



Sydney Metro Martin Place: Planning Proposal — Assessment of Airspace Approvability

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by



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Purpose / Abstract: *This report supports a Planning Proposal submitted to the Department of Planning and Environment, pursuant to Section 55 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and the Department of Planning and Environment's A Guide to Preparing Planning Proposals (August 2016).*

Macquarie Corporate Holdings Pty Limited (Macquarie) is seeking to create a World Class Transport and Employment Precinct at Martin Place, Sydney.

The key objective of the Planning Proposal is to facilitate the delivery of two predominantly commercial office Over Station Development (OSD) towers located above and intricately linked to the future Martin Place Metro Station (part of the NSW Government's Sydney Metro project).

Specifically, the Planning Proposal seeks to amend the Sydney Local Environment Plan 2012 (Sydney LEP) through enabling greater building height and floor space and thereby realising the Precinct's unique opportunities.

This report assesses the current and forecast regulated airspace height constraints over the planning proposal site for this project. The airspace constraints are examined in relation to the maximum building envelopes proposed and the additional airspace that would be required for cranes necessary to enable the development in the event that the LEP amendment proposal is adopted.

Note also that the Commonwealth Department of Infrastructure and Regional Development (DIRD) granted an approval — reference F17/2779 10, dated 28th September 2017 — under the Airports (Protection of Airspace) Regulations 1996 (APAR) for the construction of a building on the North Site up to a maximum height of 214.2 metres Australian Height Datum (AHD). Based on the results of this study, the South Tower would require a separate approval under the APAR.

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1. Introduction & Executive Summary

This report supports a Planning Proposal submitted to the Department of Planning and Environment, pursuant to Section 55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Department of Planning and Environment's *A Guide to Preparing Planning Proposals* (August 2016).

Macquarie Corporate Holdings Pty Limited (Macquarie) is seeking to create a World Class Transport and Employment Precinct at Martin Place, Sydney.

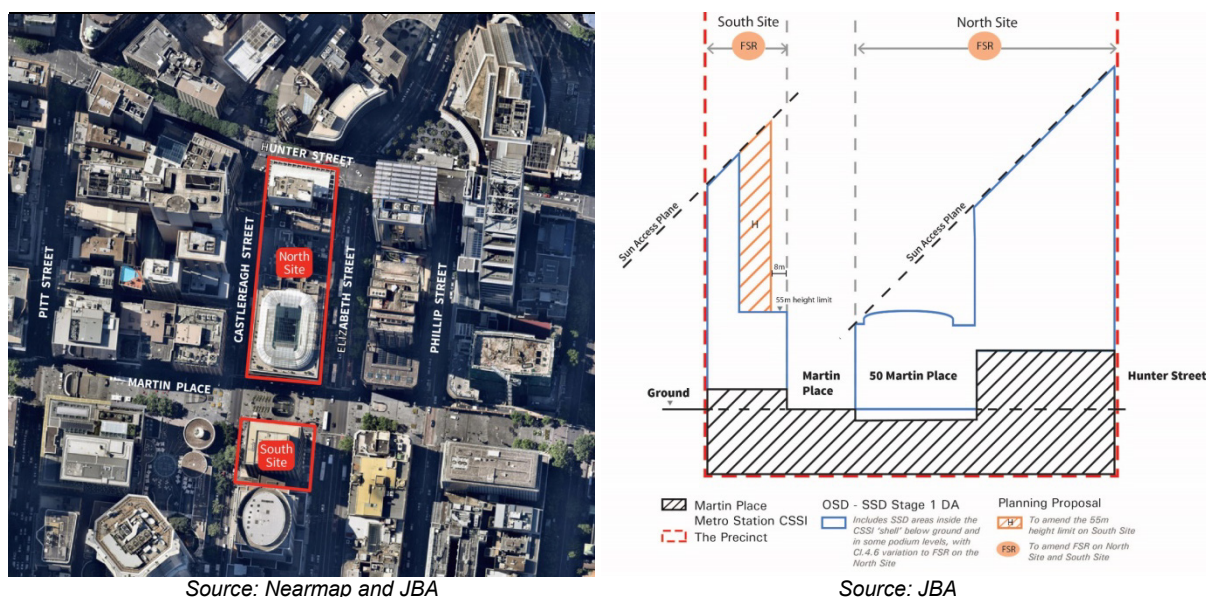
The key objective of the Planning Proposal is to facilitate the delivery of two predominantly commercial office Over Station Development (OSD) towers located above and intricately linked to the future Martin Place Metro Station (part of the NSW Government's Sydney Metro project).

Specifically, the Planning Proposal seeks to amend the *Sydney Local Environment Plan 2012* (Sydney LEP) through enabling greater building height and floor space and thereby realising the Precinct's unique opportunities.

This particular report examines the height limits overhead the site that are related to aviation airspace protection requirements and which would:

- Trigger the requirement to apply for an airspace height approval;
- Constrain the maximum permissible building envelope heights; and
- Constrain the maximum permissible heights for cranes that would be required to enable construction of the proposed development.

Figure 1-1: Scope of the Aeronautical Assessment — Sydney Metro Martin Place (Aerial & Elevation Views of the North & South Sites)



The Macquarie Martin Place Station Precinct project relates to a number of properties straddling Martin Place, between Elizabeth and Castlereagh Streets in the Sydney CBD, which together constitute the development site.

From an aeronautical impact point of view, the towers on the North and South Sites benefit from their locations in relation to several tall buildings in the immediate vicinity —

including the Sydney Tower Eye, the MLC Centre tower and the Deutsche Bank Place building. As the controlling obstacle in the Sydney CBD, the Sydney Tower Eye development determines the airspace surface constraints in that particular vicinity. Both sites, in relation to the overall development site and the three key buildings mentioned, are depicted in Figure 1-1 above.

For the purposes of the aeronautical assessment, the peak height of the proposed North Tower has been used — 214.5m Australian Height Datum (AHD), which is rounded up from the height used in concept plans. This height represents the maximum height of the proposed building envelope for the North Tower and the maximum height to be used across the development site. The maximum height of the South Tower, based on the 8-metre setback and solar access plane constraints as per the LEP change proposal, is taken to be 165m AHD for aeronautical assessment purposes.

At the proposed maximum assessment heights:

- Both the North and South Towers are sufficiently high that they would penetrate Sydney Airport's Obstacle Limitation Surfaces — the South Tower with a 8-metre setback by 9m and the North Tower by 58.5m — and would therefore require explicit airspace approvals from the Commonwealth Department of Infrastructure and Development prior to construction;
- Both would be well below the relevant flight manoeuvring and air traffic control-related surface constraints of 335m AHD; and
- There would remain a substantial margin for use of cranes, such that cranes at their maximum operating heights would also be well below the airspace constraints.

The relevant airspace constraints overhead the site are summarised as follows:

Table 1-1: Summary — Airspace Height Constraints & Clearance (or Infringement) of Airspace Protection Surfaces

Height Limits (AHD)	Limit Detail	Clearance (AHD)	Comment
156m	OLS Outer Horizontal Surface	North: - 58.5m South: - 9m	THRESHOLD HEIGHT limit: Any development that would exceed this height requires a prior 'airspace height' approval from the Department of Infrastructure and Regional Development under the Airports (Protection of Airspace) Regulations (or APAR). Thus, at the maximum heights proposed an application under APAR will need to gain approval prior to construction of each tower. An application can be made for each building separately, or a single application can be made for the precinct.
North: 214.5m South: 165m	Proposed Maximum Building Heights		Current proposed maximum building height (refer section 3.2, p10)

<i>Height Limits (AHD)</i>	<i>Limit Detail</i>	<i>Clearance (AHD)</i>	<i>Comment</i>
335.2m	Minimum Sector Altitude (MSA), and RTCC Minimum Vector Altitude (MVA) — both 2100ft above the site	North: 120.7m South: 170.2m	The 335m constraint is the maximum building height (including crane height) that would be approved by the aviation authorities. The vertical space available between the maximum proposed building heights and the applicable airspace height constraint leaves ample room for cranes.
N/A or >335	PANS-OPS Approaches & Departures		The site is outside the protection areas of PANS-OPS Approach Surfaces. PANS-OPS Missed Approach Surfaces for RWY34R RNAV(GNSS) and ILS approaches and the Departure surface limits for RWY34R and RWY25 are higher than those of the MSA and RTCC height limits.

As can be seen from the table above, the proposed maximum assessment building heights are well below the current maximum allowable height of 335m. The margin of some at least 120m (for the North Tower, more for the South Tower), between the proposed maximum building heights and the constraining airspace height limit at the site, leaves considerable room for cranes that would need to be erected for the construction of the tower.

This assessment has already been, in part, accepted by the Commonwealth Department of Infrastructure and Regional Development (DIRD), given that they recently granted approval to the construction of a building on the North Site (reference F17/2779 10, dated 28th September 2017) to a maximum height of 214.2 metres AHD¹. As the proposed building on the South Site is substantially lower than the already-approved “maximum airspace height” for the North Site, and lower than surrounding buildings, it would have no consequential impact on airspace overhead the site.

As such, **there is no technical impediment to approval of the development as currently proposed, and we consider that an application for a tower on the South Site under the Airports (Protection of Airspace) Regulations, supported by a full aeronautical assessment and safety case, would be approved by the Department of Infrastructure and Regional Development.**

¹ The DIRD-approved maximum height of 214.2m AHD was based on the concept plans submitted as part of the OSD Stage 1 SSD DA for Sydney Metro Martin Place and is just 0.3m less than the assessment height used for the North Tower in this report.

2. Introduction

This report supports a Planning Proposal submitted to the Department of Planning and Environment, pursuant to Section 55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Department of Planning and Environment's *A Guide to Preparing Planning Proposals* (August 2016).

Macquarie Corporate Holdings Pty Limited (Macquarie) is seeking to create a World Class Transport and Employment Precinct at Martin Place, Sydney.

The key objective of the Planning Proposal is to facilitate the delivery of two predominantly commercial office Over Station Development (OSD) towers located above and intricately linked to the future Martin Place Metro Station (part of the NSW Government's Sydney Metro project).

Specifically, the Planning Proposal seeks to amend the *Sydney Local Environment Plan 2012* (Sydney LEP) through enabling greater building height and floor space and thereby realising the Precinct's unique opportunities.

This particular report examines the height limits overhead the site that are related to aviation airspace protection requirements and which would:

- a) Trigger the requirement to apply for an airspace height approval;
- b) Constrain the maximum permissible building envelope heights; and
- c) Constrain the maximum permissible heights for cranes that would be required to enable construction of the proposed development.

The tower concepts as relevant to the aeronautical assessment are depicted in Figure 2-3 Relationship of Planning Applications (p8) and the tower plan and elevation figures in section 3.2 Proposed Building Envelopes & Maximum Heights (p10).

2.1 Background

The New South Wales (NSW) Government is implementing Sydney's Rail Future (Transport for NSW, 2012), a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of customers in the future.

Sydney Metro is a new standalone rail network identified in Sydney's Rail Future. The Sydney Metro network consists of Sydney Metro Northwest (Stage 1) and Sydney Metro City & Southwest (Stage 2).

Stage 2 of the Metro entails the construction and operation of a new Metro rail line from Chatswood, under Sydney Harbour through Sydney's CBD to Sydenham and eventually onto to Bankstown through the conversion of the existing line to Metro standards. The project also involves the delivery of seven (7) new Metro stations, including Martin Place.

This step-change piece of public transport infrastructure once complete will have the capacity for 30 trains an hour (one every two minutes) through the CBD in each direction catering for an extra 100,000 customers per hour across the Sydney CBD rail lines.

On 9 January 2017, the Minister for Planning approved the Stage 2 (Chatswood to Sydenham) Metro application lodged by Transport for NSW (TfNSW) as a Critical State Significant Infrastructure (CSSI) project (reference SSI 15_7400).

TfNSW is also making provision for future Over Station Development (OSD) on the land it has acquired for the Stage 2 Sydney Metro project, including land acquired for the purposes of delivering Martin Place Station. The OSD development is subject to separate applications to be lodged under the relevant provisions of the EP&A Act.

An Unsolicited Proposal submission has been lodged by Macquarie to the NSW Government for the delivery of a single fully integrated station/OSD solution for the new Sydney Metro Martin Place Station Precinct.

2.2 Site Description

The Sydney Metro Martin Place Station Precinct (the Precinct) project relates to the following properties (refer to Figure 2-1 below):

- 50 Martin Place, 9 – 19 Elizabeth Street, 8 – 12 Castlereagh Street, 7 Elizabeth Street, and 55 Hunter Street (North Site);
- 39 – 49 Martin Place (South Site); and
- Martin Place (that part bound by Elizabeth Street and Castlereagh Street).

The Planning Proposal relates only to the North and South Site (refer to Figure 2-2).

Each site will accommodate one OSD tower above the future Sydney Metro Martin Place Station (representing the northern and southern entries/gateways to the Sydney Metro station). The land acquired for the Sydney Metro Martin Place Station is the same as for the Macquarie proposal, except that the Macquarie proposal includes the two properties north of Martin Place owned by Macquarie, namely 50 Martin Place and 9-19 Elizabeth Street.

Both the North and South Sites are regular in shape and have area of approximately 6,022m² and 1,897m² respectively, totalling 7,919m².

Located close to the centre of the Sydney CBD, the Precinct comprises of the entire City block bounded by Hunter Street, Elizabeth Street, Martin Place and Castlereagh Street; that portion of Martin Place located between Elizabeth Street and Castlereagh Street and the northern most property in the block bounded by Martin Place, Elizabeth Street, Castlereagh Street, and King Street. Together it constitutes an above ground site area of approximately 9,400 square metres, with a dimension from north to south of approximately 210 metres and from east to west of approximately 45 metres. It incorporates a significant portion of one of Sydney's most revered public spaces – Martin Place.

Martin Place is recognised as one of Central Sydney's great public, civic and commemorative spaces, as well as being a historically valued commercial and finance location of Sydney's CBD. Martin Place and a large number of buildings on, or in close proximity to, Martin Place are identified as heritage items, either as items of National, State or Local significance. Number 50 Martin Place, which forms part of the Macquarie North Site, is one of these major heritage items.

There has been a number of redevelopment and refurbishment proposals in recent years along Martin Place to improve existing assets and recapture their premium commercial status (e.g. 5 Martin Place, 50 Martin Place, 20 Martin Place, upgrades of the MLC Centre, and 60 Martin Place). The City of Sydney Council has also identified a need to reinvigorate Martin Place and upgrade the public spaces.

The surrounding locality is characterised by a variety of built forms and architectural styles, with many of the buildings, including those of relatively recent years, not complying

with the current planning controls with respect to building heights, setbacks and street wall heights.

In terms of land use the area is characterised by a predominance of office uses, with some ground floor retailing, cafés, or restaurants and hotels (most notably the Westin and the Wentworth) to support its primary business centre function.

Figure 2-1: Location Map of the Precinct

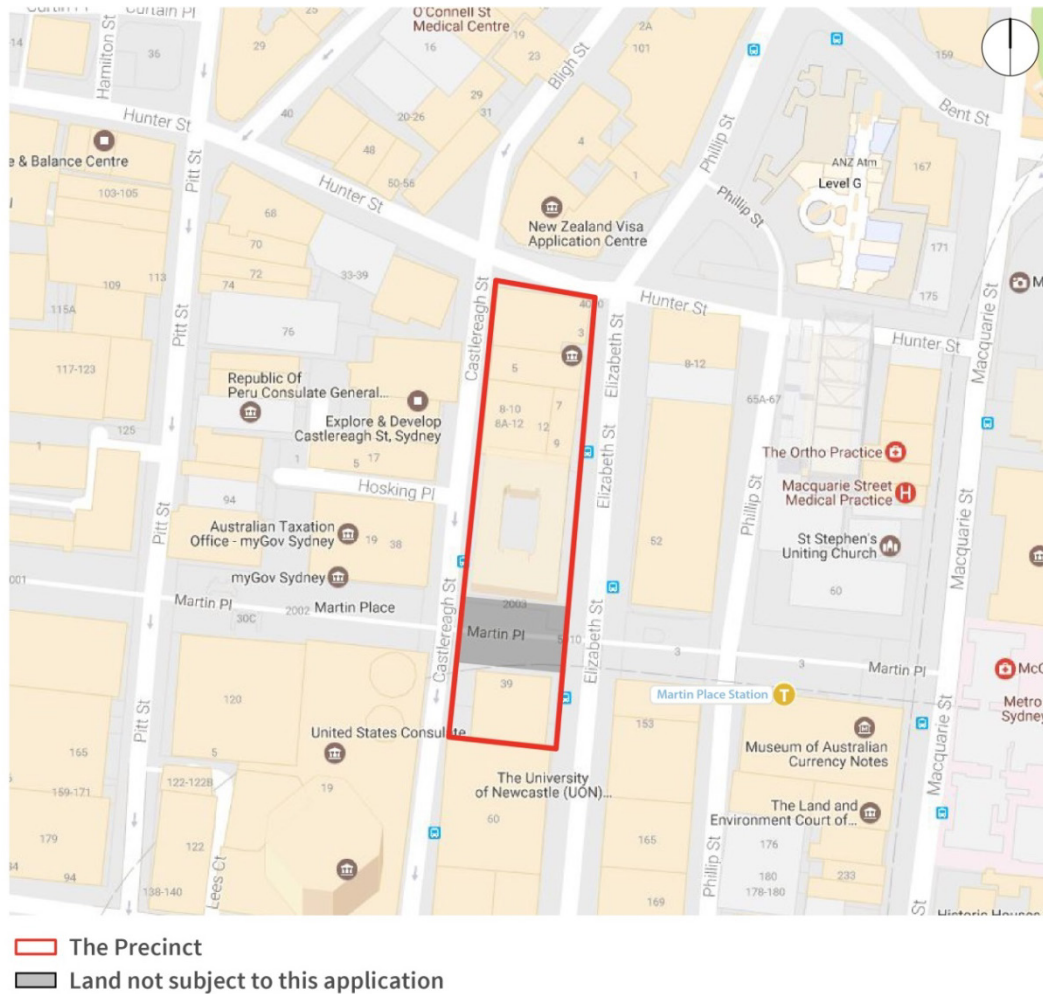


Figure 2-2: Aerial Photo of the North and South Site



Source: Nearmap and JBA

2.3 Overview of the Proposal

The proposal by Macquarie is unique and innovative in aligning the aspirations for public transport, civic amenity and the long-term sustainability of Sydney as a financial centre. It is achieved through a development designed to maximise the opportunities for an improved Metro Station, integrate the existing and new public transport infrastructure, coordinate this infrastructure with modern commercial office towers and world class retailing, and rejuvenate and complement some of Sydney's most revered public spaces whilst substantially improving station access and connectivity.

In order to realise this vision, the Planning Proposal seeks to amend the Sydney LEP through enabling greater building height (South Site only) and floor space (North and South Sites). In short, the existing planning controls that apply to the land are out-dated and do not align with the strategic planning framework, nor the aspirations and vision of the NSW Government, City of Sydney Council and Macquarie.

The proposed amendments will establish new maximum allowable Floor Space Ratios (FSRs) for both the North and South Sites, and which are limited generally to employment generating land uses. This increased capacity will greatly strengthen Sydney's historical financial district. The proposed height amendment to the South Site relates to increasing the maximum height of buildings for part of the site from 55m and up to the Hyde Park North Sun Access Plane.

A more detailed and comprehensive description of the proposal is contained within the Planning Proposal prepared by JBA.

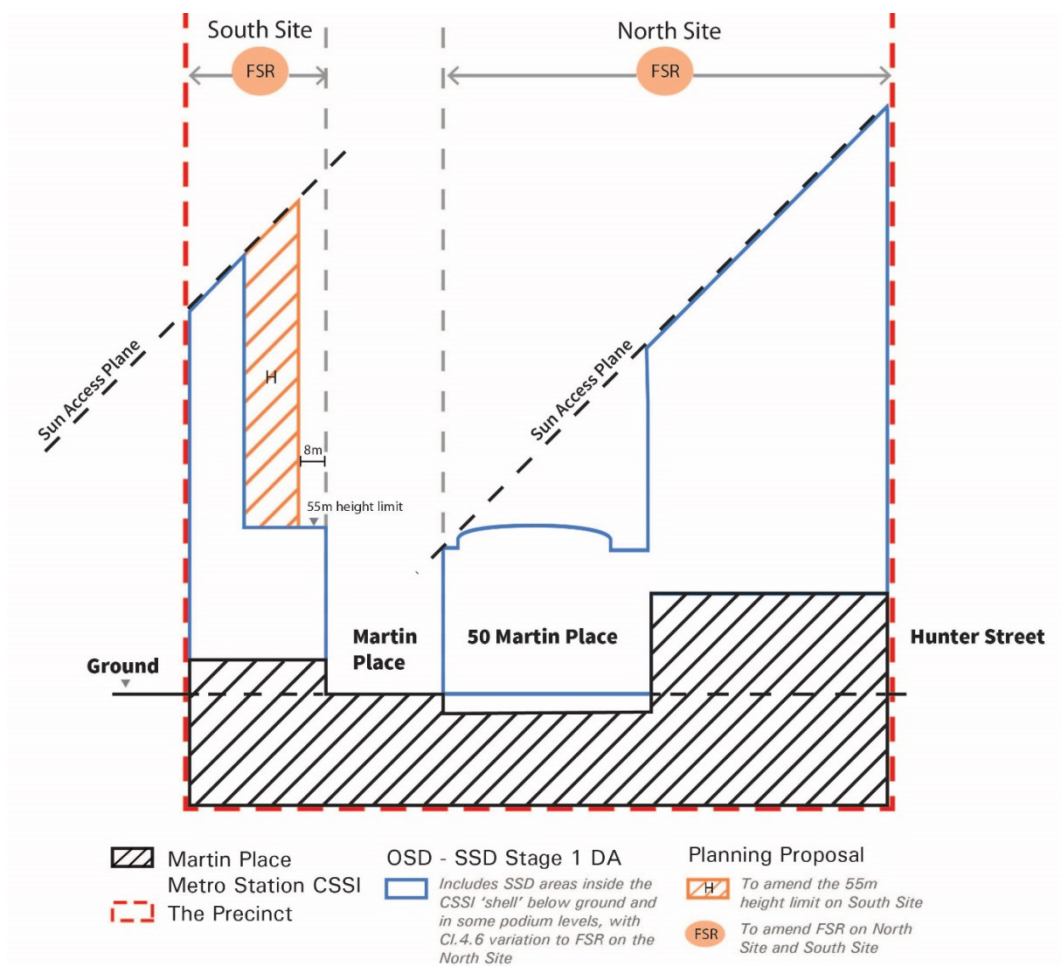
2.4 Planning Strategy Context

The Planning Proposal forms part of a comprehensive suite of applications and processes to co-ordinate and deliver a fully integrated station/OSD solution for the new Sydney Metro Martin Place Station Precinct.

As part of this co-ordinated approach, a Stage 1 State Significant Development (SSD) Development Application (DA) is being made pursuant to Section 83B of the EP&A Act. This Stage 1 SSD DA establishes the vision and planning and development framework for the precinct, and forms the basis for the consent authority to assess future detailed development applications (Stage 2 DAs). The concept proposal for the South Site under this DA includes a tower envelope that complies with the building height and FSR controls under Sydney LEP (with this Planning Proposal facilitating an alternative and larger tower). Also submitted separately to this SSD DA is an application to modify the CSSI approval (in order to align with the Macquarie proposal).

For clarity, Figure 2-3 below is a diagrammatic representation of the suite of applications proposed by Macquarie, to show the relationship of the Planning Proposal (the subject of this report) to OSD Stage 1 SSD DA and the Martin Place Metro CSSI.

Figure 2-3: Relationship of Planning Applications

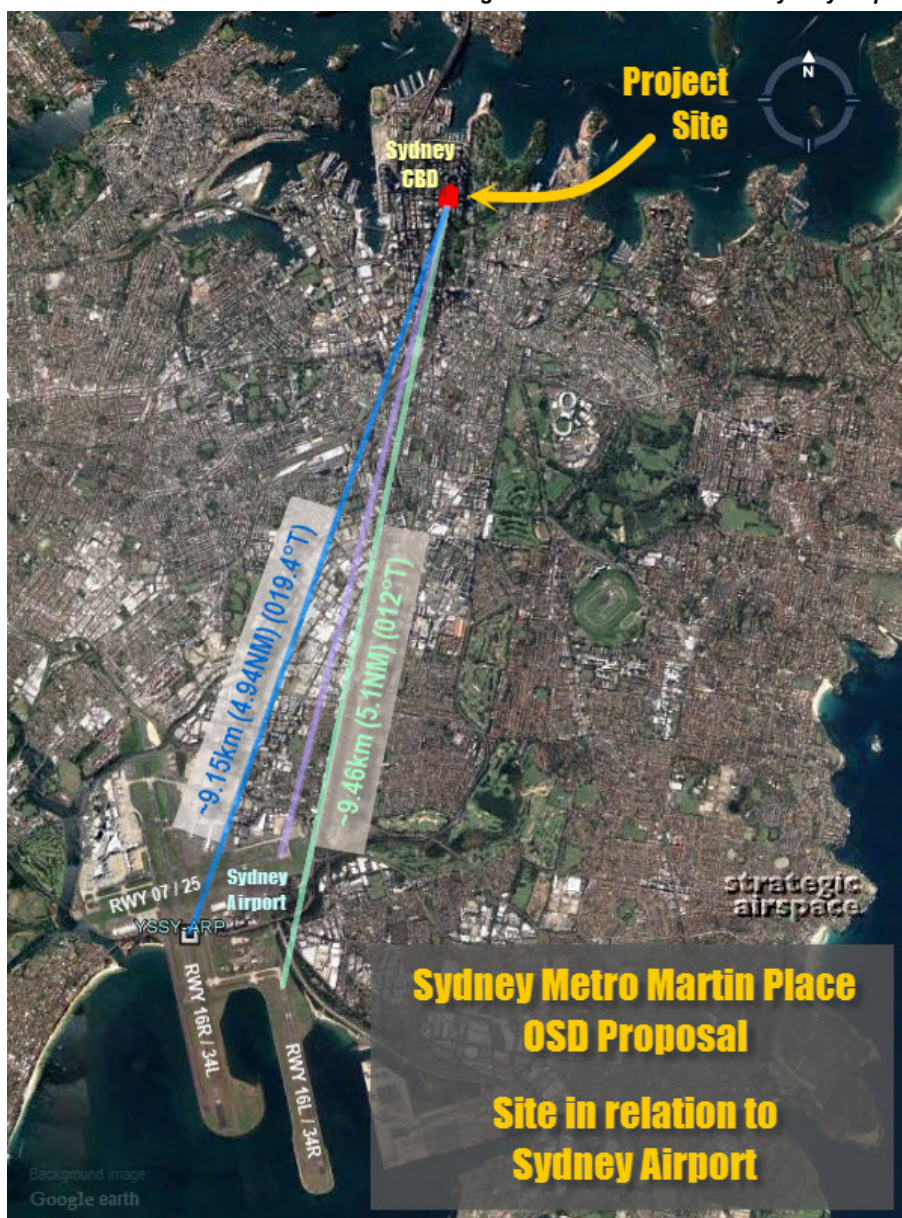


3. Aeronautical Impact Context

3.1 Location of the Proposed Development

The location of the site in the middle of the CBD means that it is surrounded by tall buildings, a substantial number of which are taller than the maximum proposed height of the tower on both the North and South sites.

Figure 3-1: Site in Relation to Sydney Airport



The site lies to the north-north-east of Sydney Airport, approximately 9.15km (4.9 Nautical Miles, NM) from the aerodrome reference point (ARP) at a bearing of 019° True (T) — as indicated in Figure 3-1 above.

The measurement point used is the centre of the southern boundary of the South Site, the WGS84 coordinate of which is approximately 33° 52.1' S 151° 12.6' E.

Other key measurement references are:

- In relation to Runway (RWY) 16L/34R, the eastern parallel runway
 - ~9.46km (5.1 NM) at 012°T from the threshold of Runway (RWY)16L
 - ~3.89km (2.1NM) from the extended runway centreline
- In relation to RWY 07/25, the short cross-runway
 - ~7.96km (4.3NM) at 014°T from the threshold of RWY 25
 - ~6.89km (3.7NM) from the extended runway centreline

In relation to tall buildings in the immediate vicinity:

- The South Site (the closest to Sydney Airport) is:
 - ~285m north-north-east (NNE) of Sydney Tower Eye (commonly known as “Centrepont Tower”)
 - ~50m NNE from the MLC Centre Tower (located at the King and Castlereagh Streets corner of the centre development)
- The North Site is:
 - ~100m west of the Deutsche Bank Place building at 126 Phillip St
 - ~108m south-west of Chifley Tower at 122 Philip St.

The towers noted above (as well as others in the CBD) are taller than the proposed maximum building heights on both the North and South Sites, and their relative locations would effectively shield the proposed development in relation to any flight procedures to and from Sydney Airport.

The other airports in the Sydney Basin are too distant from the proposed development to have any impact on the airspace surrounding it.

3.2 Proposed Building Envelopes & Maximum Heights

The change to the LEP controls through the Planning Proposal will result in an increase of the overall maximum allowable building height to RL163.832 on the South Site. The maximum building height for the site is restricted by the Solar Access Plan as defined by the LEP and may result in a building form that slopes generally from the north to the south across the site. No lift overrun or roof feature will penetrate the solar access plan, as indicated in Figure 2-3 Relationship of Planning Applications (p8). The North and South Sites within the surrounding city context, and in relation to each other, are also depicted in Figure 3-2 Streetscape and Skyline in 3D, Figure 3-3 Overview Diagram and Figure 3-4 Section View from the East below.

For the purposes of the aeronautical assessment at this stage of planning, the maximum heights (expressed in metres Australian Height Datum (AHD)) proposed for both towers have been used, with each rounded up for simplicity and as a conservative safety margin. This also assumes that the roof form and solar access plan constraints and principals of the North Site are consistent with those of the change proposal to the LEP for the South Site.

For: Macquarie

Thus, the peak heights of each site used in the assessment are:

- North Tower: 214.5m AHD
- South Tower: 165.0m AHD

Figure 3-2: Streetscape and Skyline in 3D

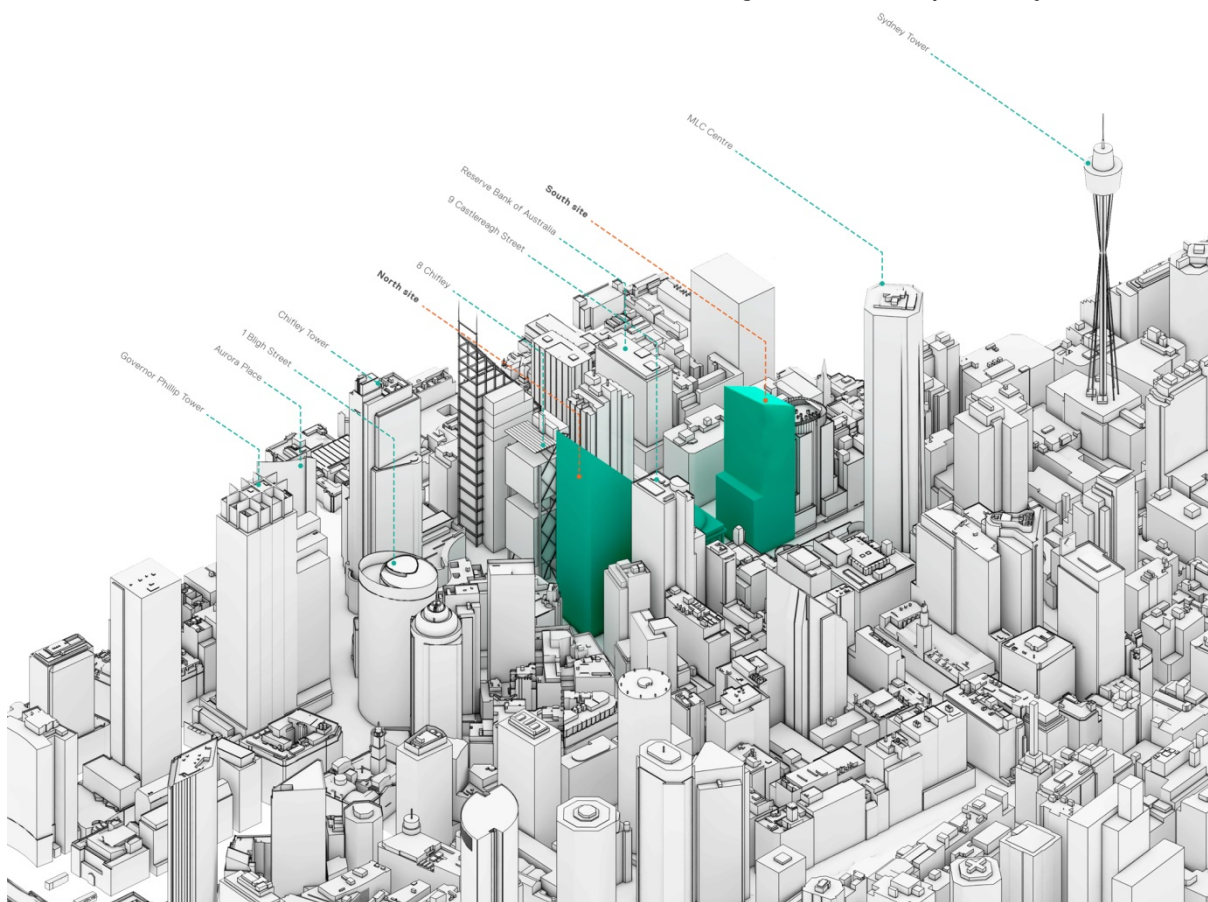


Figure 3-3: Overview Diagram

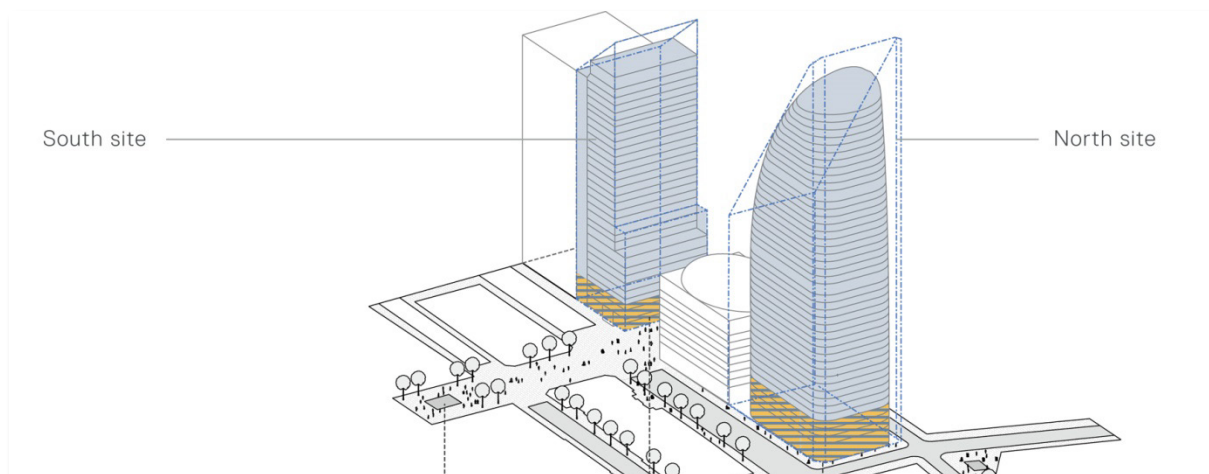
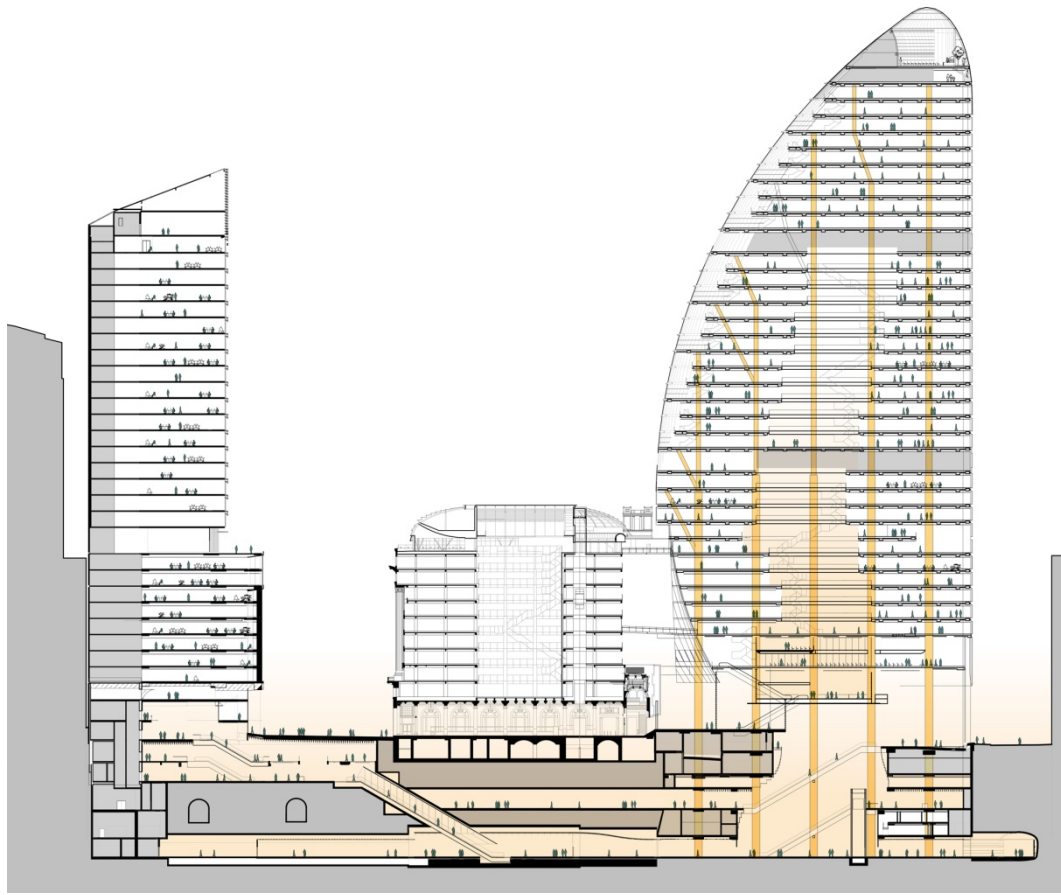


Figure 3-4: Section View from the East



3.3 Methodology

The methodology used to determine the maximum building height (or minimum airspace height limitation) above the development site takes into consideration each of the following.

3.3.1 Airspace Regulations

The proposed development site is subject to the Airports (Protection of Airspace) Regulations (APAR), under the Commonwealth's Airports Act, 1996), because of its proximity to Sydney Airport and because of its proposed height. These regulations define both: how building height limitations due to airspace safety can be determined; and the process for gaining approval of the proposed development under the regulations.

The Prescribed Airspace Regulations, and their impact upon building height limitations, are described below.

3.3.2 Prescribed Airspace

Prescribed airspace, under these regulations, includes at minimum:

■ Obstacle Limitation Surfaces (OLS)

- The OLS surfaces are used to identify buildings and other structures that may have an impact upon the safety or regularity of aircraft operations at an airport. This impact depends upon both the type of operations at the

aerodrome and which OLS surfaces are penetrated by a (proposed) building or structure.

- The OLS are flat and rising (invisible) surfaces around the airport. They are based on the geometry of the airport and its runways and therefore they rarely change.
- If a permanent building development (or temporary crane) that is proposed at a height that will penetrate (exceed) the height limit of an OLS surface, then an application must be made to the Commonwealth Department of Infrastructure and Regional Development (DIRD) — via the closest airport, and with copies to any other potentially affected airport — for an airspace height approval prior to construction of the permanent development &/or erection of the temporary crane obstacle. Such applications should demonstrate the proposed building development does not penetrate or adversely affect surfaces protecting: instrument flight procedures (PANS-OPS surfaces); radar vectoring; navigation infrastructure; or anything else that might affect the safety or regularity of operations at the airport.

■ PANS-OPS Surfaces

- PANS-OPS surfaces represent the protection surfaces for published instrument flight procedures to and from the airport. These surfaces comprise flat, sloping and complex surface components.
- PANS-OPS surfaces must not be penetrated by either permanent or temporary buildings or structures. However, for a variety of reasons, PANS-OPS surfaces can and do change over time.
- As flight procedures are changed from time to time (usually by Airservices), the PANS-OPS Surface Plan published by an airport may not reflect the current situation — which is why we not only reference the airport's plans but also review the published charts for current (or pending) instrument flight procedures and evaluate the associated PANS-OPS height limits. The regulations also make a provision for any factor which may be deemed to adversely affect the safety, regularity or efficiency of aircraft operations at an airport. In light of this, it is necessary to consider the following factors.

■ Other Considerations

- **Sydney Airport's Declared Airspace Plans** additionally include:
 - Radar Terrain Clearance Charts (RTCC), which depict the areas and height limits related to the Minimum Vector Altitudes (MVAs) used by Air Traffic Controllers when vectoring aircraft;
 - Lighting and visual guidance protection plans — used for approach guidance by aircraft, especially at night and in times of poor visibility; and
 - Navaid and radar evaluation / protection surface plans.
- **Other Factors**
 - Protection for other Instrument Flight Procedure surfaces, where the procedures are not classified as PANS-OPS and/or have been omitted from Sydney Airport's declared PANS-OPS surfaces charts. These may include a variety of Required Navigation Procedures (RNP).
 - Airline Engine-Out (Contingency) Take-Off Splays (as per Civil Aviation Order 20.7 1b)
These are generally assessed independently by the airlines as part of their own evaluations of any given airspace height application, but it is prudent to evaluate any potential impact in advance.
 - Other miscellaneous factors that may be considered as potential safety issues by any of the key stakeholders, and the Civil Aviation Safety Authority (CASA) in particular.
- **Note:** Airspace that is approved by the Department of Infrastructure and Regional Development as Declared Airspace is considered part of an airport's Prescribed Airspace.
- All applications under APAR must be submitted to DIRD, at the appropriate time, through the closest relevant airport. Applications should include aeronautical impact assessment reports that are based on the most current plans for the proposed development

available at the time. For major developments, such reports should include consideration of cranes that will be required for construction.

4. Analysis

The impact of the various building height limitations, from lowest to highest, is summarised in the following table.

Table 4-1: Airspace Height Constraints & Clearance (or Infringement) of Airspace Protection Surfaces

Height Limits (AHD)	Limit Detail	Clearance (AHD)	Comment
156m	OLS Outer Horizontal Surface	North: - 58.5m South: - 9m	THRESHOLD HEIGHT limit: Any development that would exceed this height requires a prior 'airspace height' approval from the Department of Infrastructure and Regional Development under the Airports (Protection of Airspace) Regulations (or APAR). Thus, at the maximum heights proposed an application under APAR will need to gain approval prior to construction of each tower. An application can be made for each building separately, or a single application can be made for the precinct.
North: 214.5m South: 165.5m	Proposed Maximum Building Heights		Current proposed maximum building height (refer section 3.2, p10)
335.2m	Minimum Sector Altitude (MSA), and RTCC Minimum Vector Altitude (MVA) — both 2100ft above the site	North: 120.7m South: 170.2m	The 335m constraint is the maximum building height (including crane height) that would be approved by the aviation authorities. The vertical space available between the maximum proposed building heights and the applicable airspace height constraint leaves ample room for cranes.
Other PANS-OPS Surface Height Constraints <i>The constraints listed in this section are higher than the MSA and RTCC MVA height limits — and so, in the particular location, most likely not considered relevant by the aviation authorities.</i>			
~335+m	PANS-OPS Departure Surfaces	North: 120+m South: ~170+m	The Departure Surfaces must clear the Sydney Tower Eye (~330.7m). Based on the current Omnidirectional Departures for RWY07 and RWY34R, the protection surfaces over the southern-most point of the site will be at least 5m higher, resulting in a minimum surface limit of ~335m AHD. This excludes the additional 15m now available due to changes in the PANS-OPS Departure design criteria, which would mean a limit of at least 350m AHD.

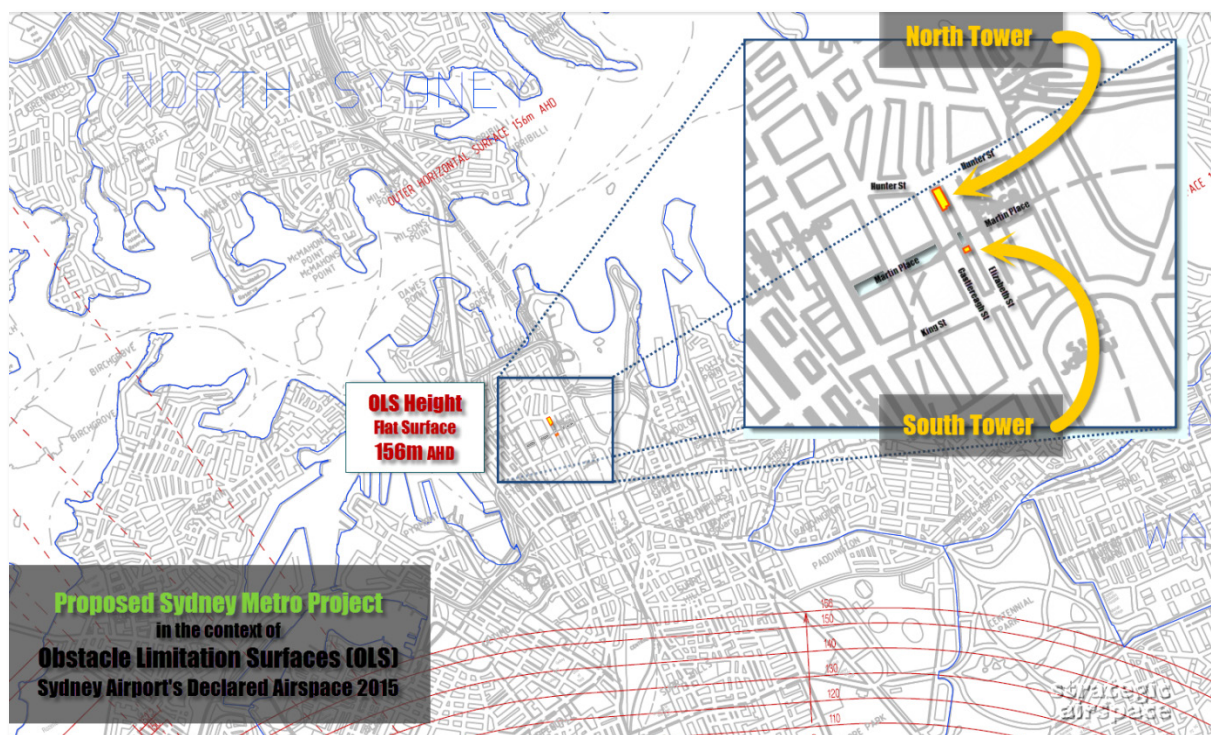
Height Limits (AHD)	Limit Detail	Clearance (AHD)	Comment
N/A or >335	PANS-OPS Approaches & Other Surfaces	N/A	The site is outside the protection areas of PANS-OPS Approach Surfaces. The limits of the PANS-OPS Missed Approach surfaces for the RWY34R are higher at that point than that of other surfaces. Other surface types (eg, nav aids, lighting) are not applicable over the site.

4.1 OLS Analysis

The height limit of Sydney Airport's OLS at the proposed development site is **156m AHD**. The OLS surface directly above the site is called the Outer Horizontal Surface (OHS). Both towers would penetrate this surface, as would the cranes required to construct the tower buildings.

Similar, or greater, penetrations of the OHS are quite common and generally considered acceptable. However, because of this penetration, an application must be made for approval of the proposed development by DIRD. Failure to obtain such approval before construction commences can result in significant penalties under the Airports Act (1996).

Figure 4-1: SACL Obstacle Limitation Surfaces (OLS) Context



Source: SACL Declared Airspace Chart 2015 and StratAir

4.2 PANS-OPS Analysis

The site is not constrained by protection surfaces related to flight procedures to/from other runways at Sydney Airport. The effective limit imposed by PANS-OPS procedure is that pertaining to the Minimum Sector Altitude (MSA).

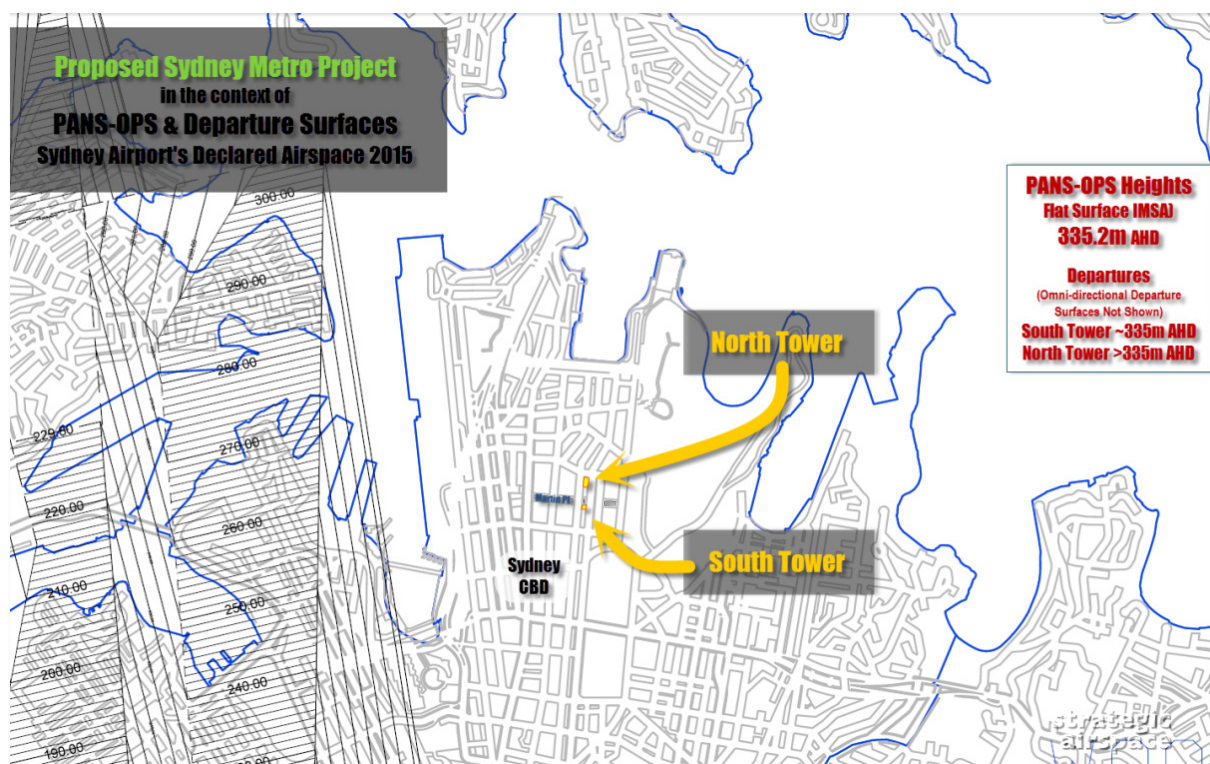
The analysis was based initially on the PANS-OPS and (PANS-OPS) Omnidirectional Radar Departure Surfaces charts published by Sydney Airport Corporation Limited (SACL) as part of their 2015 Declared Airspace charts (the latest available). In addition, due to the currency issue, the Instrument Flight Procedures (IFPs) published in the Australian Aeronautical Information Publication (AIP) on Airservices Australia website were also consulted to check if any changes to PANS-OPS procedures since the publication of the SACL charts would affect the height limits.

The latest versions of the IFPs consulted were from the current AIP Amendment 150, effective from 02-Mar-2017 to 24-May-2017.

Table 4-2: PANS-OPS Height Limitations

<i>Procedure</i>	<i>Height Limit (m AHD)</i>	<i>Description</i>
Circling	N/A	Outside the Circling area protection surface.
Approaches and Missed Approaches to all Runways	N/A or >335	Outside the protection areas for Approach surfaces. The limits related to the missed approach surfaces related to the RWY34R RNAV(GNSS) and ILS approaches are not shown on Sydney Airport's PANS-OPS Surfaces chart. However, the protection areas for these missed approaches must clear Sydney Tower Eye (~330.7m), and thus are therefore higher than that clearance height overhead the northern edges (peak heights) of both the North and South Towers.
Departures	~335+	Sydney Airport's (PANS-OPS) Omnidirectional Departure Surfaces chart shows height limits across the site that are too low and cannot be correct (they are indicative only). The PANS-OPS Departure Surfaces must clear the Sydney Tower Eye (~330.7m). Based on the current Omnidirectional Departures Procedures for RWY07 and RWY34R that are published in the Australian Aeronautical Information Publication (AIP) on the Airservices Australia website, the protection surfaces over the southern-most point of the site will be at least 5m higher, resulting in a minimum surface limit of ~335m AHD over the south-eastern corner of the South Tower. The height constraint overhead the North Tower is higher still. This excludes the additional 15m now available due to changes in the PANS-OPS Departure design criteria, which would mean a limit of at least 350m AHD overhead the south-eastern corner of the development site, rising in a north-westerly direction across the site.
Minimum Sector Altitude	335.2	10NM Inner MSA of 2100ft.

Figure 4-2: SACL PANS-OPS Surfaces (excluding Departures) Context



Source: SACL Declared Airspace Chart 2015 and StratAir

4.3 Other Assessment Considerations

The following table provides a brief assessment of other considerations.

Table 4-3: Other Assessable Height Limitations

Procedure	Height Limit (m AHD)	Description
Radar Terrain Clearance Chart (RTCC)	335.2	This is the limit related to the Minimum Vectoring Altitude (MVA), which is used by air traffic controllers. This information is sourced from the RTCC published as part of Sydney Airport's Prescribed Airspace Plans. See also Figure 4-3 below. Note that this is the same height limit as that of the MSA.
Navigation Infrastructure	N/A	The proposed development is too far from the airport to affect any navigation infrastructure.
Airlines Engine Out Procedures	N/A	Engine Out procedures (from RWY 34R, the most relevant take-off runway end) are designed and maintained by each of the passenger transport aircraft operators in accordance with the relevant regulations. All such procedures necessarily take into account Sydney Tower Eye, which is closer to the airport and taller than the proposed development. As such this proposal will not adversely affect any contingency procedures.

Figure 4-3: Height Limit related to RTCC/MVA for Air Traffic Control



Source: SACL Declared Airspace Chart 2015, Google Earth and StratAir

There are no other considerations that might limit the building height at the project site.

5. Conclusion

From an aeronautical impact point of view, the development site benefits from its location in relation to several tall buildings in the immediate vicinity — including the Sydney Tower Eye, the MLC Centre tower, the Deutsche Bank Place building and Chifley Tower. As the controlling obstacle in the Sydney CBD, the Sydney Tower Eye development determines the airspace surface constraints in that particular vicinity.

However, as both towers at their maximum assessment heights are tall enough that they would penetrate Sydney Airport's Obstacle Limitation Surfaces — the South Tower with a 8m setback by no more than 9m, and the North Tower by 58.5m — and would therefore require explicit airspace approvals from the Commonwealth Department of Infrastructure and Development prior to construction.

At their proposed maximum height, both towers at their peak heights would remain well below the relevant flight manoeuvring and air traffic control-related surface constraints of 335m AHD.

This also leaves a vertical margin, above the proposed maximum building heights available for cranes — a margin of at least 120m for the North Tower and 170m for the South Tower. If one were to assume that a luffing crane would have a top height at say 45m above the maximum building height, this would mean that there would still be a safe margin of 75m to 125m (for the North and South Towers respectively) between the crane and the maximum permissible obstacle height as dictated by the airspace constraints.

This assessment has already been, in part, accepted by the Commonwealth Department of Infrastructure and Regional Development (DIRD), given that they recently granted approval to the construction of a building on the North Site (reference F17/2779 10, dated 28th September 2017) to a maximum height of 214.2 metres AHD. This is the maximum height that was applied for, based on the concept plans submitted as part of the OSD Stage 1 SSD DA for Sydney Metro Martin Place, and is just 0.3m less than the assessment height used for the North Tower in this report

As the proposed building on the South Site is some 49m lower than the already-approved "maximum airspace height" for the North Site, and lower than surrounding buildings, it would have no consequential impact on airspace overhead the site.

As such, there is no technical impediment to approval of the development as currently proposed, and we consider that an application for a tower on the South Site under the Airports (Protection of Airspace) Regulations, supported by a full aeronautical assessment and safety case, would be approved by the Department of Infrastructure and Regional Development.

APPENDIX 1 — ABBREVIATIONS

Abbreviations used in this report and/or associated reference documents, and the meanings assigned to them for the purposes of this report are detailed in the following table:

<i>Abbreviation</i>	<i>Meaning</i>
AC	Advisory Circular (document supporting CAR 1998)
ACFT	Aircraft
AD	Aerodrome
AGL	Above Ground Level (Height)
AHD	Australian Height Datum
AHT	Aircraft Height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Services
ALARP	As Low As Reasonably Practicable
ALC	Airport Lease Company
Alt	Altitude
AMAC	Australian Mayoral Aviation Council
AMSL	Above Minimum Sea Level
ANEF	Australian Noise Exposure Forecast
ANSP	Airspace and Navigation Service Provider
APACL	Australia Pacific Airports Corporation Limited, owner of Melbourne and Launceston Airports
APCH	Approach
APARs, or A(PofA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ASDA	Accelerated Stop Distance Available
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BA (Planning)	Building Application or Building Approval (Planning)
BAC	Brisbane Airport Corporation
BCC	Brisbane City Council
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
CBD	Central Business District
CG	Climb Gradient
CNS/ATM	Communications, Navigation, Surveillance / Air Traffic Management
CPA	Cairns Port Authority, Operators Of Cairns Airport
DA (Aviation)	Decision Altitude (Aviation)
DA (Planning)	Development Application or Development Approval (Planning)
DAH	Designated Airspace Handbook
DAP	Departure and Approach Procedures (published by AsA)
DEP	Departure
DER	Departure End (of the) Runway
DEVELMT	Development
DH	Decision Height
DIRD	Department of Infrastructure and Regional Development (sometimes also abbreviated as Infrastructure)
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DoD	Department of Defence
DODPROPS	Dependent Opposite Direction Parallel Runway Operations

Abbreviation	Meaning
EIS	Environmental Impact Study
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	EnRoute Supplement Australia
ESE	East South East
FAF	Final Approach Fix
FAP	Final Approach Point
Ft	Feet
GBAS	Ground-Based Augmentation System, a GNSS augmentation system to provide vertical guidance and additional precision to non-precision approaches — permits GLS Approaches
GLS	GNSS Landing System – a precision landing system like ILS but based on augmented GNSS using ground and satellite systems.
GNSS	Global Navigation Satellite System
GP	Glide Path
HIAL	High Intensity Approach Light
HLS	Helicopter Landing Site
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System, a precision approach landing system
IMC	Instrument Meteorological Conditions
IPA	Integrated Planning Act 1997, Queensland State Government
ISA	International Standard Atmosphere
IVA	Independent Visual Approach
Km	Kilometres
Kt	Knot (one nautical mile per hour)
LAT	Latitude
LDA	Landing Distance Available
LEP	Local Environment Plan (Planning
LLZ	Localizer
LONG	Longitude
LSALT	Lowest Safe ALTitude
M	Metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MDH	Minimum Descent Height
MDP	Major Development Plan
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOCA	Minimum Obstacle Clearance Altitude
MOS	Manual Of Standards, published by CASA
MP	Master Plan
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NASF	National Airports Safeguarding Framework
NDB	Non-Directional Beacon
NE	North East
NM	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in Nautical Miles)
NNE	North North East
NNW	North North West
NOTAM	NOTice to AirMen

Abbreviation	Meaning
NPR	New Parallel Runway (Project, Brisbane Airport)
OAR	Office of Airspace Regulation
OCA	Obstacle Clearance Altitude (in this case, in AMSL)
OCH	Obstacle Clearance Height
ODPROPS	Opposite Direction Parallel Runway OPERations
OHS	Outer Horizontal Surface, an Obstacle Limitation Surface
OLS	Obstacle Limitation Surface, defined by ICAO Annex 14; refer also CASA MOS Part 139
PANS-OPS	Procedures for Air Navigation – Operations, ICAO Doc 8168; refer also CASA MOS Part 173
PAPI	Precision Approach Path Indicator (a form of VGSI)
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
RAAF	Royal Australian Air Force
RAPAC	Regional Airspace users Advisory Committee
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart (refer also MVA)
RWY	Runway
SACL	Sydney Airport Corporation Limited
SID	Standard Instrument Departure
SODPROPS	(Independent) Simultaneous Opposite Direction Parallel Runway OPERations
SPP	State Planning Policy, Queensland (specifically SPP 1/02: Development in the Vicinity of Certain Airports and Aviation Facilities)
SSDA	State Significant Development Application
SSR	Secondary Surveillance Radar
STAR	STandard Arrival
TAR	Terminal Approach Radar
TAS	True Airspeed
THR	THReshold (of Runway)
TMA	TerMinal Area
TNA	Turn Altitude
TODA	Take-off Distance Available
TORA	Take-Off Runway Available
VFR	Visual Flight Rules
VIS	Visual
VMC	Visual Meteorological Conditions
V _n	Aircraft critical velocity reference
VOR	Very high frequency Omni-directional Range
VSS	Visual Segment Surface
WAC	Westralia Airports Corporation, operators of Perth Airport
WAM	Wide-Area Multilateration
WNW	West North West
WSW	West South West
WGS84	World Geodetic System 1984
WSA	Western Sydney Airport – the proposed second international airport for the Sydney Basin