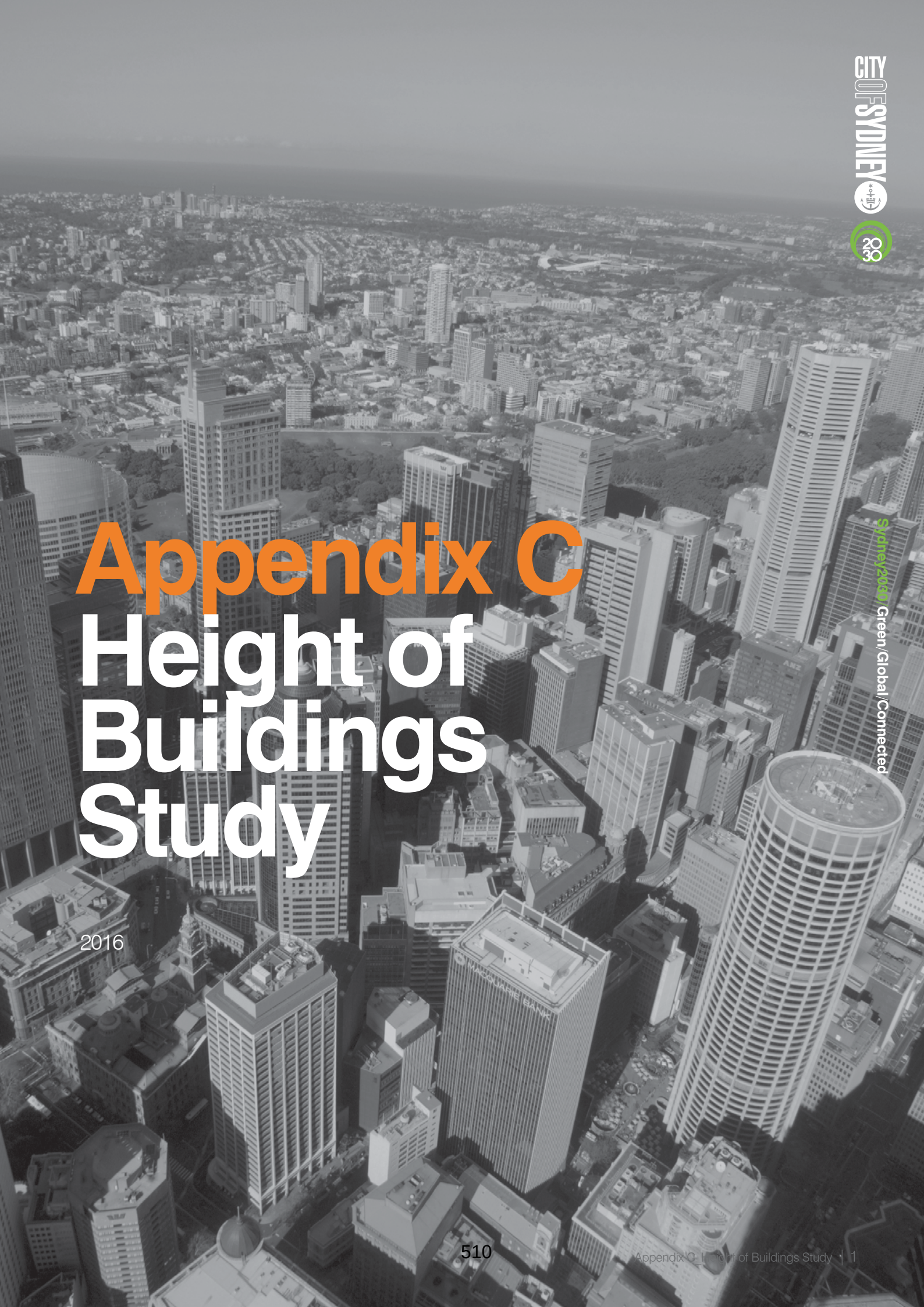

Appendix C
Height of Buildings Study

2016

Sydney2030 Green/Global/Connected

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1
Introduction

Purpose of this study

The purpose of this study is to review height of buildings applying to the city for efficacy against objectives of the existing controls. The intent is to compare the intended city form and realised city form.

The additional purpose is, as per the preferred growth strategy, to identify places where additional height could be released, and review how that would affect the city form, measuring against existing and historical city form objectives.

Methodology

The methodology has been to:

Review the intent and objectives for height in Central Sydney, as embedded in previous strategic plans and the current planning framework (Sydney Local Environmental Plan 2012).

Describe existing height controls for Central Sydney and model the controls into a 3D format to represent the maximum city form of Central Sydney under these controls.

Use the 3D city model to measure the existing built form against the current controls to identify the degree and location of compliance and non-compliance.

Compare the existing conditions with the intent and objectives for height under the current planning framework. Analyse the efficacy of the controls.

Compare the existing height of buildings with the maximum physical capacity of Central Sydney under the current controls to identify capacity for future growth.

2
Existing Controls

2.1
Existing Controls

Building heights in Central Sydney remained relatively low until the 1957 amendment to the Height of Buildings Act, when height restrictions were lifted and the City's skyline began to change dramatically to include high rise buildings.

Between 1957 and 1996, there was no planning control that applied a maximum height limit to the Central Sydney area. Height was managed on a site by site basis, assessed on merit by the Height of Buildings Advisory Committee. Generally, FSR controls were relied upon to limit building height. The Committee considered the FSR available on the site, and the likely impacts on the local context, includinwg overshadowing of public space, wind, heritage buildings and other amenity concerns including a consideration of human scale. In the case of very tall buildings, approval by the Civil Aviation Authority was required.

Development of tall buildings through the '60s focussed on the northern parts of the city centre, accessing views and amenity offered by the harbour. New development moved progressively back from the harbour front areas and spread along the ridgelines, capitalising on views, light and air available in those locations.

The 1971 Strategic Plan recognised and supported this trend, and was updated in the 1974-77 Statement of Objectives, Policies and Action Priorities. For example:

> 14A Preserve and enhance harbour views, emphasise the City's natural topography, and protect and enhance the drama of the City's skylines, by encouraging the erection of the tallest building along ridges, and restricting the heights of buildings on slopes and valleys leading to the harbour.

Through the '80s the impacts of increasing numbers of tall buildings had stimulated new policies to emerge that sought to limit the negative impacts of those buildings, primarily with regard to overshadowing of public spaces.

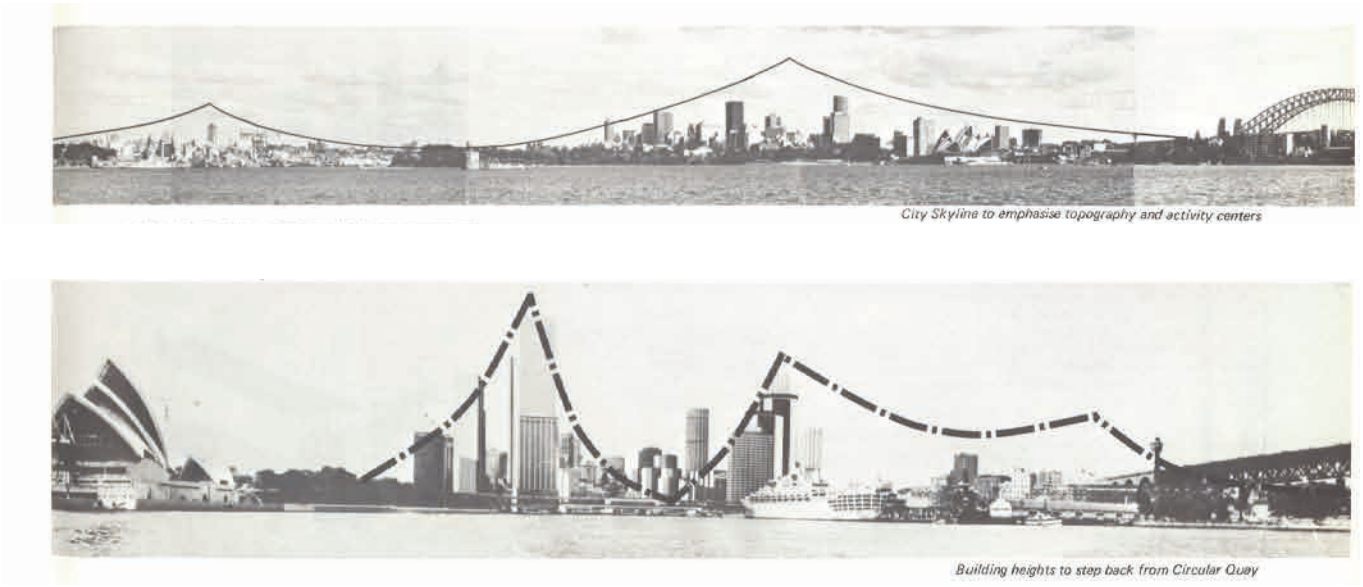
The 1996 controls formalised the values expressed by the 1971 and 1988 strategies, translating them into a map describing maximum height limits, with some additional controls to protect amenity to public space, manage human scale in streets and mitigate wind effects and loss of heritage significance.

The current height controls applying to Central Sydney have been translated from the 1996 LEP. The 1996 controls were responsive to the city form objectives already established by policies contained within previous strategic plans 1971 - 1988. The 1996 controls were based on objectives that balanced opportunities for future growth with amenity outcomes, within the context of demand at the time.

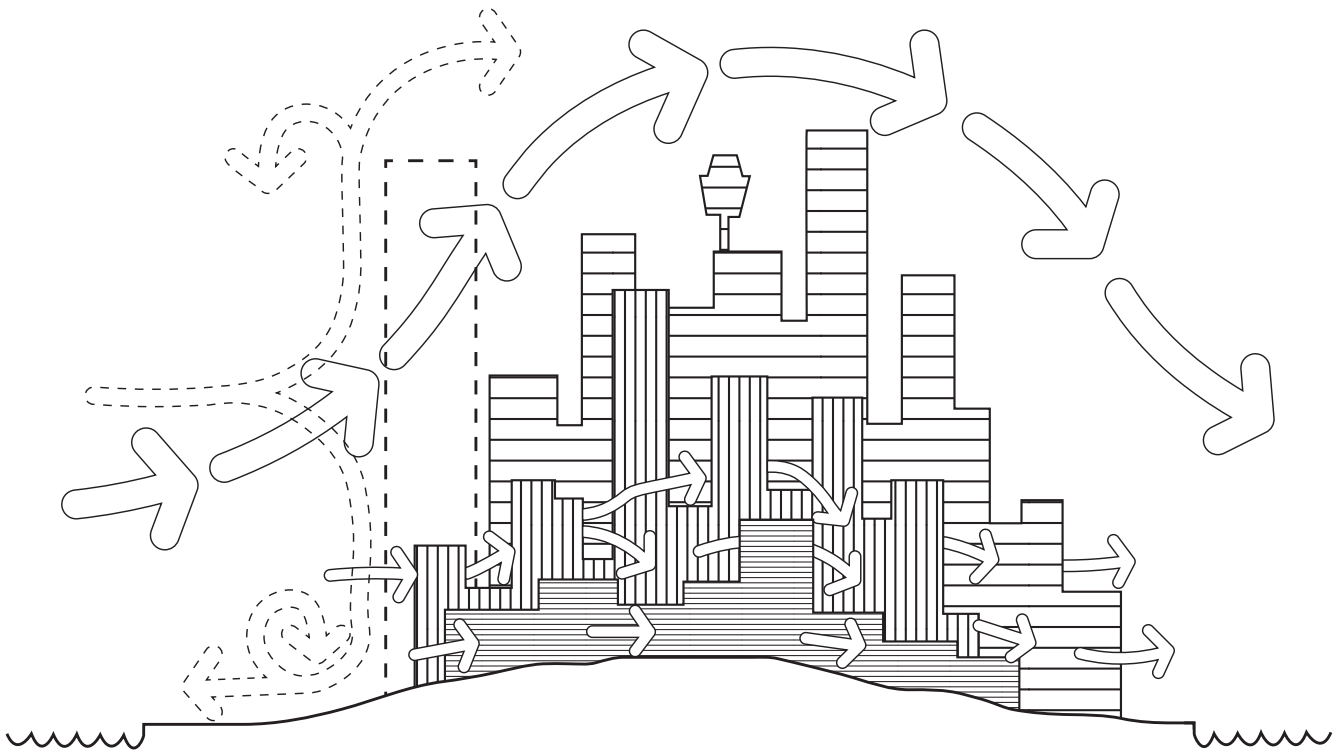
The current controls applying to Central Sydney are based on the following values/objectives for city form:

1. Maintain an overall city form where maximum heights are located on the ridgelines to the north and south and building heights step down to the edges (refer C_01). This strategy was first established by the 1971 Strategic Plan and acted to manage general amenity of Central Sydney while allowing tall buildings by:
    i. knitting in with existing context
    ii. managing wind effects at edges of the city (refer C_02)
    iii. promoting daylight into streets
    iv. maintaining human scale in streets
    v. promoting view sharing
2. Protection of areas of significant heritage or urban quality, as Special Character Areas, where heights may be reduced to match heritage items or patterns of form in the street.
3. Generally, protection of important parks and public open spaces by limiting height of development to their north and north west (No Additional Overshadowing controls and Sun Access Planes - 1988, formalised 1996).
4. Observation of limits set by Civil Aviation Authority. Maximum heights are capped at 235m, which reflects the highest building (other than Centrepoint) to have been approved by the Civil Aviation Authority at the time (1996), and also maintains the primacy of Centrepoint Tower within the skyline.

C_01
1971 height diagrams



C_02
Principle diagram of bell curve shaped city from 1988 – wind, light, views



2.2
Local Environmental Plan Mapped Heights

Height in Central Sydney is limited by height controls described on a Local Environmental Plan (LEP) heights map in metres shown in C_03. Heights are mapped in metres, and can be varied in response to a Design Excellence Competition or, in some cases, a general variation clause.

For some areas with special height controls, the LEP map does not describe a height in metres. This occurs primarily on land affected by Sun Access Planes and significant heritage items. An additional map, the LEP Sun Access Protection Map supplements the LEP heights map. Refer C_04 and C_05.

City Form

The 1971 height and city form strategy is evident in the LEP Heights Map, with the two areas of greatest permissible height located at the north and south of Central Sydney, separated by a lower area around Centrepoint, and generally reducing in height towards the edges, most clearly at the west and south.

Special Character Area Heights

Some Special Character Areas are reflected with lower height controls in the LEP heights map. This is evident around Bridge Street, Macquarie Street, Martin Place, Wynyard Park, Town Hall and the Western Edge. These controls complement site-specific street frontage height and setback controls designed to protect the integrity of the urban form and experience in these parts of Central Sydney.

Sun Protection Controls

The LEP Sun Access Protection Map provides further detail to the LEP Heights Map, describing areas and places affected by Sun Protection Controls.

A number of important parks and places in Central Sydney are protected. Generally, new development is not allowed to overshadow those parks or places at certain times and dates of the year.

C_03

Existing LEP Height Control Map

These are the most significant of the height controls in Central Sydney and generally cannot be varied.

There are two types of controls:

1. Sun Access Planes (SAPs)
2. Overshadowing of Certain Public Places (No Additional Overshadowing - NAOs)

Some places are protected by both a SAP and an NAO.

The LEP Sun Access Protection Map indicates areas where the permissible height of development is only defined by SAPs. It also identifies parks and places protected by No Additional Overshadowing controls, though it does not identify land where heights are affected by those controls.

C_04

Existing Controls

Sun Access Protection

	SAP	NAO	SAP Date		SAP Time			NAO Control Time 14 April - 31 August						Protects Ground Plane	Protects Heritage facade	LEP variation clause
			14 April	21 June	10-am	12noon	2pm	10-11	11-12	12-1pm	1-2	2-3	3-4			
Martin Place (incl. NAO)		■								■	■				GPO	
Australia Square		■								■	■					■
Chifley Square		■								■	■					■
First Government House Place		■								■	■					■
Sydney Town Hall Steps		■						10.30	■	■	■	■	■			■
Sydney Square		■							■	■	■	■	■			
Lang Park		■								■	■					
Prince Alfred Park		■								■	■					
Belmore Park	■			■		■	■							■		
Hyde Park North	■			■		■	■							■		
Hyde Park West	■			■			■							■		
The Domain	■			■			■							■		
Royal Botanic Gardens	■			■			■							■		
Wynyard Park	■			■		■	■							■		
Martin Place	■		■			■								summer	all south facade	
Macquarie Place	■	■	■		■			■	■	■	■			■	■	
Pitt Street Mall	■	■	■			■	1pm	■	■	■	■					

C_05

Sydney LEP 2012 Sun Access Protection

2.3
Sun Access Planes

Further to the LEP maps, the technical details of Sun Access Protection controls are described in the LEP (SAP protected spaces are shown at C_07). The technical description of SAPs in the LEP override the LEP heights maps.

In the LEP, Sun Access Planes (SAPs) are defined by the following information, described in the LEP:

- The edge(s) to the protected space, typically this is aligned with buildings frontages to the space;
- Co-ordinate points, at each vertex along the edge of the plane (as above);
- An elevation for each coordinate point (defined by Reduced Level), corresponding to the permissible street frontage height;
- Solar altitude and azimuth angles for the date and time of the plane (ie 21 June, 2pm)

Insert diagram?

The plane projects from the edge of the space at the angles defined by the solar altitude and azimuth. Where a space is protected over a time period, say between 12pm and 2pm, two planes are defined, corresponding with the solar azimuth and altitude at those respective times (refer C_06).

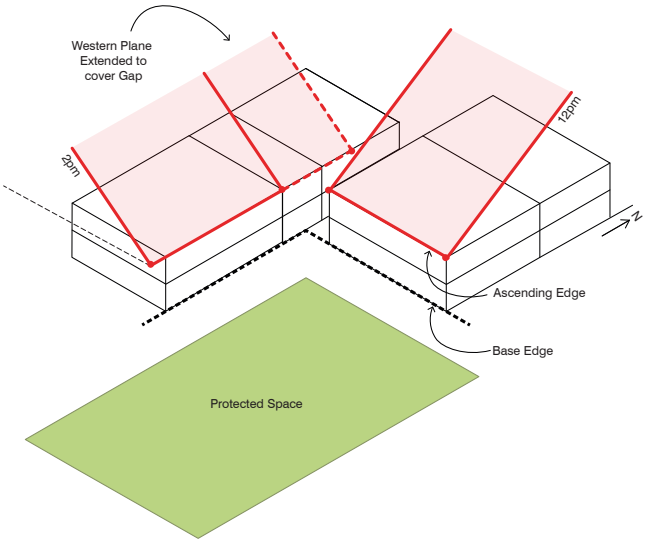
Planes protecting afternoon sun are constructed to the west of the space, midday sun to the north of the space, and so on.

In some cases, where two planes are defined for one space, one plane extends further than the edge of the space, to account for the triangular gap created between the times.

In some cases where two planes protecting the same space overlap, the higher plane prevails e.g. the control for Hyde Park, Pitt Street Mall and Wynyard Park.

C_06

Construction of Sun Access Planes



The general intent of SAPs is to (according to 1995 DCP part 2):

- Limit further overshadowing caused by future development, up to a defined point that represents the preferred outcome on balance of urban form and sunlight.
- Increase sunlight into protected spaces, as a result of redevelopment of existing sites where tall buildings above the SAP already cause overshadowing.
- Maintain sunlight to the facades of buildings that reflect light back into the space, contribute to the aesthetic quality of the space through their illumination, or require direct sunlight access for conservation purposes (ie – heritage buildings).
- Establish an appropriate street frontage height to edge the space, effectively an exercise in city design. The street frontage height is set at a level that balances the need to define the edge of the street and the need to maintain an adequate amount of solar access. The 1995 DCP part 2 refers to these controls as the street frontage height/sun access plane controls.

Several additional places were identified by the 1995 DCP Part 2 for SAPs, but were included as NAO spaces in the 1996 controls:

- Sydney Square (acknowledging the ground plane was mostly in shadow through the winter already) including Town Hall Steps and the porch of St Andrews Cathedral
- Prince Alfred Park (and allowing for a 25m street frontage height along the north west edge of the park)

Street Frontage Height of Planes

The Street Frontage Heights from which the Sun Access Planes spring, assumes an acceptable 'edge' of shade that will be cast over the park/place. It is assumed that the pattern of shadow across the park/place will eventually reflect the shape of the SAP, whereby the 'edge' zone fills with shadow as sites redevelop to the street frontage height, and conversely, the larger extents of shadow protruding into the park/place will be reduced as towers over the SAP are redeveloped underneath the limits of the SAP.

In smaller spaces surrounded by more dense development and thereby already overshadowed, an NAO control complements the SAP to avoid the loss of sunshine currently afforded by street frontage heights lower than the SAP.

C_07

Sun Access Protected Spaces

Parks

Places

Date and Time of Planes

The SAPs are typically set at the control date of 21 June, intended to protect sun access into the space at all times of the year. This date establishes the most conservative plane possible, when the angle of the sun is at its lowest in the sky. Three places in the inner city area, Macquarie Place, Pitt Street Mall and Martin Place, have a plane set at 14 April. From the 1995 DCP Part 2:

> For certain parks or community places located in the midst of relatively tall city buildings and where substantial development has already occurred to the north of these areas, the nominated control date is *14 April which will allow sun access during the lunchtime hours for eight months of the year. [i.e from August to April over summer]*

The dates 14 April and 31 August are known as the astronomical coincidence, the only days in the year where the sun is in exactly the same place at each time of the day. This date strikes an equal period either side of midwinter partly chosen to align with existing city form and partly to streamline compliance checking. Also from 1995 DCP Part 2:

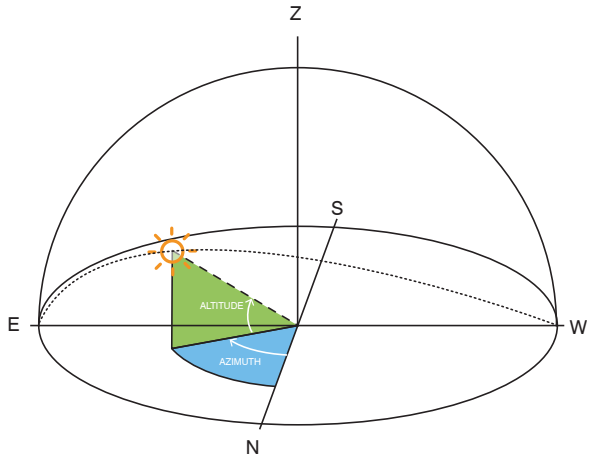
> Therefore on 31 August the sun access plane will become effective, ie the street frontage height component will cast shadows onto the space in question, and will remain effective until 14 April. Between these two dates, ie *through the winter, buildings beyond the street frontage height will generate shadows onto the park or place, although the geometry of the plane will still determine the extent and pattern of overshadowing.*

SAPs are constructed at specific dates and times, rather than periods of time. Where a park is protected by a SAP intended to cover a period, for instance from 12-2pm, two planes are in place for each of those times, set at the control date.

Altitude (vertical angle) and Azimuth (horizontal angle from north) for relevant control times are shown at C_08 and C_09.

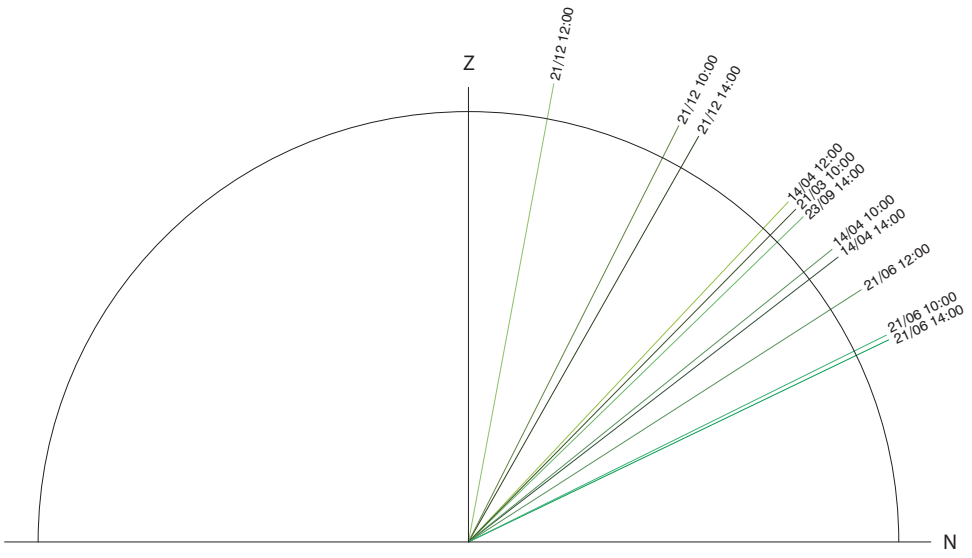
C_08

Azimuth and Altitude Angles



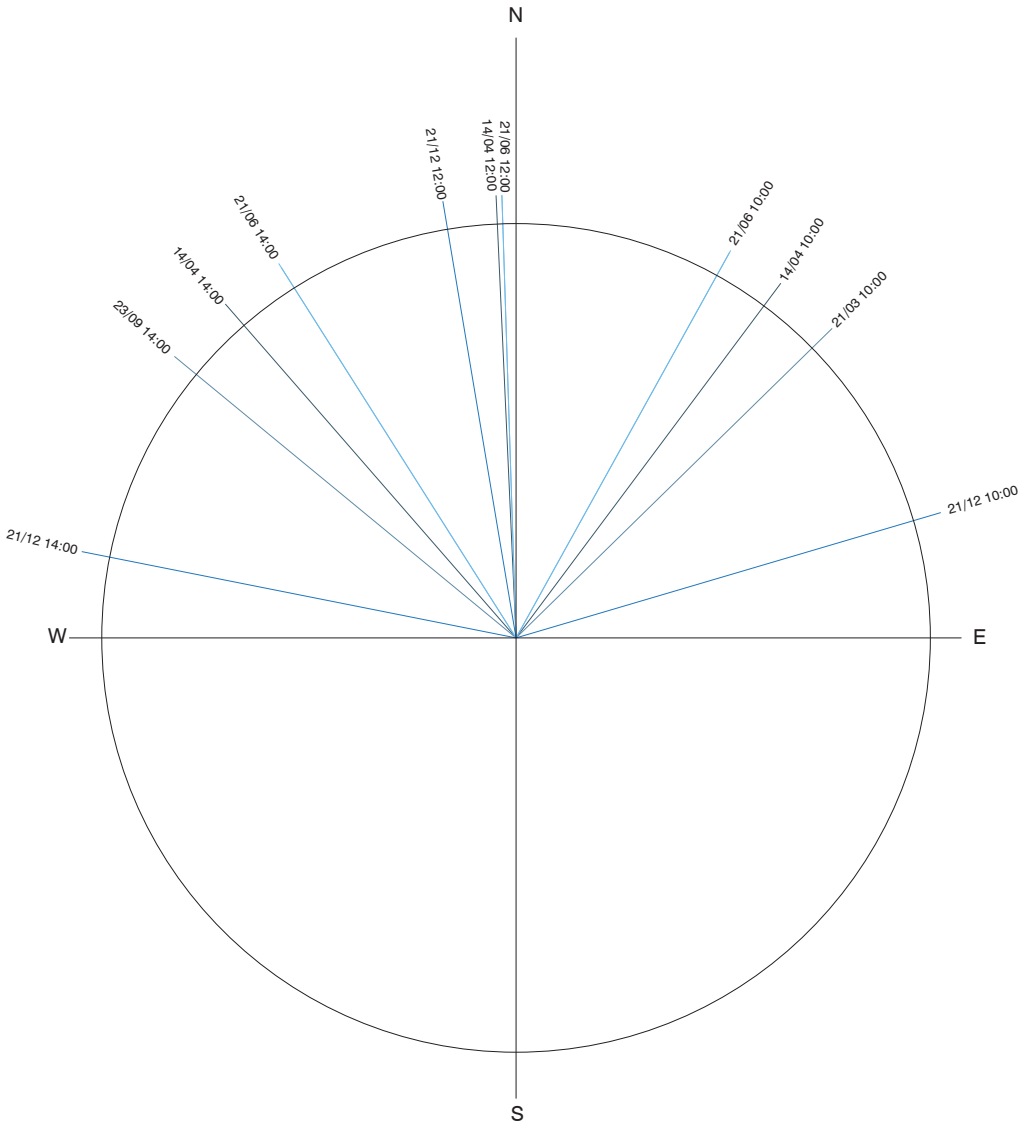
C_10

Altitude Angles shown from east
(i.e. not true altitudes)



C_09

Azimuth Angles



SAP Category A and B sites

Caveats to SAP controls are expressed in Clause 6.18 of the LEP.

Under this clause, specified buildings are allowed to extend above the SAP if:

- They are on category A land and will result in at least a 50% reduction in the overshadowing on Belmore Park, Hyde Park or Wynyard Park.
- They are on category B land and are no higher than the existing building on adjacent category A land. This effectively creates a fan of influence that takes advantage of buildings already projecting above the sun access plane. Assumes those sites breaching the sun access plane will not be redeveloped.

Category A and B sites are noted on the LEP Sun Access Protection Map (refer C_11).

The A and B sites framework assumes that some buildings may redevelop to lower than existing heights. The framework is based on a simplification of solar geometry which in some cases could lead to additional overshadowing of protected spaces at critical times outside of the winter solstice.

C_11

Category A and B Sites

Category A Sites

Category B sites

2.4
No Additional Overshadowing Controls

NAOs have generally been applied to places and parks that are located amongst tall development in Central Sydney (refer C_12). This is with the exception of Lang Park, and Prince Alfred Park, as discussed earlier.

Similarly to the rationale for SAPs, the control aims to protect existing extent of direct sunlight access to the space in the winter months. The astronomical coincidence dates of 14 April to 31 August are used to define the period of protection to simplify compliance checking.

The time of protection during the day is generally aimed at maximising sunlight during the lunchtime period, to best service the needs of workers using public spaces in Central Sydney. The time periods vary for each location according to the existing period during which the space is in sunlight.

The significant difference between the NAO and SAP controls is that SAPs identify a maximum height for development, regardless of surrounding developments except category A and B sites. In the case of NAOs, the existing surrounding development, combined with the movement of the sun, create the height limitation for new development.

NAOs were intended to be supplementary to sun access planes but in some cases, depending on the context, they are more onerous. For example, if an existing, lower building defines the extent of shadow to a NAO protected place, development is limited to the existing height. Conversely, they can be considered less onerous than a sun access plane, which implies that existing breakages should be redeveloped to heights lower than the existing building.

An additional NAO was identified in 1995 DCP Part 2 to protect Parliament House Forecourt. It was not carried through into the controls.

SAP and NFO combined

There are three smaller spaces that are protected by both SAPs and NAOs:

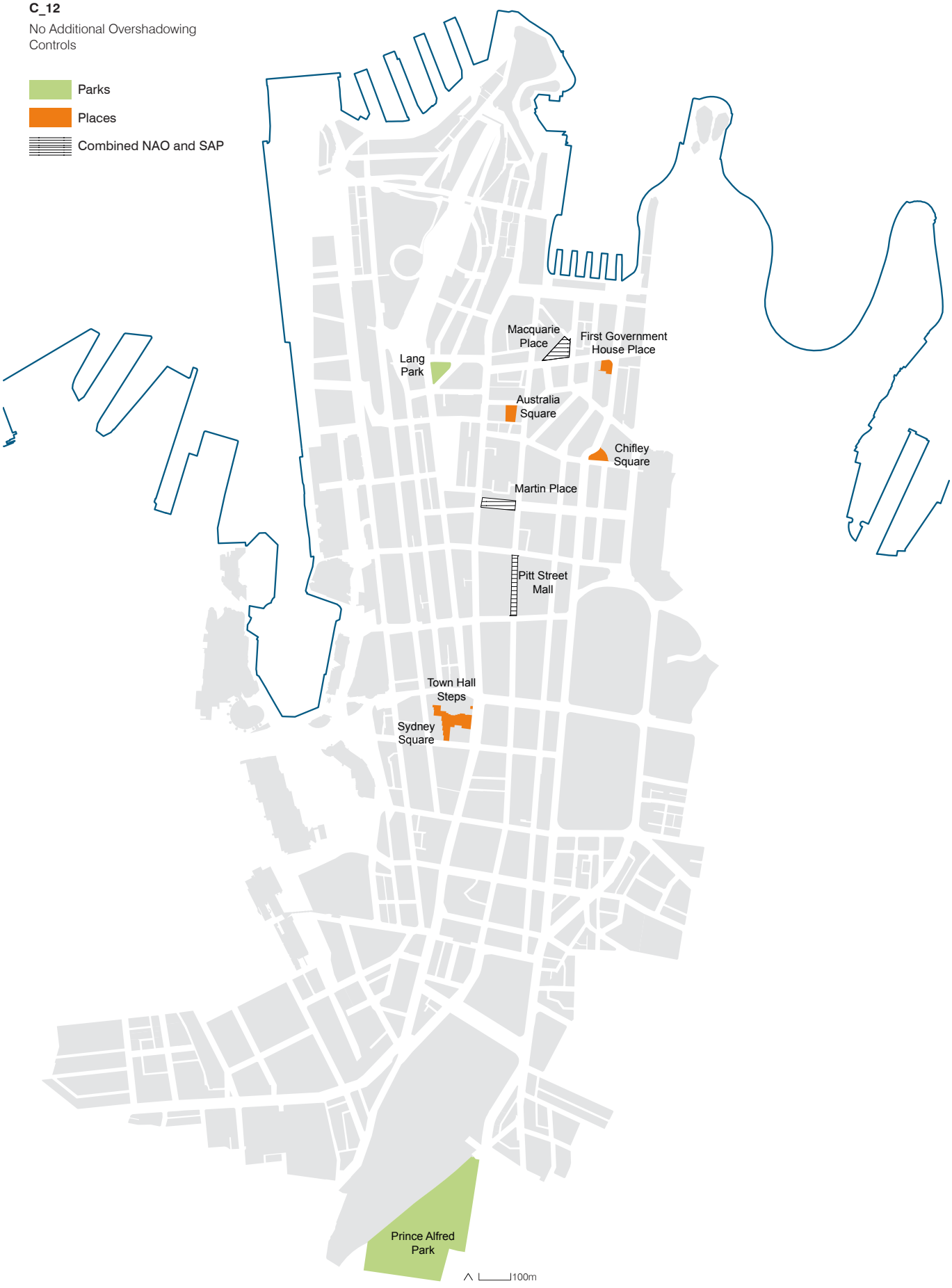
- Martin Place west (between Pitt and George)
- Pitt Street Mall
- Macquarie Place

In these spaces, where the existing street frontage height is defining the shadow line on the space, the street frontage height cannot be increased to the maximum permissible allowed by the Special Character Area controls.

The SAP and the NAO protect the spaces at different times of the year. The NAO protects the space through the winter, but the SAPs for those places are set at 14 April, so that they protect the space over the summer. In fact, the NAO through the winter period is a more onerous control than the SAP. The SAP represents the preferred overshadowing scenario for the place in the long term. The NAO prevents the existing level of overshadowing from getting any worse.

C_12

No Additional Overshadowing Controls



2.5
Site Size

LEP clause 6.16 Tall Buildings effectively limits development on small sites less than 800m^2 to a height of 55m above ground (affected sites are shown at C_13).

Height on small sites is limited primarily because small sites are unable to achieve the necessary setbacks from boundaries at upper levels, whilst also achieving a viable floorplate.

Generally, small sites are unable to present as towers in the round because their windows cannot be sufficiently set back from boundaries to meet minimum separation and amenity requirements.

Non-compliance with boundary setbacks above 55m has the following negative impacts:

1. Tall buildings on small sites, without side setbacks, would create odd proportioned building forms and potentially presents as a 'wall of towers'
2. Tall 'walls' above 55m (ie where side setbacks at upper levels are not observed) would compromise light and air into the street
3. Wind conditions would be worsened

Setbacks are typically managed through the DCP, whereas height is defined by the LEP. Therefore the LEP height clause is required to support the desired outcome.

Another very important consideration is that small sites are unable to provide the necessary street frontage for access and servicing requirements associated with tall buildings at the ground level, as well as achieving adequate street frontage activation.

Many small sites are also heritage items, or adjacent to heritage items. Allowing tall buildings on small sites would compromise some heritage items or contexts.

Note that this control responds, at least in part, to recommendations contained within the 1998 Discussion Paper, titled Cityplan Review: Small Sites in the City Centre. This Discussion Paper found that a site size of 1000m2 was the threshold for small sites.

C_13
Site Size

up to and including 800m²

>800-1000m²

2.6
Consolidated Height Control Map

Consolidated Heights Map

The existing height controls in metres, from the LEP Heights Map, have been combined with the actual limitations created by SAPs and NAOs. This is translated into a consolidated heights map (refer C_18). This is a combination of height controls, SAPs and NAOs (refer C_03,19 & 20).

In order to make this map, SAPs and NAOs have been constructed digitally in 3D.

Construction of SAPs follow the description in the LEP, although where two planes protecting the same space overlap, they have been connected to create a consolidated, simpler form. See discussion regarding this in later section.

NAO controls are much more complex to construct because they describe the movement of the sun around existing buildings into the space. Indicative NAO 'fans' have been created for each space (refer C_14 - 17). The methodology for creating each fan is:

- The outline of direct sunlight falling on to the space throughout the control period and time was determined.
- Each shape generated was projected upwards at the angle and azimuth of the sun's path, corresponding with the time and date, to create a series of prisms.
- A 'fan' was constructed connecting the underside of all the prisms with contours. The fan wraps around the existing buildings and represents the maximum heights that would not create additional overshadowing of the protected space.

The NAO fans are more complex geometric forms than the SAPs.

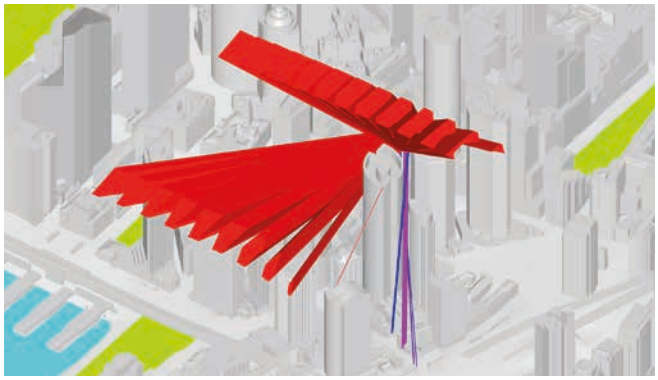
Note that the NAO fans have been constructed using the 3D city model and are not survey accurate.

C_14

Step 1: Outline of sun on to the space through the control period and time

C_15

Step 2: 15 minute increments: control times / weekly increments: control dates



C_16

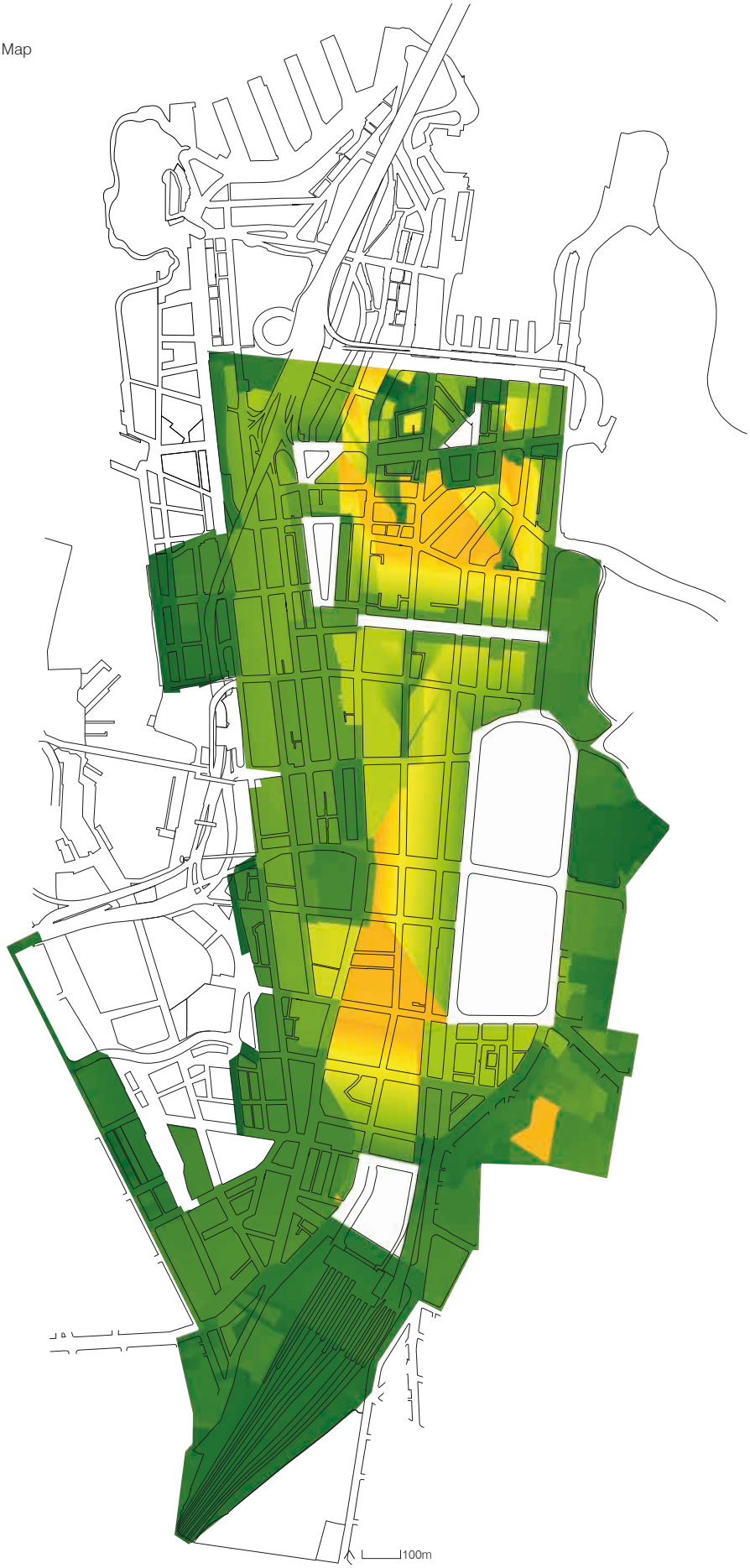
Step 3: Shapes projected upwards at the angle of the sun's path to create prisms

C_17

Step 4 : Construction of fan representing the underside of all the prisms with contours

C_18

Consolidated LEP Heights Map



C_19

Sun Access Plane Controls

The SAP's Described in this map have been projected to RL330

C_20

No Additional Overshadowing Extents

The NAO's Described in this map have been projected to RL330 - the actual extent will be less under the LEP