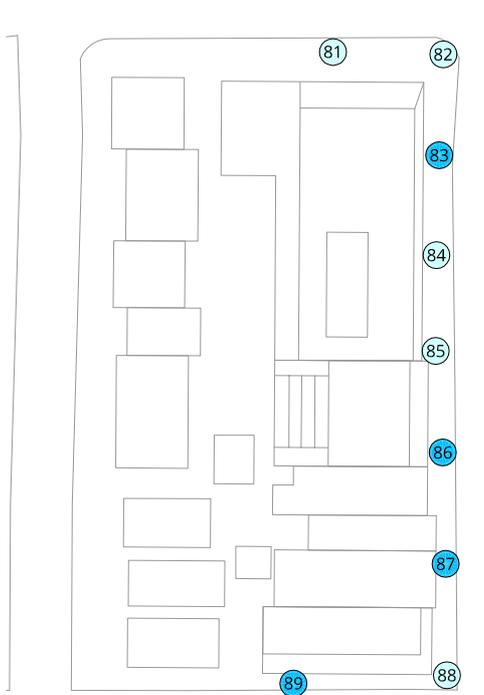
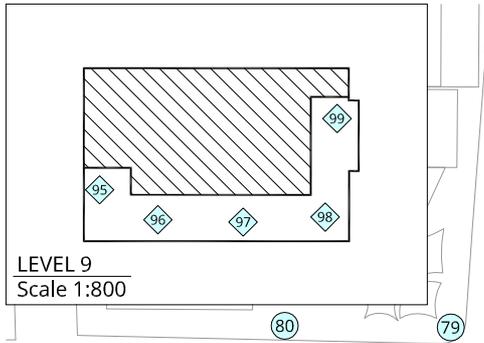
Crow's Nest OSD Site C - North Sydney NSW



Project #1903880

Drawn by: SSU	Figure: 2A
Approx. Scale: 1:1500	
Date Revised: Feb. 10, 2020	





**LEGEND:**

COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:

- Grade Level
- Roof Level
- Main Entrance Location



<p><b>Pedestrian Wind Comfort Conditions</b> Proposed Winter (May to October, 6:00 to 23:00)</p> <p>Crow's Nest OSD Site C - North Sydney NSW</p>	<p>True North</p>	<p>Drawn by: SSU</p>	<p>Figure: 2B</p>	
			<p>Approx. Scale: 1:1500</p>	
			<p>Date Revised: Feb. 10, 2020</p>	
		<p>Project #1903880</p>		

A large decorative graphic on the left side of the page. It features a dark grey triangle in the top-left corner, a white curved line separating it from a light grey curved area, and a larger light grey curved area below. The word 'TABLES' is centered within the light grey area.

# TABLES

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
1	Existing	13	Standing	14	Standing	67	Pass
	Proposed	15	Strolling	15	Strolling	69	Pass
2	Existing	14	Standing	14	Standing	61	Pass
	Proposed	10	Sitting	10	Sitting	48	Pass
3	Existing	15	Strolling	14	Standing	61	Pass
	Proposed	13	Standing	13	Standing	66	Pass
4	Existing	16	Strolling	14	Standing	63	Pass
	Proposed	16	Strolling	14	Standing	60	Pass
5	Existing	14	Standing	12	Standing	51	Pass
	Proposed	17	Strolling	16	Strolling	74	Pass
6	Existing	14	Standing	12	Standing	53	Pass
	Proposed	16	Strolling	13	Standing	55	Pass
7	Existing	14	Standing	13	Standing	55	Pass
	Proposed	18	Walking	16	Strolling	65	Pass
8	Existing	13	Standing	12	Standing	53	Pass
	Proposed	20	Walking	16	Strolling	71	Pass
9	Existing	14	Standing	13	Standing	54	Pass
	Proposed	12	Standing	11	Standing	55	Pass
10	Existing	6	Sitting	6	Sitting	23	Pass
	Proposed	5	Sitting	5	Sitting	20	Pass
11	Existing	16	Strolling	13	Standing	63	Pass
	Proposed	14	Standing	12	Standing	62	Pass
12	Existing	13	Standing	10	Sitting	57	Pass
	Proposed	13	Standing	11	Standing	51	Pass
13	Existing	13	Standing	10	Sitting	53	Pass
	Proposed	12	Standing	10	Sitting	50	Pass
14	Existing	11	Standing	10	Sitting	43	Pass
	Proposed	11	Standing	9	Sitting	42	Pass
15	Existing	11	Standing	8	Sitting	45	Pass
	Proposed	12	Standing	9	Sitting	49	Pass
16	Existing	12	Standing	9	Sitting	49	Pass
	Proposed	12	Standing	9	Sitting	51	Pass
17	Existing	13	Standing	11	Standing	47	Pass
	Proposed	12	Standing	11	Standing	52	Pass
18	Existing	11	Standing	10	Sitting	47	Pass
	Proposed	11	Standing	10	Sitting	49	Pass
19	Existing	15	Strolling	14	Standing	59	Pass
	Proposed	13	Standing	12	Standing	59	Pass

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
20	Existing	10	Sitting	10	Sitting	45	Pass
	Proposed	9	Sitting	8	Sitting	40	Pass
21	Existing	10	Sitting	11	Standing	55	Pass
	Proposed	13	Standing	12	Standing	55	Pass
22	Existing	10	Sitting	11	Standing	60	Pass
	Proposed	13	Standing	12	Standing	59	Pass
23	Existing	9	Sitting	11	Standing	52	Pass
	Proposed	12	Standing	12	Standing	60	Pass
24	Existing	10	Sitting	12	Standing	60	Pass
	Proposed	14	Standing	14	Standing	64	Pass
25	Existing	15	Strolling	14	Standing	59	Pass
	Proposed	14	Standing	14	Standing	62	Pass
26	Existing	15	Strolling	14	Standing	59	Pass
	Proposed	17	Strolling	14	Standing	63	Pass
27	Existing	13	Standing	13	Standing	54	Pass
	Proposed	14	Standing	13	Standing	53	Pass
28	Existing	12	Standing	12	Standing	55	Pass
	Proposed	13	Standing	12	Standing	53	Pass
29	Existing	12	Standing	12	Standing	55	Pass
	Proposed	12	Standing	12	Standing	53	Pass
30	Existing	10	Sitting	11	Standing	59	Pass
	Proposed	13	Standing	13	Standing	60	Pass
31	Existing	11	Standing	11	Standing	55	Pass
	Proposed	12	Standing	11	Standing	44	Pass
32	Existing	12	Standing	12	Standing	55	Pass
	Proposed	11	Standing	11	Standing	56	Pass
33	Existing	11	Standing	11	Standing	50	Pass
	Proposed	5	Sitting	5	Sitting	25	Pass
34	Existing	12	Standing	12	Standing	53	Pass
	Proposed	9	Sitting	11	Standing	56	Pass
35	Existing	13	Standing	14	Standing	61	Pass
	Proposed	11	Standing	11	Standing	52	Pass
36	Existing	14	Standing	14	Standing	64	Pass
	Proposed	10	Sitting	11	Standing	52	Pass
37	Existing	16	Strolling	16	Strolling	72	Pass
	Proposed	15	Strolling	15	Strolling	65	Pass
38	Existing	17	Strolling	16	Strolling	73	Pass
	Proposed	15	Strolling	15	Strolling	68	Pass

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
39	Existing	17	Strolling	16	Strolling	72	Pass
	Proposed	15	Strolling	15	Strolling	73	Pass
40	Existing	13	Standing	13	Standing	56	Pass
	Proposed	12	Standing	10	Sitting	49	Pass
41	Existing	12	Standing	12	Standing	53	Pass
	Proposed	11	Standing	10	Sitting	43	Pass
42	Existing	9	Sitting	10	Sitting	47	Pass
	Proposed	9	Sitting	8	Sitting	36	Pass
43	Existing	10	Sitting	10	Sitting	45	Pass
	Proposed	10	Sitting	10	Sitting	45	Pass
44	Existing	12	Standing	11	Standing	50	Pass
	Proposed	11	Standing	10	Sitting	42	Pass
45	Existing	11	Standing	11	Standing	45	Pass
	Proposed	9	Sitting	9	Sitting	44	Pass
46	Existing	12	Standing	11	Standing	47	Pass
	Proposed	10	Sitting	10	Sitting	43	Pass
47	Existing	11	Standing	11	Standing	48	Pass
	Proposed	10	Sitting	9	Sitting	45	Pass
48	Existing	12	Standing	12	Standing	50	Pass
	Proposed	10	Sitting	10	Sitting	47	Pass
49	Existing	13	Standing	12	Standing	51	Pass
	Proposed	11	Standing	12	Standing	55	Pass
50	Existing	16	Strolling	14	Standing	57	Pass
	Proposed	14	Standing	13	Standing	56	Pass
51	Existing	15	Strolling	15	Strolling	63	Pass
	Proposed	11	Standing	11	Standing	51	Pass
52	Existing	11	Standing	11	Standing	54	Pass
	Proposed	9	Sitting	9	Sitting	44	Pass
53	Existing	12	Standing	13	Standing	61	Pass
	Proposed	11	Standing	9	Sitting	42	Pass
54	Existing	10	Sitting	12	Standing	59	Pass
	Proposed	10	Sitting	11	Standing	50	Pass
55	Existing	10	Sitting	11	Standing	56	Pass
	Proposed	10	Sitting	9	Sitting	42	Pass
56	Existing	10	Sitting	12	Standing	61	Pass
	Proposed	12	Standing	11	Standing	50	Pass
57	Existing	14	Standing	12	Standing	53	Pass
	Proposed	14	Standing	12	Standing	52	Pass

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
58	Existing	16	Strolling	12	Standing	60	Pass
	Proposed	15	Strolling	12	Standing	55	Pass
59	Existing	13	Standing	11	Standing	48	Pass
	Proposed	12	Standing	10	Sitting	44	Pass
60	Existing	15	Strolling	14	Standing	65	Pass
	Proposed	15	Strolling	13	Standing	60	Pass
61	Existing	11	Standing	11	Standing	59	Pass
	Proposed	14	Standing	14	Standing	70	Pass
62	Existing	11	Standing	11	Standing	50	Pass
	Proposed	14	Standing	12	Standing	59	Pass
63	Existing	12	Standing	10	Sitting	45	Pass
	Proposed	11	Standing	9	Sitting	41	Pass
64	Existing	12	Standing	12	Standing	62	Pass
	Proposed	12	Standing	11	Standing	47	Pass
65	Existing	14	Standing	14	Standing	69	Pass
	Proposed	13	Standing	13	Standing	61	Pass
66	Existing	12	Standing	12	Standing	55	Pass
	Proposed	12	Standing	12	Standing	61	Pass
67	Existing	9	Sitting	10	Sitting	53	Pass
	Proposed	11	Standing	12	Standing	59	Pass
68	Existing	9	Sitting	9	Sitting	42	Pass
	Proposed	10	Sitting	11	Standing	55	Pass
69	Existing	10	Sitting	10	Sitting	43	Pass
	Proposed	11	Standing	11	Standing	57	Pass
70	Existing	9	Sitting	9	Sitting	41	Pass
	Proposed	12	Standing	12	Standing	59	Pass
71	Existing	10	Sitting	9	Sitting	42	Pass
	Proposed	10	Sitting	10	Sitting	50	Pass
72	Existing	10	Sitting	9	Sitting	39	Pass
	Proposed	10	Sitting	9	Sitting	37	Pass
73	Existing	12	Standing	10	Sitting	45	Pass
	Proposed	11	Standing	9	Sitting	39	Pass
74	Existing	13	Standing	11	Standing	48	Pass
	Proposed	13	Standing	11	Standing	51	Pass
75	Existing	17	Strolling	14	Standing	68	Pass
	Proposed	16	Strolling	14	Standing	64	Pass
76	Existing	18	Walking	15	Strolling	68	Pass
	Proposed	18	Walking	16	Strolling	69	Pass

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
77	Existing	17	Strolling	17	Strolling	82	Pass
	Proposed	18	Walking	17	Strolling	82	Pass
78	Existing	16	Strolling	16	Strolling	72	Pass
	Proposed	17	Strolling	16	Strolling	71	Pass
79	Existing	14	Standing	14	Standing	63	Pass
	Proposed	14	Standing	13	Standing	61	Pass
80	Existing	14	Standing	13	Standing	53	Pass
	Proposed	14	Standing	13	Standing	53	Pass
81	Existing	13	Standing	13	Standing	58	Pass
	Proposed	13	Standing	13	Standing	56	Pass
82	Existing	14	Standing	14	Standing	71	Pass
	Proposed	13	Standing	14	Standing	69	Pass
83	Existing	11	Standing	10	Sitting	46	Pass
	Proposed	11	Standing	10	Sitting	46	Pass
84	Existing	12	Standing	11	Standing	51	Pass
	Proposed	12	Standing	11	Standing	50	Pass
85	Existing	11	Standing	10	Sitting	47	Pass
	Proposed	12	Standing	11	Standing	48	Pass
86	Existing	12	Standing	10	Sitting	46	Pass
	Proposed	12	Standing	10	Sitting	45	Pass
87	Existing	11	Standing	9	Sitting	46	Pass
	Proposed	11	Standing	9	Sitting	42	Pass
88	Existing	13	Standing	11	Standing	51	Pass
	Proposed	13	Standing	11	Standing	52	Pass
89	Existing	11	Standing	9	Sitting	41	Pass
	Proposed	11	Standing	9	Sitting	40	Pass
90	Existing	12	Standing	12	Standing	49	Pass
	Proposed	11	Standing	11	Standing	49	Pass
91	Existing	12	Standing	11	Standing	45	Pass
	Proposed	12	Standing	11	Standing	48	Pass
92	Existing	11	Standing	10	Sitting	44	Pass
	Proposed	12	Standing	10	Sitting	44	Pass
93	Existing	14	Standing	12	Standing	56	Pass
	Proposed	14	Standing	13	Standing	52	Pass
94	Existing	11	Standing	10	Sitting	45	Pass
	Proposed	12	Standing	11	Standing	49	Pass
95	Existing	-	-	-	-	-	-
	Proposed	14	Standing	11	Standing	54	Pass

**Table 1: Pedestrian Wind Comfort and Safety Conditions**

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
96	Existing	-	-	-	-	-	-
	Proposed	17	Strolling	12	Standing	69	Pass
97	Existing	-	-	-	-	-	-
	Proposed	14	Standing	12	Standing	65	Pass
98	Existing	-	-	-	-	-	-
	Proposed	13	Standing	11	Standing	56	Pass
99	Existing	-	-	-	-	-	-
	Proposed	14	Standing	11	Standing	50	Pass

Seasons	Hours	Comfort Speed (km/h)	Safety Speed (km/h)
Summer	November - April	6:00 - 23:00 for comfort	(20% Seasonal Exceedance)
Winter	May - October	0:00 - 23:00 for safety	(> 0.1% Annual Exceedance)
<b>Configurations</b>		≤ 10	≤ 90
<b>Existing</b>	Without the proposed development	11 - 14	Pass
<b>Proposed</b>	With the proposed development	15 - 17	Exceeded
		18 - 20	
		> 20	