PEDESTRIAN WIND ENVIRONMENT STATEMENT

1 & 2 MURRAY ROSE AVENUE, OLYMPIC PARK

WE215-04F02(REV0)- WS REPORT

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EXECUTIVE SUMMARY

This report is in relation to the development located at 1 and 2 Murray Rose Avenue, Olympic Park and presents an opinion on the likely impact of the proposed design on the local wind environment on the critical outdoor areas within and around the subject development. The effect of wind activity is examined for the three predominant wind directions for the Greater Sydney region; namely those which prevail from the north-east, south-east to south, and west. 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 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. 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 is relatively exposed with minimal shielding from the easterly and westerly prevailing wind directions. As a result, there are expected adverse wind effects within certain areas of the development. It is expected that suitable wind conditions can be achieved through all trafficable areas within and around the site with the treatments recommended in this report, which are summarised below:

- Include densely foliating vegetation along Bennelong Parkway,
- Include additional densely foliating vegetation along Murray Rose Avenue,
- Include additional vegetation in the through-site-link,
- Include additional vegetation to the north of Tower 1 on the ground level,
- Include awnings over the southern entrance to the Communal Open Space on the ground level of Tower 1,
- Seal the southern entrance to the Communal Open Space of Tower 2,
- Include additional vegetation around the Level 8 Communal Open Spaces,
- Include a 2m high impermeable screen around the perimeter of the Level 8 Communal Open Spaces,
- Include end screens for the corner balconies,
- Include 2m high impermeable screens around the large, upper level north and south-facing balconies of both towers, and
- Include impermeable balustrades for all other balconies in general.

It should be noted that for any tree planting and landscaping to be effective as a wind ameliorative device, the species selected should be of an evergreen variety and densely foliating. Trees should by planted in clusters with interlocking canopies to help absorb the wind as a tree in isolation can be impacted by stronger wind conditions.

Wind tunnel testing is recommended to be undertaken to assess the wind conditions within and around the subject development. This will provide a quantitative analysis of the wind conditions and determine the extent of the abovementioned wind mitigation treatments to ensure suitable wind conditions are achieved.

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1 INTRODUCTION

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 subject 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 THE DEVELOPMENT AND SURROUNDINGS

The proposed development site is located at 1-2 Murray Rose Avenue located in Sydney Olympic Park. Immediately surrounding the site to the north and north-west are rough grassy areas of the Brickpit Park. Immediately to the north-east through to the south of the site are thick mangroves and bushland of Badu Mangroves. Immediately to the south-west and west are mid-rise commercial buildings. Further from the site to the north are a combination of bushlands, open parks, the mid-rise apartments of Wentworth Point and Homebush Bay which leads to Parramatta River. Further to the east of the site are the low-rise residential properties of Liberty Grove. Further to the south-east of the site is Bicentennial Park and beyond that are low-rise residential houses. Further to the south-west and west of the site are the mid-rise buildings of Sydney Olympic Park.

A survey of the land topography indicates there are some minor elevation changes around the site. The site is approximately 7m lower on the eastern side of the site along Murray Rose Avenue which isn't expected to cause any major impact to the wind conditions of the site. The Brickpit Park to the north of the site is situated in a quarry and is approximately 30m lower than the development site. This may lead to increased turbulence of winds approaching the site from the north caused by winds hitting the southern wall of the quarry and accelerating upward. An aerial image of the subject site and the local surroundings is shown in Figure 1.

The subject development is comprised of 2 apartment buildings separated by Murray Rose Avenue.

Tower 1 is on the north side of Murray Rose Avenue and is 11 levels high with a U-shaped plan-form for the first 8 Levels and only the west-wing continuing for the full 11 Levels. Levels 9-11 have stepped planforms, stepping back from the south. The building has a Communal Open Space courtyard that opens up to the north and is open to the south on the ground level allowing pedestrian traffic and wind flows. Level 8 has a large Communal Open Space on the east-wing of the development.

Tower 2 is on the south side of Murray Rose Avenue and is 15 Levels high with a trapezoidal plan-form with a courtyard in the middle for the first 8 Levels, with only the west-wing continuing for the full 15 Levels. The Levels 9-15 have stepped planforms, stepping back from the south. The building has a large Communal Open Space in the centre of the tower that is open on the north and south ends allowing pedestrian traffic and wind flows. Level 8 has a large Communal Open Space on the east-wing of the development with a metal pergola extending from the west-wing over the courtyard of the main building.

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:

- Pedestrian footpaths and trafficable areas around the site on the Ground Level,
- Pedestrian areas within the Communal Open Spaces on the ground level of both towers,
- Communal Open Spaces on Level 8 of both Tower 1 and Tower 2, and
- The private balconies of both Tower 1 and Tower 2.

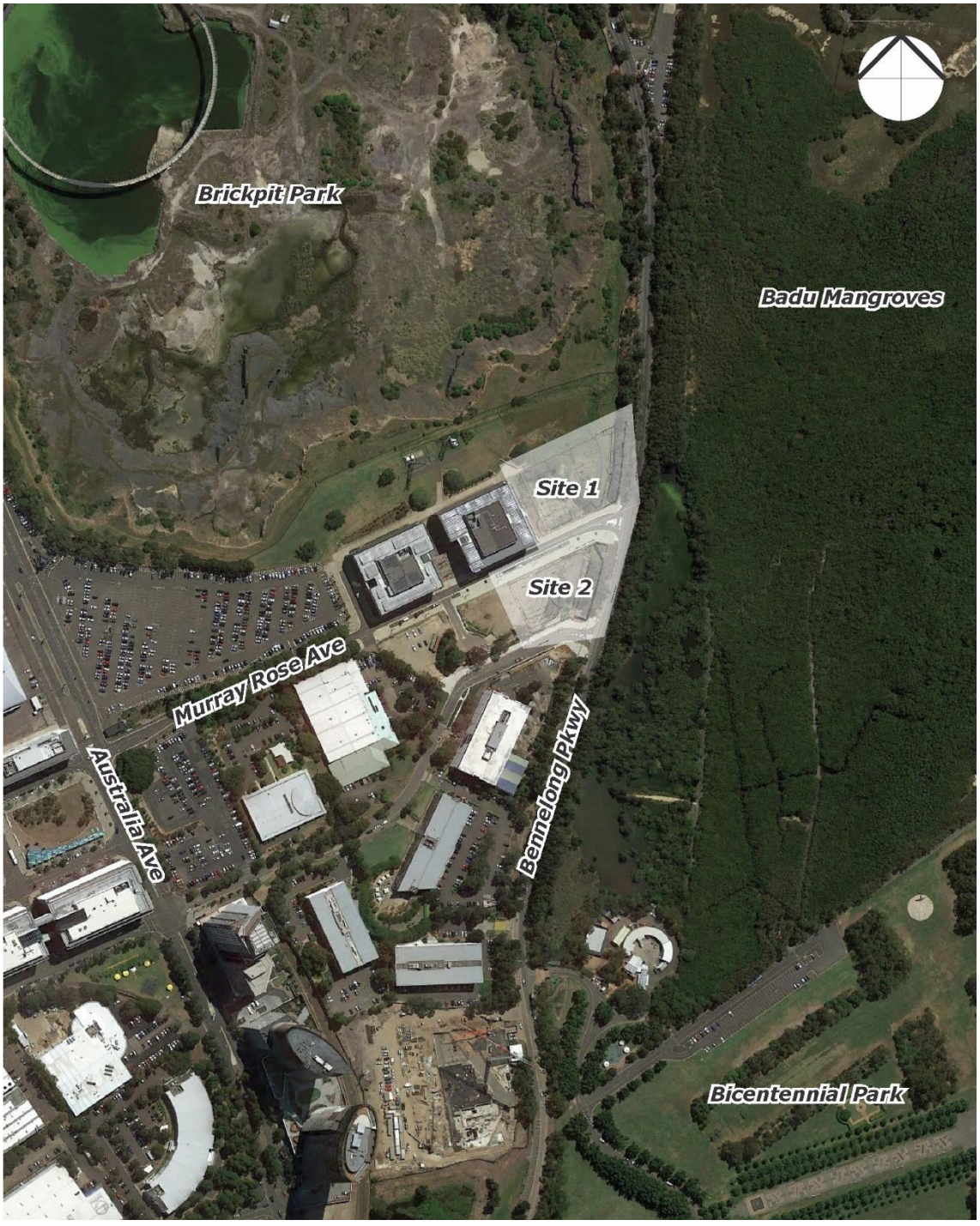

Figure 1: Aerial Image of the Site Location

3 REGIONAL WIND

The Greater 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-east to south, and west. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained at the meteorological station located at Bankstown Airport by the Bureau of Meteorology. The data has been collected from this station from 1993 to 2016 and corrected so that it represents winds over standard open terrain at a height of 10m above ground level. Figure 2 shows a summary of this analysis 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 determined and shown in Figure 2.

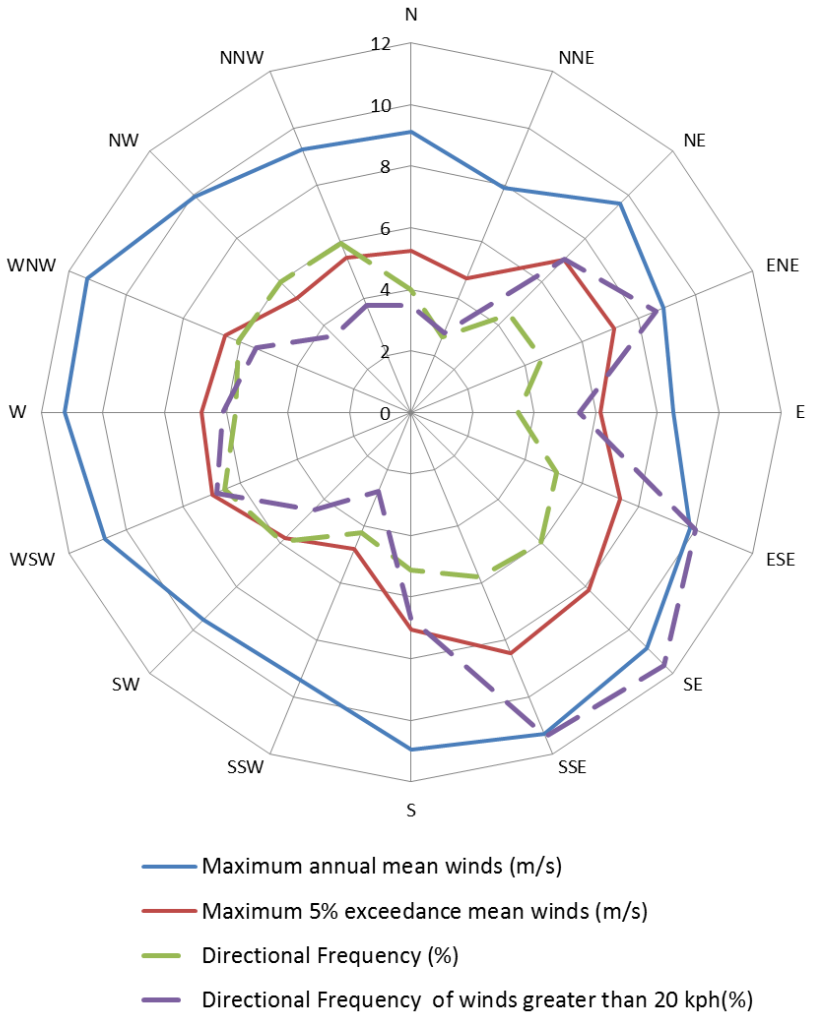

Figure 2: Annual and 5% Exceedance Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Greater Sydney Region (referenced to 10m above ground in standard open terrain)

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 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.

5 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. The interaction between the wind and the building morphology in the area is considered and important features considered 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.

It should be noted that for any tree planting and landscaping to be effective as a wind ameliorative device, the species selected should be of an evergreen variety and densely foliating. Trees should by planted in clusters with interlocking canopies to help absorb the wind as a tree in isolation can be impacted by stronger wind conditions

5.1 Pedestrian Footpaths and Ground Level Areas

The pedestrian footpaths, site entrances and public open spaces around the site are exposed to the prevailing winds from the south-east, west and north-east.

The pedestrian areas along Bennelong Parkway are exposed to the prevailing southerly and north-easterly winds; however, this area will benefit from the shielding provided by the bushland of the Badu Mangroves. It is recommended to include the street front vegetation to maintain suitable wind conditions.

The pedestrian areas along Murray Rose Avenue, are exposed to the prevailing westerly winds flowing directly along the street front as well as the prevailing southerly and north-easterly winds that hit the building facades of the subject development and deflect downward onto the street front. The irregularly shaped facades are expected to assist in breaking up both the downwash wind flows of the prevailing southerly and north-easterly winds, as well as breaking up the direct westerly winds along the street front. Nevertheless it is recommended to include additional densely foliating vegetation along the street front to assist in slowing the direct flows.

The pedestrian areas around the north-side of Tower 1 are exposed to the prevailing north-easterly and westerly winds. It is recommended to include additional densely foliating vegetation in this area.

The through-site-link to the west of Tower 1 which connects Murray Rose Avenue and Brickpit Park is exposed to the prevailing northerly winds funnelling into the passageway. It is recommended to include additional densely foliating vegetation in this area to slow the prevailing winds.

5.2 Pedestrian areas within the Communal Open Spaces on the Ground Level

The Communal Open Space on Tower 1 is exposed to the prevailing north-easterly winds funnelling into the major opening on the northern aspect, and also the prevailing south-easterly winds flowing into the opening on the southern aspect. The Tower 1 Communal Space benefits

from some vegetation within the space. The area may experience adverse wind conditions as a result of the wind flows funnelling into the narrow entrance on Murray Rose Avenue. It is recommended to include an awning over the entrance on both the north and south sides to help prevent these wind flows. This is shown in Figure 3.

The Communal Open Space on Tower 2 is exposed to the prevailing south-easterly winds flowing into the southern entrance of the opening on the southern aspect. It is recommended to seal this entrance with either an impermeable or a porous full height screen with a door to prevent funnelling wind flows.

5.3 Communal Open Spaces on Level 8

The Communal Open Space on Level 8 of Tower 1 is exposed to the prevailing north-easterly and south-easterly winds. The area benefits from landscaping in areas which are expected to help slow the wind flows, however is still exposed to direct winds in several areas. It is recommended to include additional vegetation with densely foliating undergrowth. It is also recommended to include a 2m high impermeable screen around the perimeter of the level.

The Communal Open Space on Level 8 of Tower 2 is exposed to the prevailing north-easterly and south-easterly winds similar to the Open Space of Tower 1. The area benefits from landscaping in areas which is expected to help slow the wind flows, however is still exposed to direct wind in several areas. It is recommended to include additional vegetation with densely foliating undergrowth as well as to include a 2m high impermeable screen around the perimeter of the level.

5.4 The Private Balconies of the Development

The private balconies of the development are exposed to the prevailing winds of the Greater Sydney Region. The balconies recessed in the major aspects of the towers are expected to experience suitable wind conditions. The corner balconies however are expected to be exposed to adverse wind conditions caused by corner accelerations. It is recommended to include end screens on one of the ends of the corner balconies of each development to deflect corner accelerations.

The large north and south-facing balconies on the upper levels of each tower are exposed to the prevailing winds. It is recommended to include 2m high perimeter screens to deflect the prevailing winds upward.

Impermeable balustrades are recommended for all other balconies in general.

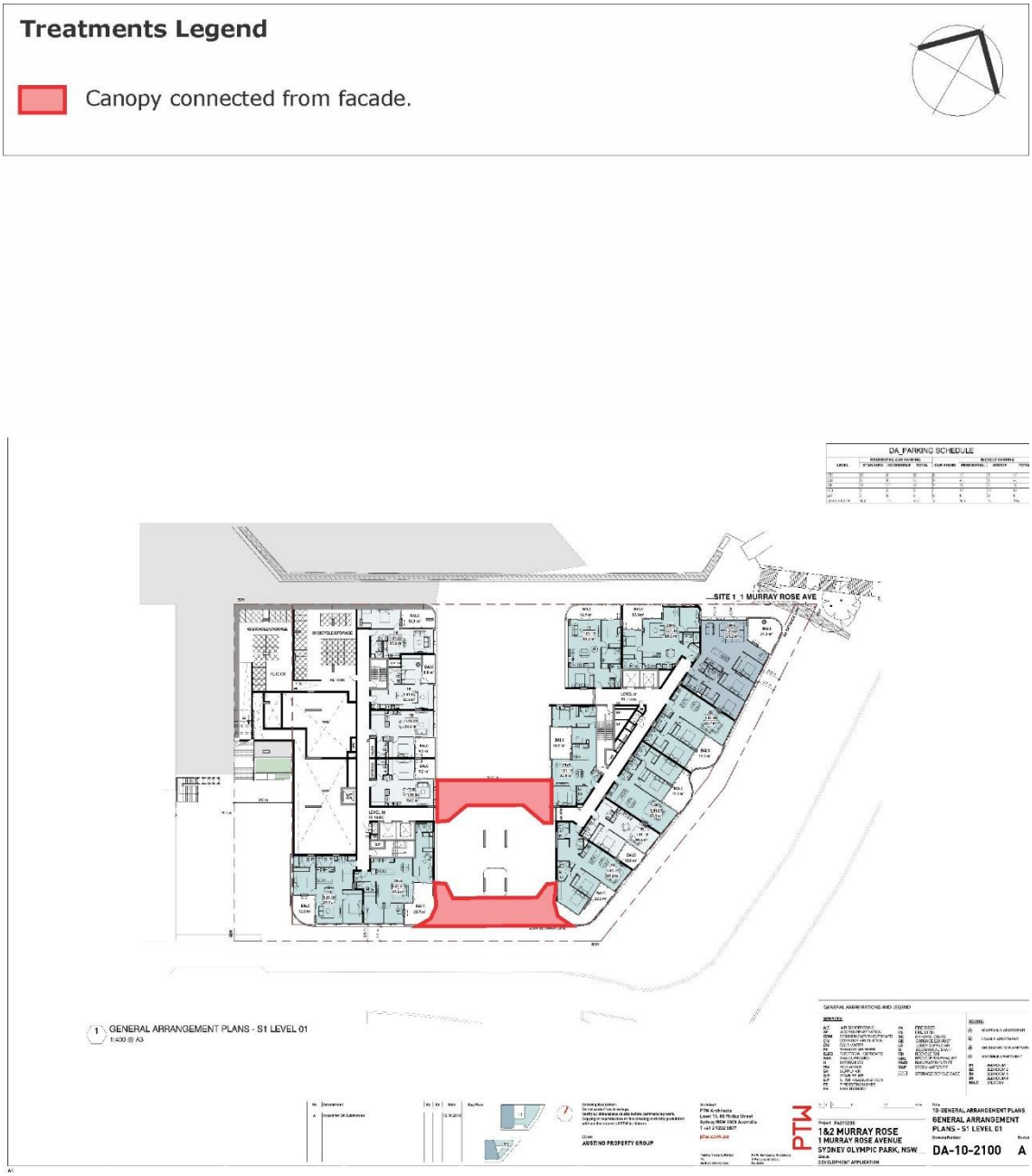

Figure 3: Recommended Treatments for the Communal Open Space of Tower 1

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