AERONAUTICAL IMPACT ASSESSMENT REPORT

APPENDIX Y

Sydney Metro City & Southwest: Waterloo Over Station Development

Aeronautical Impact Assessment Report

Applicable to:	Sydney Metro City & Southwest
Author:	Strategic Airspace Pty Limited
Owner	Sydney Metro
Status:	Final
Version:	02.1
Date of issue:	01 November 2018
Review date:	01 November 2018

© Sydney Metro 2018

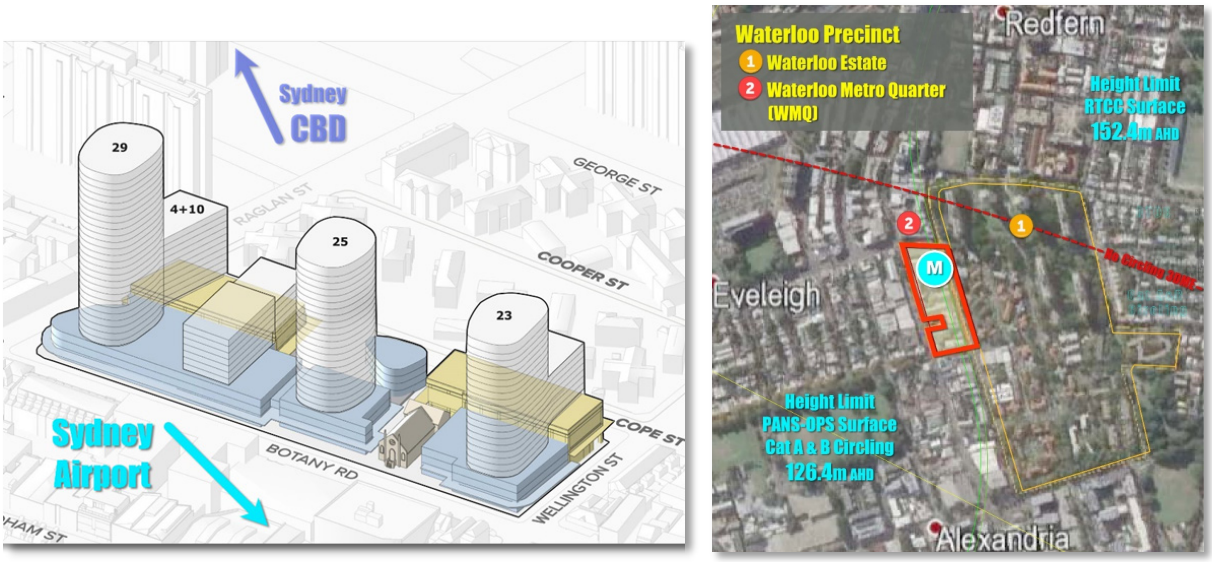
Table of Contents

Executive Summary **3**
1.0 Introduction **5**
1.1 Purpose of this report 5
1.2 Overview of Sydney Metro in its context 6
1.3 Nominated State Significant Precinct - Waterloo 9
1.4 Planning relationship between Waterloo Station and the OSD 9
1.5 The site 12
1.5.1 Location 12
1.5.2 Site context 13
1.6 Overview of the proposed development 16
2.0 Scope of assessment **20**
2.1 The Concept Proposal, Massing and Planned Building Heights 20
2.2 Aeronautical Impact Context & Analysis 22
2.2.1 Location of the Proposed Development 22
2.2.2 Methodology 24
2.2.3 Airport Plans & Aeronautical Data References for the Study 28
2.2.4 Analysis Summary 30
2.2.5 OLS Analysis 31
2.2.6 PANS-OPS Analysis 32
2.2.7 Other Assessment Considerations 38
2.2.8 Other Approvability Measures in relation to Sydney Airport Operations 40
2.2.9 Proposed Development: Building Height Clearances & Cranes 40
3.0 Consultation **42**
3.1 SACL Response 42
3.2 CASA Response 43
3.3 Consultation with DIRD 44
4.0 Conclusion **45**

Executive Summary

This report accompanies a concept State Significant Development Application (concept SSD Application) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The concept SSD Application is made under Section 4.22 of the EP&A Act.

Specifically, this study addresses the aviation-related airspace overhead the Metro Quarter, which is subject to the Commonwealth *Airports (Protection of Airspace) Regulations* (APAR), and responds to the *Secretary's Environmental Assessment Requirements* (SEARs) issued by the NSW Minister for Planning on 29 June 2018 (section 1.1).



Metro Quarter Proposed Massing the viewed from the West, and the Site in Relation to Maximum Building Airspace Heights

The SEARs refer to the potential impact of the concept proposal on the *Prescribed Airspace* of Sydney Airport. This is triggered when the top height of a proposed building or temporary structure exceeds the airport's *Obstacle Limitation Surfaces* (OLS), or any other relevant and pre-defined airspace surface designed to protect instrument flight procedures and navigation infrastructure effectiveness.

The study area, approximately 5.6 kilometres (3.1 Nautical Miles) from Sydney Airport, is situated in the small virtual corridor midway between the straight-in flight paths to the closest runways (Runways 07/25 and 16L/34R) and the Sydney Central Business District (CBD).

At this location, the OLS is the lowest of the Prescribed Airspace surfaces. It slopes up from approximately 63m *Australian Height Datum* (AHD) at the southern-most corner to around 73m AHD at the north-east corner of the Metro Quarter. Based on the concept proposal for the Metro Quarter, the three taller buildings (as depicted in the figure above) would infringe the OLS and would thus require prior airspace approvals under the APAR. Buildings other than the three tower buildings may or may not require prior approval, depending on their final location and height relative to the OLS. The maximum potential height of the buildings, or any temporary structures such as cranes that would require approval prior to construction,

are the height constraints imposed by the PANS-OPS surfaces, which protect the approach, missed approach and departure procedures for Sydney Airport. The constraining PANS-OPS surface overhead the Metro Quarter is a horizontal (flat) surface, at an elevation of 126.4 metres AHD, which protects the Category A and B circling procedure. The extent of it is illustrated in the image on the right-hand side of the figure above. The top heights of all buildings are below the PANS-OPS height constraint.

Additional assessments included the following:

- Potential impact on the contingency (one engine inoperative) procedures required by the regular passenger transport airline operators: no impact.
- Potential impact on the helicopter flight paths to and from the nearby helicopter landing site at the Royal Prince Alfred Hospital: no impact.
- Potential mitigations:
    - The Metro Quarter development is located between the Green Square Town Centre (GSTC), which is 1 km to the south and closer to the airport, and the CBD to the north, but within sufficiently proximity to each in aviation terms. It is also less than 200m from the existing Turanga and Matavai towers, which are located in the neighbouring Waterloo Estate *State Significant Precinct* (SSP) and which are approximately the same height as the tallest of the proposed Metro Quarter buildings (Building A, the northern-most tower). Logically this forms a virtual airspace corridor which contains buildings of equivalent heights in the GSTC to the south and in the adjacent Waterloo Estate, and far taller buildings in the CBD.
    - The Metro Quarter concept proposal does not challenge any of the airspace protection surfaces that already cater for existing buildings in this virtual corridor.
- Construction feasibility in relation to the potential impact of cranes on airspace in the event of an APAR approval for the concept proposal: Feasible. All buildings at their maximum proposed heights could be constructed using cranes that will be able to operate at heights below the PANS-OPS height constraint.

The study concluded that the concept proposal would not contribute any measurable adverse effect to the safety, regularity or efficiency of air traffic to and from Sydney Airport and or in the foreseeable future.

As such, there is no technical impediment to approval of the building envelopes proposed as part of the Metro Quarter OSD. An application under the APAR, supported by a full aeronautical assessment and safety case, would be required to be made and would be expected to be approved by DIRD.

1.0 Introduction

1.1 Purpose of this report

This report accompanies a concept State Significant Development Application (concept SSD Application) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The concept SSD Application is made under Section 4.22 of the EP&A Act.

This report should be read in conjunction with the Nominated State Significant Precinct (SSP) Study – Waterloo, submitted to the Minister for Planning (the Minister) in July 2018. That study proposes new planning controls to facilitate the development proposed.

Sydney Metro is seeking to secure concept approval for over station development (OSD) above and adjacent to Waterloo Station including a podium and three taller buildings which include commercial, residential, and community land uses. The concept SSD Application seeks consent for a building envelope and use for residential, retail, commercial, entertainment, community and recreational purposes, maximum building height, maximum gross floor area (GFA), pedestrian and vehicular access, circulation arrangements and associated car parking and the strategies and design parameters for the future detailed design of development.

Sydney Metro proposes to procure the construction of the OSD as part of an integrated station development package, which would result in the combined delivery of the station, OSD and public domain improvements. The station and its public domain elements form part of a separate planning approval for Critical State Significant Infrastructure (CSSI) approved by DPE on 9 January 2017.

As the development is within a rail corridor, is associated with railway infrastructure and is for "commercial premises or residential accommodation" with a Capital Investment Value of more than $30 million, the project is identified as State Significant Development (SSD) pursuant to Schedule 1, 19(2)(a) of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

This report has been prepared to address the Metro Quarter Aeronautical Impact Assessment requirements and specifically respond to the Secretary's Environmental Assessment Requirements (SEARs) issued for the concept SSD Application on 29th June 2018 which states that the Environmental Impact Statement (EIS) is to address the following requirements:

Reference	SEARs Requirement	Where Addressed in Report
SSD 9393 Key Issue	**5. Prescribed airspace for Sydney Airport** The EIS shall identify any impacts of the proposal on the prescribed airspace for Sydney	The whole of **Section 2.0** Specific References also include Sections **2.2.2.2** (p25), **2.2.3.2** (p28), **2.2.4** (p30), **2.2.5** (p31) and **2.2.6** (p32).

	Airport.	
SSD 9393 Key Issue	**19. Consultation** During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers and community groups. In particular, you must consult with: • Sydney Airport Corporation Limited and the Civil Aviation Safety Authority	Section **3.0** (p42)
SSD 9393 Plans and Documents	In addition, the EIS must include the following: • flight path report	This report, with specific reference to the contents of **Section 2.0 Scope of assessment** (p20).

1.2 Overview of Sydney Metro in its context

Sydney Metro is Australia's biggest public transport project. A new standalone metro railway system, this 21st century network will deliver 31 metro stations and 66km of new metro rail for Australia's biggest city — revolutionising the way Sydney travels. Services start in the first half of 2019 on Australia's first fully-automated railway.

Sydney Metro was identified in *Sydney's Rail Future*, as an integral component of the *NSW Long Term Transport Master Plan*, a plan to transform and modernise Sydney's rail network so it can grow with the city's population and meet the future needs of customers. In early 2018, *the Future Transport Strategy 2056* was released as an update to *the NSW Long Term Transport Master Plan* and *Sydney's Rail Future*. Sydney Metro City & Southwest is identified as a committed initiative in the *Future Transport Strategy 2056*.

Sydney Metro is comprised of three projects:

Sydney Metro Northwest — formerly the 36km North West Rail Link. This $8.3 billion project is now under construction and will open in the first half of 2019 with a metro train every four minutes in the peak.

Sydney Metro City & Southwest — a new 30km metro line extending the new metro network from the end of Sydney Metro Northwest at Chatswood, under Sydney Harbour, through the CBD and south west to Bankstown. It is due to open in 2024 with an ultimate capacity to run a metro train every two minutes each way through the centre of Sydney.

Sydney Metro West – a new underground railway connecting the Parramatta and Sydney central business districts. This once-in-a-century infrastructure investment will double the rail capacity of the Parramatta to Sydney CBD corridor and will establish future capacity for Sydney's fast growing west. Sydney Metro West will serve five key precincts at Westmead, Parramatta, Sydney Olympic Park, The Bays and the Sydney CBD. The project will also provide an interchange with the T1 Northern Line to allow faster connections for customers from the Central Coast and Sydney's north to Parramatta and the Sydney CBD.

Sydney's new metro, together with signalling and infrastructure upgrades across the existing Sydney suburban rail network, will increase the capacity of train services entering the Sydney CBD – from about 120 an hour currently to up to 200 services beyond 2024. That's an increase of up to 60 per cent capacity across the network to meet demand.

Figure 1: Sydney Metro alignment map

Sydney Metro City & Southwest includes the construction and operation of a new metro rail line from Chatswood, under Sydney Harbour through Sydney's CBD to Sydenham and on to Bankstown through the conversion of the existing line to metro standards.

The project also involves the delivery of six (6) new metro stations, including at Waterloo, together with new underground platforms at Central. Once completed, Sydney Metro will

have the ultimate capacity for a train every two minutes through the CBD in each direction - a level of service never seen before in Sydney.

On 9 January 2017, the Minister approved the Sydney Metro City & Southwest - Chatswood to Sydenham application lodged by TfNSW as a CSSI project (reference SSI 15_7400).

The CSSI Approval includes all physical work required to construct the CSSI, including the demolition of existing buildings and structures on each site. Importantly, the CSSI Approval also includes provision for the construction of below and above ground structures and other components of the future OSD (including building infrastructure and space for future lift cores, plant rooms, access, parking and building services, as relevant to each site). The rationale for this delivery approach, as identified within the CSSI application is to enable the OSDs to be more efficiently built and appropriately integrated into the metro station structures.

The EIS for the Chatswood to Sydenham alignment of the City & Southwest project identified that the OSD would be subject to a separate assessment process.

Since the CSSI Approval was issued, Sydney Metro has lodged four modification applications to amend the CSSI Approval as outlined below:

- Modification 1 - Victoria Cross and Artarmon Substation which involves relocation of the Victoria Cross northern services building from 194-196A Miller Street to 50 McLaren Street together with inclusion of a new station entrance at this location referred to as Victoria Cross North. The modification also involves the relocation of the substation at Artarmon from Butchers Lane to 98 – 104 Reserve Road. This modification application was approved on 18 October 2017.

- Modification 2 - Central Walk which involves additional works at Central Railway Station including construction of a new eastern concourse, a new eastern entry, and upgrades to suburban platforms. This modification application was approved on 21 December 2017.

- Modification 3 - Martin Place Station which involves changes to the Sydney Metro Martin Place Station to align with the Unsolicited Proposal by Macquarie Group Limited (Macquarie) for the development of the station precinct. The proposed modification involves a larger reconfigured station layout, provision of a new unpaid concourse link and retention of the existing MLC pedestrian link and works to connect into the Sydney Metro Martin Place Station. It is noted that if the Macquarie proposal does not proceed, the original station design remains approved. This modification application was approved on 22 March 2018.

- Modification 4 - Sydenham Station and Sydney Metro Trains Facility South which incorporated Sydenham Station and precinct works, the Sydney Metro Trains Facility South, works to Sydney Water's Sydenham Pit and Drainage Pumping Station and ancillary infrastructure and track and signalling works into the approved project. This modification application was approved on 13 December 2017.

The CSSI Approval as modified allows for all works to deliver Sydney Metro between Chatswood and Sydenham Stations and also includes upgrade of Sydenham Station.

The remainder of the City & Southwest alignment (Sydenham to Bankstown) proposes the conversion of the existing heavy rail line from west of Sydenham Station to Bankstown to metro standards. This part of the project, referred to as the Sydenham to Bankstown upgrade, is the subject of a separate CSSI Application (Application No. SSI 17_8256) for which an EIS was exhibited between September and November 2017. A Response to Submissions and Preferred Infrastructure Report was submitted to DPE in June 2018 for further exhibition and assessment. This application is subject to assessment and determination by DPE, taking into consideration a further Response to Submissions Report which was submitted to DPE in September 2018.

1.3 Nominated State Significant Precinct - Waterloo

Following the decision to locate a metro station in Waterloo, the Minister determined that parts of Waterloo are of State planning significance which should be investigated for urban renewal through the SSP process. Study requirements for such investigations were issued by the Minister on 19 May 2017.

Investigation of the Precinct is being undertaken by UrbanGrowth NSW Development Corporation (UrbanGrowth NSW), in partnership with Sydney Metro and the Land and Housing Corporation (LAHC). The outcome of the SSP process will be new planning controls that will enable future development applications for renewal of the Precinct.

The Precinct includes two separate but contiguous and inter-related parts:

- The Waterloo Metro Quarter (the Metro Quarter)
- The Waterloo Estate (the Estate)

A separate SSP Study for the Metro Quarter was lodged in July 2018 in advance of the SSP Study for the Estate to provide a planning framework for the construction of OSD within the Metro Quarter. The staged submission of the Metro Quarter SSP Study also facilitates the proposed development to be delivered concurrently with the metro station, as an integrated station development.

As this concept SSD Application relies upon the planning framework proposed in the Metro Quarter SSP Study, it is anticipated that the SSP Study and the Environmental Impact Statement (EIS) for the SSD Application will be exhibited concurrently.

1.4 Planning relationship between Waterloo Station and the OSD

While Waterloo Station and the OSD will form an integrated station development, the planning pathways defined under the EP&A Act require separate approval 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.

For clarity, the approved station works under the CSSI Approval included the construction of below and above ground structures necessary for delivering the station and also enabling construction of the integrated OSD. This includes but is not limited to:

- demolition of existing development
- excavation
- integrated station and OSD structure (including concourse and platforms)
- lobbies
- retail spaces within the station building
- public domain improvements associated with the station
- access arrangements including vertical transport such as escalators and lifts
- space provisioning and service elements necessary to enable the future development of the OSD, such as lift cores, plant rooms, access, parking, retail, utilities connections and building services.

The vertical extent of the approved station works above ground level is defined by the 'transfer level' level (which for Waterloo is defined by approximately RL 33.1 over the northern station box and RL 35.1 over the southern station box), above which would sit the OSD. An example of this delineation is illustrated in **Figure 2**.

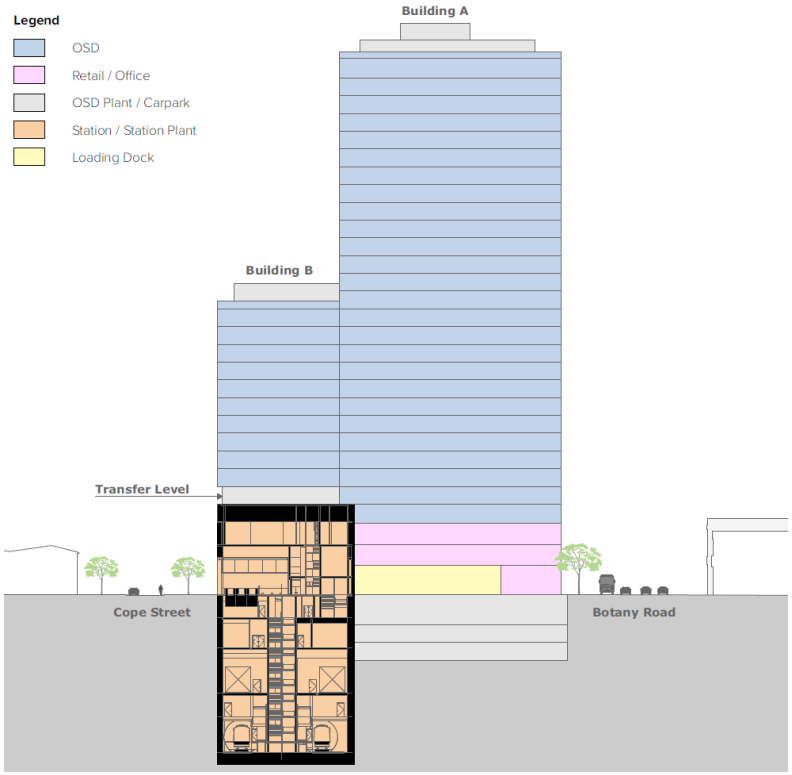


Figure 2: Delineation between the Metro station and OSD

It is noted that the structural and service requirements and space provisioning to support OSD vary from station to station. For example, based on the current level of design, Waterloo Station is not expected to provide for OSD lobbies, end of trip facilities and plant rooms. However, the detailed design may be amended to incorporate these elements as part of the integrated station development.

The CSSI Approval also establishes the general concept for the ground plane of Waterloo Station including access strategies for commuters, pedestrians and workers. In this regard, the main pedestrian access to the station would be via an entry located at the corner of Raglan and Cope Streets. The station design has continued to be developed having regard to its integration with the Metro Quarter OSD, and as a result, a second entrance to the station is to be provided from a proposed public plaza adjacent to Cope Street. Retail uses (approved under the CSSI Approval) would be located on the ground floor of the station development along the Cope Street frontage of the site.

Since the issue of the CSSI Approval, Sydney Metro has undertaken design work to determine the technical requirements for the structural integration of the OSD with the station. This level of design work, together with the planning and design undertaken for the remainder of the Metro Quarter has informed the concept proposal for the OSD. It is noted that ongoing design development of the works to be delivered under the CSSI Approval would continue with a view to developing an Interchange Access Plan (IAP) and Station

Design Precinct Plan (SDPP) for Waterloo Station to satisfy Conditions E92 and E101 of the CSSI Approval. The detailed design for the Metro Quarter would continue to evolve having regard to the IAP and SDPP.

Public domain improvement works immediately adjacent to Waterloo Station would be delivered as part of the CSSI Approval to support pedestrian movements between transport modes (including to new and relocated bus stops, bike parking on Cope Street, and taxi and kiss-and-ride bays on Cope Street), while other public domain works within the Metro Quarter are proposed as part of the OSD. Final details of public domain works for the OSD will be provided with the detailed SSD Application(s) following finalisation of the SDPP and IAP for the CSSI Approval.

1.5 The site

1.5.1 Location

The site is located within the City of Sydney Local Government Area (LGA).

The Metro Quarter comprises land to the west of Cope Street, east of Botany Road, south of Raglan Street and north of Wellington Street. The heritage listed Waterloo Congregational Church located at 103–105 Botany Road is within this block but is not part of the site.

The site has an approximate area of 1.287 hectares (refer to Figure 3).

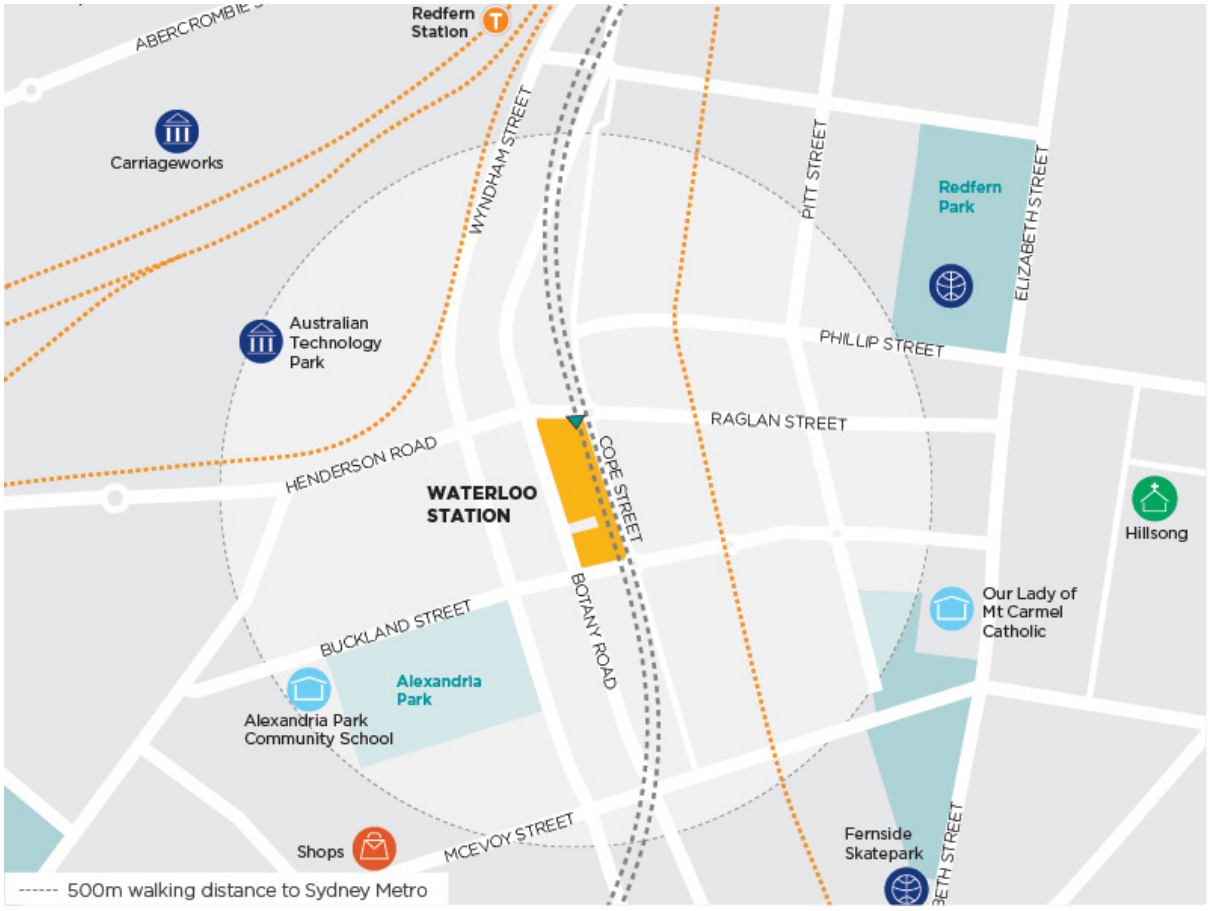


Figure 3: Waterloo Station location plan

1.5.2 Site context

The Metro Quarter is located in Redfern Street Village (see Figure 4) in the City of Sydney LGA approximately 3.3 kilometres south of Sydney CBD, 1 kilometre north of Green Square and less than 1 kilometre south of Redfern Station.

Directly east is the Waterloo Estate, which is owned by the NSW Government and is under the management of NSW LAHC. The Waterloo Estate comprises 2,012 social housing dwellings and a small number of private dwellings in medium and high density forms, ranging from single storey attached dwellings to apartment buildings of up to thirty storeys.

The Metro Quarter is less than 1 kilometre south-east of the Australian Technology Park (ATP), a technology micro-cluster that currently contains around 3,000 – 3,500 workers with a range of businesses in technology and creative industries; and a start-up/business incubator hub. It is set to grow into a business park that will soon accommodate new premises currently under construction (i.e. Commonwealth Bank Australia (CBA) has committed to two major office towers).

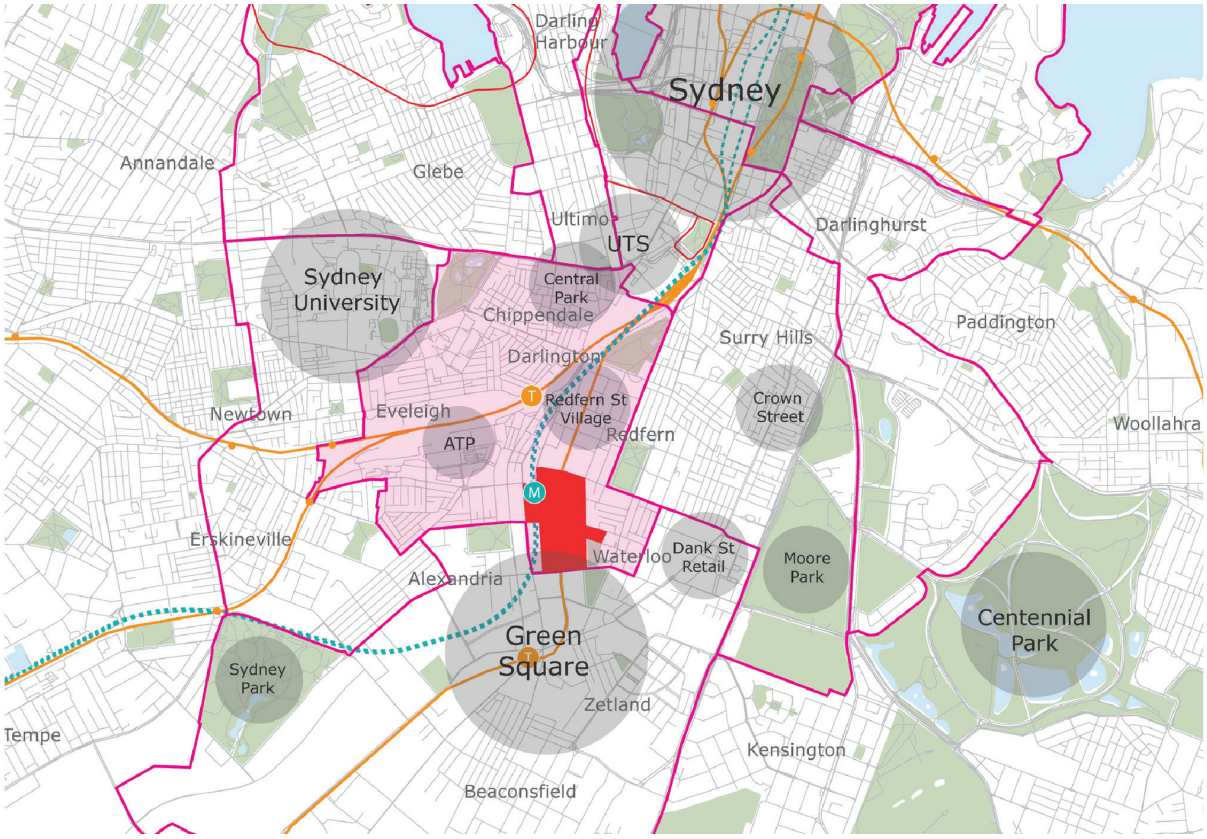


Figure 4 Location and site plan of the Waterloo State Significant Precinct (in red) and Redfern Street Village (in pink)

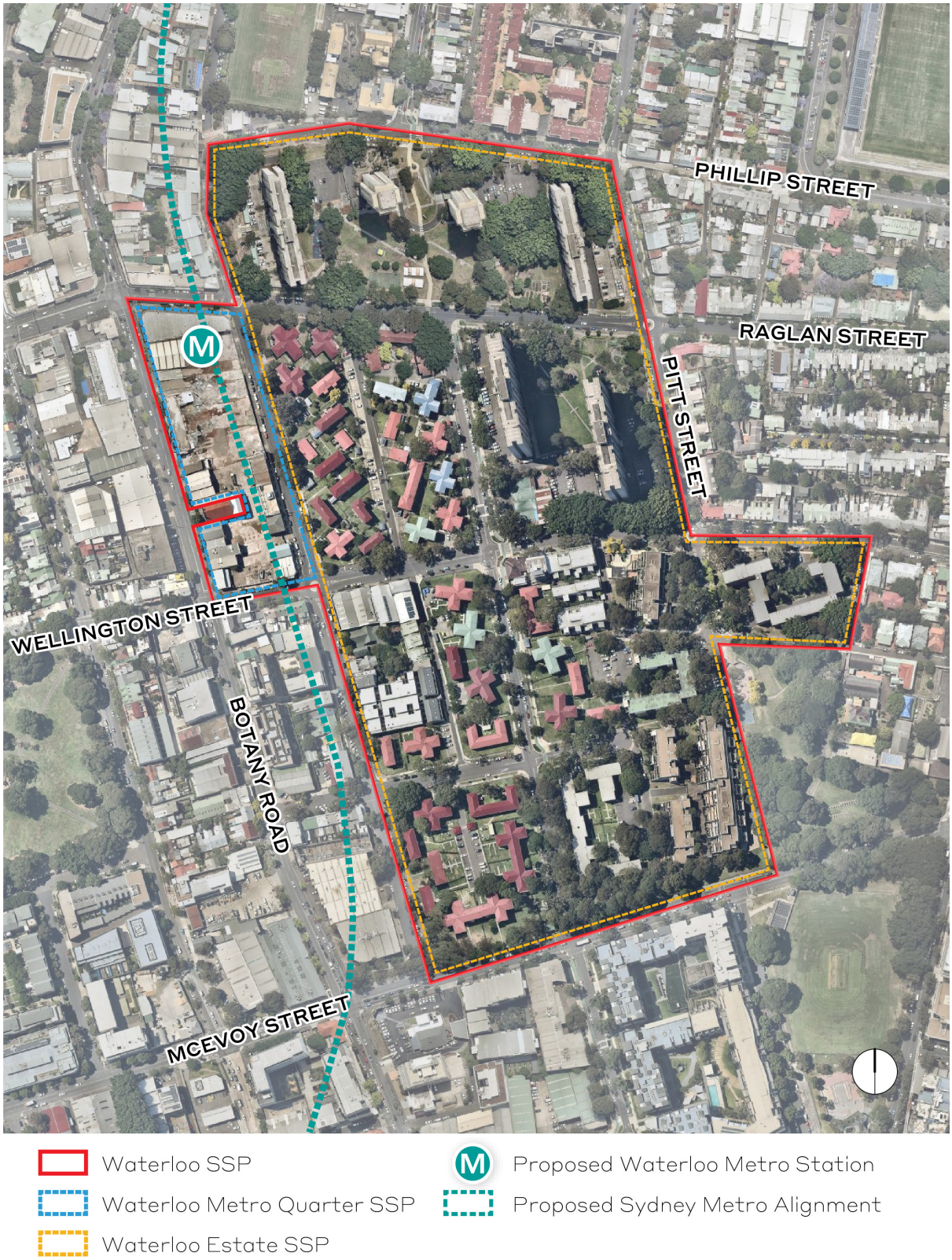


Figure 5 Nominate State Significant Precinct - Waterloo

The site comprises the following properties:

- 136B Raglan Street — Lot 4 DP 215751
- 59 Botany Road — Lot 5 DP 215751
- 65 Botany Road — Lot 1 DP814205
- 67 Botany Road — Lot 1 DP228641
- 124-128 Cope Street — Lot 2 DP228641
- 69-83 Botany Road — SP75492
- 130-134 Cope Street — Lot 12 DP399757
- 136-144 Cope Street — Lots A-E DP108312
- 85 Botany Road — Lot 1 DP27454
- 87 Botany Road — Lot 2 DP27454
- 89-91 Botany Road — Lot 1 DP996765
- 93-101 Botany Road — Lot 1 DP433969 & Lot 1 DP738891
- 156-160 Cope Street — Lot 31 DP805384
- 107-117A Botany Road — Lot 32 DP805384 & Lot A DP408116
- 119-121 Botany Road — Lot 1 DP205942 & Lot 1 DP436831
- 170-174 Cope Street — Lot 2 DP205942

The buildings and structures on the site are now demolished in accordance with the CSSI Approval, with the exception of one building which is being used to support construction.

1.6 Overview of the proposed development

This concept SSD Application follows the submission of a SSP Study which supports a proposal to amend existing controls to facilitate the proposed development. The concept SSD Application will in turn comprises the first stage of seeking SSD development consent for the Waterloo OSD project. It will be followed by a future detailed SSD Application(s) for the design and construction of the OSD built form.

This concept SSD Application seeks approval for the planning and development framework and strategies to inform the future detailed design of the OSD. It specifically seeks approval for:

- maximum building envelopes, including maximum building heights, street-wall heights and ground and upper level setbacks
- A maximum gross floor area (GFA) of 68,750 square metres, comprising:
  - approximately 56,200 square metres GFA of residential accommodation, providing for approximately 700 dwellings, including 5 to 10 percent affordable housing and 70 social housing dwellings

  - approximately 3,905 square metres GFA of retail premises and entertainment facilities
  - approximately 8,645 square metres GFA for business and commercial premises and community, health service and recreational facilities (indoor), including at least 2,000 square metres of floor space for community uses
- a three storey podium and a free standing building located within a public plaza, accommodating non-residential land uses
- residential uses above podium level in various building forms including three buildings of 23, 25 and 29 storeys (Relative Level (RL) 96.9, 104.2 and 116.9 metres AHD respectively)
- use of the OSD space provisioning within the footprint of the CSSI Approval
- public domain works, including open spaces, through-site links, footpaths, provision for cycle facilities and enhanced pedestrian crossings and roads
- car parking for up to 427 vehicles
- cycle parking to support residential and non-residential land uses and visitors to the Metro Quarter. Approval is also being sought for space within the future basement for a bike hub which would also support future bike parking for Waterloo Station
- loading, vehicular and pedestrian access arrangements
- strategies for utilities and services provision
- strategies for managing stormwater and drainage
- a strategy for the achievement of ecologically sustainable development
- a public art strategy
- provision for future signage zones
- a design excellence framework
- the future subdivision of parts of the OSD footprint (if required).

It is noted that the Sydney Metro comprises GFA of approximately 8,415 square metres on the site, approved under CSSI Approval. The total GFA for the integrated station development, including the station GFA is approximately 77,165 square metres, which is equivalent to an FSR of approximately 6:1.

Key parameters of the Concept proposal based on the current level of design development are indicated at Figure 6 and Figure 7.

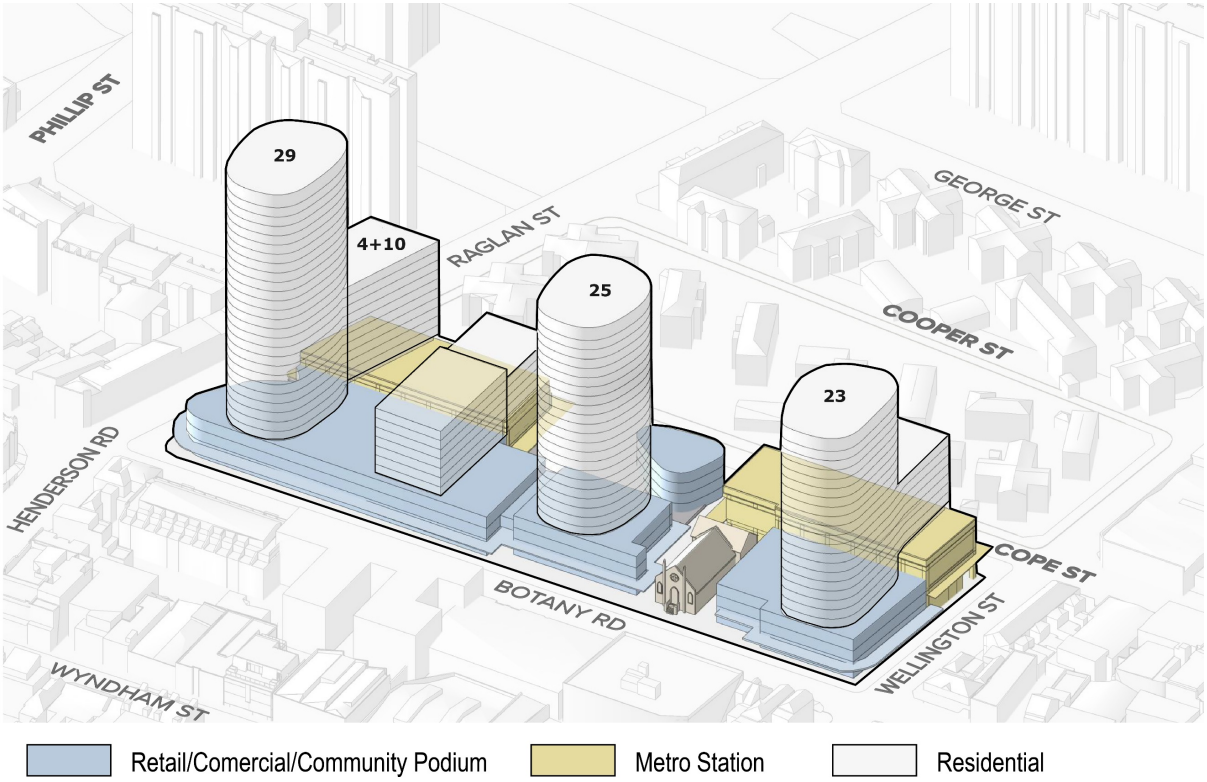


Figure 6 Proposed massing, viewed from the west

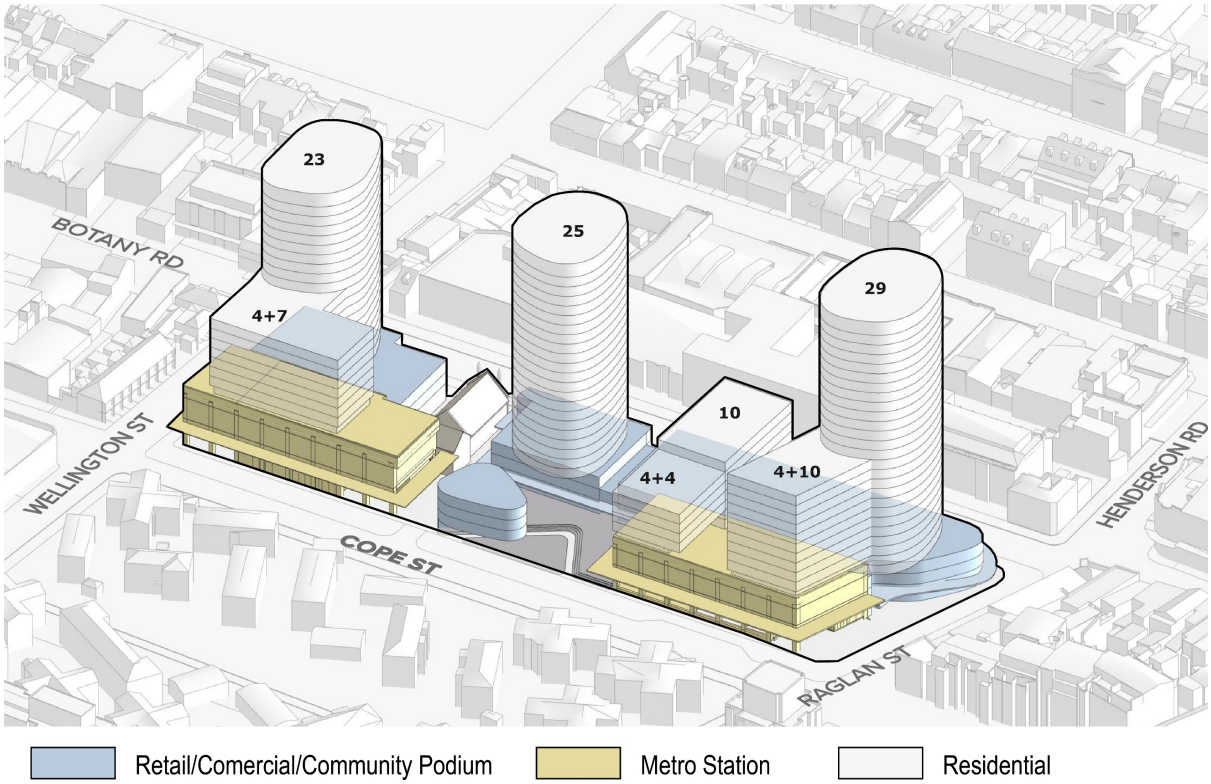


Figure 7 Proposed massing, viewed from the east

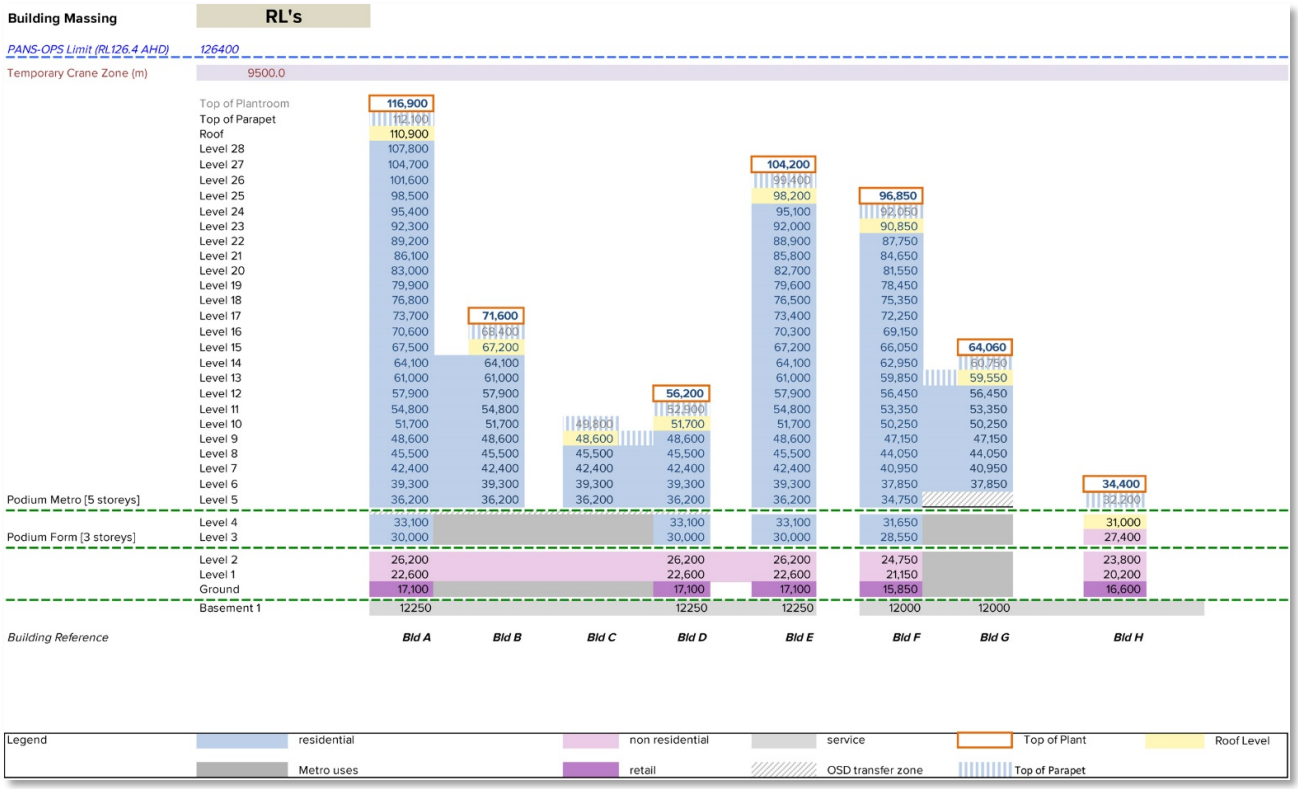
The proposal is a significant opportunity to contribute to the urban renewal process for the Waterloo SSP. The objective to deliver the Metro Quarter project as soon as reasonably possible after completion of the Sydney Metro works (earmarked to open 2024) would ensure buildings within the Metro Quarter are occupied to support maximum patronage of the proposed metro station.

The Metro Quarter would contain a mix of uses including residential, commercial, retail, community facilities and services and cultural opportunities sufficient for daily life to be provided for within the wider neighbourhood and to support the activation of the precinct. This would help make Waterloo one of the most connected and attractive inner-city places to live, work and visit.

2.0 Scope of assessment

2.1 The Concept Proposal, Massing and Planned Building Heights

Figure 8 shows the proposed massing and the maximum building envelope heights of all buildings. The PANS-OPS height shown on the diagram is the limiting airspace height that was determined from the aeronautical impact assessment, the details of which can be found in Section 2.2 of this report. Table 1 below documents the top building heights used for the aeronautical assessment.



Source: UGDC, Turner

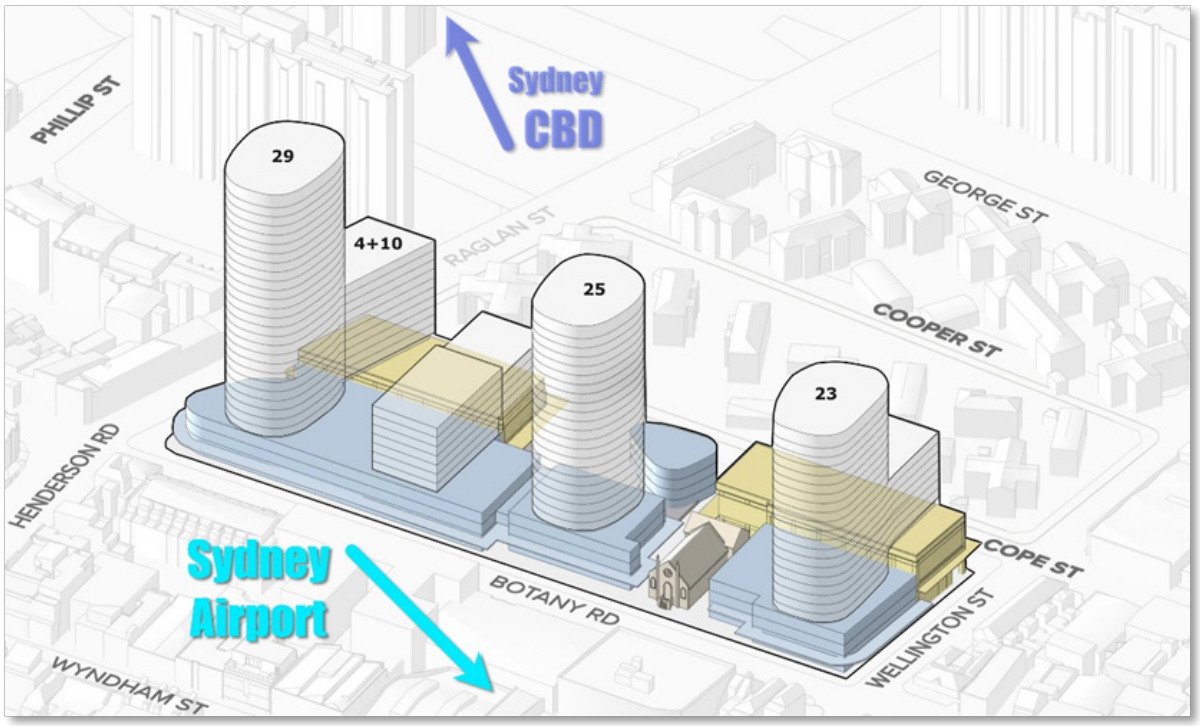
Figure 8: Proposed Massing Schedule & Building Heights (View from the West)

Table 1: Proposed Building Heights

Building	Height Used for Airspace Assessment Metres AHD	Building Elevation RLs Proposed Metres AHD	Source of Height from Massing Plan
A – Northern Tower	**116.9**	**116.9**	Top of Lift Overrun
B	71.6	71.6	Top of Plantroom
C	49.8	49.8	Top of Roof / Parapet

Building	Height Used for Airspace Assessment Metres AHD	Building Elevation RLs Proposed Metres AHD	Source of Height from Massing Plan
D	56.2	56.2	Top of Plantroom
E – Central Tower	**104.2**	**104.2**	Top of Plantroom
F – Southern Tower	**96.9**	**96.85**	Top of Plantroom
G	64.1	64.06	Top of Plantroom
H	34.4	34.4	Podium, Top of Roof / Parapet

The 3D model of the overall concept proposal viewed from the west, as depicted in Figure 9, highlights the orientation of the proposal in relation to Sydney Airport and the Sydney CBD.



Source: UGDC, Turner
Figure 9: Metro Quarter in 3D view from the West, shown in relation to CBD and Sydney Airport

2.2 Aeronautical Impact Context & Analysis

The aeronautical assessment is based on the Metro Quarter site boundary and the building envelopes presented in the concept proposal. Where possible, for example, where a limiting airspace surface height was horizontal, height impacts were calculated based on the height of the different building envelopes. However, where this was not possible (because the airspace surfaces sloped up across the site and the building envelope locations were not final at the time of assessment), the airspace assessments were made based on a single point south of the site boundary. This approach was taken to ensure conservative results that would be applicable to the entire Metro Quarter.

2.2.1 Location of the Proposed Development

The site lies to the north of Sydney Airport, approximately 5.65 kilometres (3.1 Nautical Miles (NM)) from the aerodrome reference point (ARP) at a bearing of 009° Magnetic (M) or 022° True (T) — as indicated in Figure 10 below.

The primary measurement point used is the south-western corner of the Metro Quarter, at the corner of Botany Road and Wellington Street, Waterloo. The south-eastern boundary point is at the corner of Cope Street intersection with Wellington Street.

Other key measurement references are:

- In relation to Runway (RWY) 07/25, the cross-runway
    - ~4.45km (2.4NM) at 001°M (013°T) from the threshold of RWY 25
    - ~3.89km (2.1NM) from the extended runway centreline
- In relation to Runway (RWY) 16L/34R, the eastern parallel runway
    - ~5.96km (3.2 NM) at 357°M (010°T) from the threshold of Runway (RWY)16L
    - ~2.25km (1.2NM) from the extended runway centreline

In addition, it is noted that the Metro Quarter, at its southern border, is approximately 780 metres (0.4NM) to the north of the most significant development in the local region, the Green Square Town Centre, which is partly developed, and which has a maximum airspace height approval (for buildings and/or cranes) up to 125 metres AHD. This development will have the potential to provide a 'shielding effect' to buildings proposed for the Metro Quarter, thereby facilitating the airspace-related height assessment and approval path for developments.

It is also noted that the maximum heights of the Metro Quarter buildings took into consideration the heights of the nearby Turanga and Matavai social housing buildings in adjacent the Waterloo Estate, located some 150-200 metres to the north-east and east-north-east (see Figure 11). The building envelope proposed for Building A of the Metro Quarter concept proposal would be no more than 1.9 metres taller than the existing Matavai

tower, and all other building envelopes proposed would be lower than both of the existing Waterloo Estate buildings.

The other airports in the Sydney Basin are too distant from the study area to have any impact on the airspace overhead the precinct.

Figure 10: Metro Quarter in relation to Sydney Airport

Source: UGDC, Strategic Airspace
Figure 11: Aerial View of the Proposed Metro Quarter in relation to the nearby development precincts

2.2.2 Methodology

The methodology used to determine the maximum permissible building heights is based on an orderly assessment of the potential impact against the various elements described in this section.

2.2.2.1 Airspace Regulations

The proposed development site is subject to the *Airports (Protection of Airspace) Regulations* (APAR), pursuant to the *Commonwealth's Airports Act 1996*, because of its proximity to Sydney Airport and its proposed height. These regulations, which are administered by the Commonwealth *Department of Infrastructure, Regional Development and Cities* (DIRD), define:

- how building height limitations due to airspace safety can be determined

- 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.

2.2.2.2 Prescribed Airspace

Prescribed airspace, as defined under the APAR, 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, Regional Development & Cities (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 and/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 Australia), the PANS-OPS Surface Plan published by an airport may not reflect the current situation — requiring that the assessment references the airport's plans and also review of the published charts for current (or pending) instrument flight procedures and evaluation of 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 also necessary to consider the other factors such as those listed below.
- 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.
- 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. This may also include protection of critical airspace for visual flight procedures used for emergency service helicopter landing sites.

Note: Airspace that is approved by the DIRD as Declared Airspace is considered part of an airport's Prescribed Airspace.

2.2.2.3 Note about Heights: Australian Height Datum (AHD) vs Above Ground Level (AGL)

All "heights" provided in this document are elevations expressed in metres in AHD, and thus they are true elevations, and not heights above ground level (AGL).

For estimating maximum development heights AGL, the ground elevation AHD should be subtracted from the airspace height limits AHD.

Note also for aviation-related airspace height limits, any building height approval under the *Airports (Protection of Airspace) Regulations* is regarded as inclusive of the building itself plus all rooftop furniture and overruns (plant buildings, lift risers, etc).

2.2.2.4 The Application Pathway for Airspace Height Approvals

All applications under the *Airports (Protection of Airspace) Regulations* for permanent structures (called controlled activities) and temporary (short-term controlled activities) must be submitted to DIRD, at the appropriate time, through the closest relevant airport, in this case Sydney Airport. It is expected that these applications would be made at the detailed SSD Application stage, once the detailed design and construction methodology are developed.

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: this information will be used for assessment of the feasibility of constructing the buildings if approved at the maximum heights sought. Separate applications for cranes would also be required at the appropriate times during the construction period, prior to their erection.

There are a number of factors and considerations that would influence a decision on when to make an APAR application for a building. Common decision criteria are outlined below.

- The need for early certainty of approval, versus the effort entailed in preparing documentation and supporting details required to prepare and justify an APAR application that can be approved.
- Application assessment lead time: under the APAR, the minimum processing time for evaluation is 49 days, but it may be substantially longer before a determination is made if additional information and/or clarifications are required.
- Approvals are sometimes not required prior to submitting a development application (DA) but in other cases planning assessment requires a level of certainty that an APAR application would be approved in the event that the planning proposal or DA is approved.
  - Some DAs are granted with the requirement to secure an airspace height approval as a consent condition.
  - Sydney Airport, CASA and DIRD prefer to process applications that already have DA approval for several reasons:
    - Because applications based on advanced development plans and designs (eg, to DA level or beyond) will have enough associated information — eg, a Construction Management Plan which includes preliminary crane plans — that will help to support and justify the feasibility of construction in the event of an APAR approval; and
    - To reduce the likelihood that they will have to re-evaluate the sites for amended applications in the future due to changed designs (for example, following DA resolution).
  - In the event that changes to a design or construction events are likely to exceed an approval already granted for the site, an application for an amendment to the pre-existing approval would need to be made. The documentation requirements and assessment periods for amendments are usually the same as for an initial application.

2.2.2.5 Applications for Buildings

For proposed developments that would penetrate the OLS, such as those proposed as part of the concept proposal for the Metro Quarter, Sydney Airport Corporation Limited (SACL) will seek consultation from Airservices Australia, CASA and other key stakeholders (such as

major airlines), and then within 3 weeks from the date of receipt forward the application to DIRD. Upon final receipt of technical calculations and agency and stakeholder feedback, DIRD would make a determination and advise the SACL and the applicant. Whilst the APAR provide a 4-week response timeframe for the DIRD response, there are provisions whereby this timeframe can be extended, especially where DIRD seeks clarification or further information to help in the assessment of complex cases.

A successful application would be given approval under Regulation 14 of the APAR as a controlled activity.

2.2.2.6 Applications for Cranes

For proposed cranes and temporary structures that would penetrate the OLS but not infringe the PANS-OPS constraint overhead, SACL may grant approval of applications under delegation. If an application seeks approval for cranes that would penetrate the PANS-OPS height constraint, permission may be granted subject to operational and safety assessments, as well as the agreement of SACL. In such cases, a crane which infringes the PANS-OPS would be approved for a maximum duration of 3 contiguous months as a short-term controlled activity under Regulation 14(5) of the APAR.

2.2.3 Airport Plans & Aeronautical Data References for the Study

2.2.3.1 Sydney Airport Master Plan 2033

The current plan in effect, the *Sydney Airport Master Plan 2033* which was prepared in 2015, no longer accurately reflects the current airspace height constraints due to changes to navigation and airspace that have occurred over recent years. This is because of changes in some standards and changes in operational requirements that are beyond the control of Sydney Airport.

SACL is currently revising the Master Plan with a vision for Sydney Airport in 2039. The *Sydney Airport Master Plan 2039 preliminary draft*, released in September 2018 for public consultation, indicates no changes to the airport infrastructure which would affect the existing OLS, nor does it forecast any changes to the flight paths of the PANS-OPS procedures that are currently in place. Based on the current timeline, Sydney Airport has advised that they would anticipate that the final *Master Plan 2039* would be approved (by DIRD) around April-May 2019.

2.2.3.2 Sydney Airport Prescribed Airspace Plans

The currently available plans — including OLS, PANS-OPS, airspace related to the protection of radar and ground-based navigation aids, and the RTCC surfaces — were published in March 2015 as the Declared Airspace for Sydney Airport. Like the Master Plan 2033 they no longer reflect the current airspace height constraints due to changes in on-airport navigation-related infrastructure and PANS-OPS flight procedures since that time.

2.2.3.3 Procedure & Airspace Charts published by Airservices Australia

These charts are regularly updated every three months and the updates are published on Airservices Australia's website six weeks prior to implementation. These charts reflect changes in the international standards for PANS-OPS procedures, changes in the navigation infrastructure used and other changes implemented as a result of air traffic management demands and practices from time to time.

The PANS-OPS instrument flight procedures published in these charts are the procedures pilots are obliged to follow. Hence, they are the best source of information in deriving current airspace restrictions. The height limitations identified in this report are based on the most recent version of these and other relevant charts published by Airservices Australia.

2.2.3.4 Effects of Recent Changes

There have been significant changes to Sydney Airport airspace in recent years. These changes have been caused by new types of operations, new navigation technology and changed safety criteria and standards which are developed and maintained by the *International Civil Aviation Organisation* (ICAO) and used by Airservices and CASA. Most of these changes have not affected the critical airspace directly above the Metro Quarter site.

All such changes that have been identified from Airservices and ICAO documents and have been taken into consideration in this report. These are the constraints that are relevant for the foreseeable future.

2.2.3.5 Trends that May Affect the Airspace over the Metro Quarter

The *Master Plan 2033* identified several trends, mostly in terms of aircraft types and number that may affect the environmental (noise) impact and airspace limitations over the Metro Quarter. These trends were:

- A slowly decreasing number of General Aviation and Corporate Aviation operations: these types of airport users are the most likely to use the most restrictive PANS-OPS operation (the Category A and B Circling Area) affecting the Metro Quarter site. As the number of potential users of this type of landing procedure diminishes, the relevance of this most restrictive surface diminishes. This strengthens any argument for changing or removing the restriction.

- Increasing use of newer navigation technologies: this will decrease the need for the Category A and B Circling Area and may eventually reduce the current reliance on 'radar vectoring' which is the cause of the second most restrictive surface (the RTCC) above the Metro Quarter site. No other changes to flight paths that would impact the Metro Quarter are anticipated.

- The increasing number of new technology larger passenger transport aircraft, which are more efficient and have significantly lower noise emissions. This aspect is not anticipated

to change the impact of flight paths in any way that will affect height constraints overhead the Metro Quarter.

The preliminary draft of the *Master Plan 2039* currently available for review and comment forecasts no changes to the flight paths currently in use, which means that there are no consequential changes to airspace height limits that would further constrain the maximum building heights in the Metro Quarter.

2.2.4 Analysis Summary

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

Table 2: Analysis Summary — Airspace Height Constraints for the Metro Quarter

Height Limits (AHD)	Height Limit Detail	Comment
63m – 73m	**OLS Conical Surface**	The OLS height limits applicable to the Metro Quarter site (as per the 1m contours depicted in Figure 12) Any development that would exceed the relevant limiting heights at the location would require a prior 'airspace height' approval from DIRD under the APAR. An application can be made for each building separately, or for the Metro Quarter as a single site. To facilitate technical coordination with the aviation authorities and a timely application and approval process, any such application(s) should be made via or with the assistance of an airspace consultant.
126.4m	**PANS-OPS Circling Surface for Category A & B Aircraft** — Entire Metro Quarter	**This constraint is the maximum permissible building height (including heights for long term crane usage) that would be approved by the aviation authorities in the relevant areas** (see Figure 13) The vertical space available between the top of all buildings (and for Building A, the top of roof rather than the top of the overrun) and this PANS-OPS height constraint leaves ample room for cranes. Consideration may need to be given to the construction technologies and types of cranes used for any buildings where the maximum heights sought are close to this PANS-OPS height constraint.
152.4m	Radar Terrain Clearance Chart (RTCC) / Minimum Vector Altitude (MVA)	This constraint, which sits above the PANS-OPS Circling height limit across the entire Metro Quarter, is the absolute maximum permissible building height (including crane heights) that would be approved by the aviation authorities in the event that a temporary approval was granted for a crane that would infringe the PANS-OPS Circling Surface Height.

Height Limits (AHD)	Height Limit Detail	Comment
N/A or >152.4m	PANS-OPS Approaches & Departures Surfaces	The study area is outside the extent of the protection areas of PANS-OPS Approach Surfaces for Sydney Airport. Where PANS-OPS Missed Approach and Departure Procedure Surfaces do overlay the study area, the limiting heights are higher than that of the RTCC/MVA constraint.
NA	Other Surfaces	The study area is outside any airspace protection requirements related to Sydney Airport's Navigation and Airport Lighting and Visual Guidance facilities, as well as those related to Airline Engine Inoperative contingency take-off procedures.

2.2.5 OLS Analysis

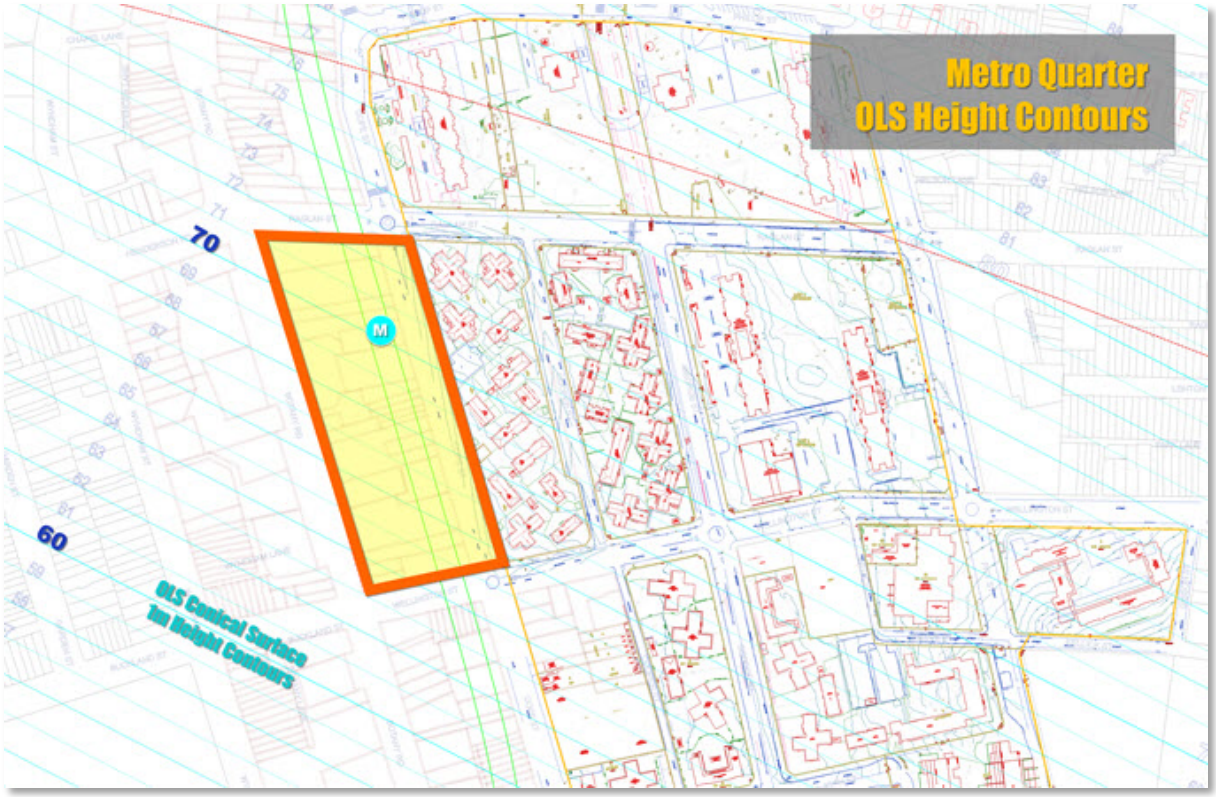


Figure 12: Waterloo Precinct in relation to Sydney Airport's OLS

The height limit of Sydney Airport's OLS overhead the precinct is defined by the Conical Surface, which rises at a gradient of 5 per cent from the south-west to the north-east, as depicted in Figure 12 above.

Table 3: Proposed Building Heights, OLS Impact and Relevance to Building Height Application Requirements under APAR

Building	Proposed Max Height (Metres AHD)	Probable OLS Impact Clearance / Penetration (Metres AHD)	Height Approval Implication
A – Northern Building	**116.9**	**~ –47**	Will penetrate the OLS; prior airspace height approval will be required
B	71.6	**~ –3**	*May* penetrate the OLS, subject to final design footprint. Need for prior height approval subject to OLS impact.
C	49.8	~ 18	No OLS impact; prior height approval for this building N/A
D	56.2	~ 12	No OLS impact; prior height approval for this building N/A
E – Central Building	**104.2**	**~ –37**	Will penetrate the OLS; prior airspace height approval will be required
F – Southern Building	**96.9**	**~ –32**	Will penetrate the OLS; prior airspace height approval will be required
G	64.1	~ 0	*May* penetrate the OLS, subject to final design footprint. Need for prior height approval of the building subject to OLS impact.
H	34.4	~ 30	No OLS impact; prior height approval for this building N/A

In summary, based on the building envelopes proposed, three buildings A, E and F would penetrate the OLS and would require airspace approvals prior to construction. Subject to final designs, the mid-rise buildings B and G may infringe the OLS. The other buildings would below the OLS and therefore are not expected to require approval.

2.2.6 PANS-OPS Analysis

In addition to reviewing the PANS-OPS Surfaces chart of Sydney Airport's Prescribed Airspace (as declared and approved by DIRD in 2015), assessment was conducted of the following instrument (non-visual) procedure types for Sydney Airport, as published by Airservices Australia in the Australian Aeronautical Information Publication (AIP) Departure and Approach Procedures (DAP), up to Amendment 155 (effective 24-May-2018 to 15-Aug-2018).

- The Circling Minima and Minimum Sector Altitudes (MSAs) for existing PANS-OPS procedures
  "Area" procedures, which provide protection for aircraft manoeuvring or circling within defined areas above the airport and surrounds

- The discrete minima for the Instrument Approach Procedures.
- Missed Approaches — as part of the evaluation of Approach Procedures
- The existing Standard Instrument Departure Procedures (SIDs)

Of the approach and departure procedures, only procedures that might be relevant to the Metro Quarter are included in this report. Principally these are procedures for the eastern north-south runway (RWY 16L/34R) and the east-west runway (RWY 07/25), as well as the "area" procedures.

The western north-south parallel runway (RWY 16R/34L) is not mentioned because of the location of the site in relation to the airport, and because aircraft using that runway are prohibited from operation to the east of the runway centreline (so as not to cause conflicts with aircraft on the other parallel runway).

As the building is still subject to detailed design, the overall site envelope has been used for assessment of the impact of PANS-OPS surfaces on building heights. This means that the closest corner of the site to the relevant runway end of each procedure is used to determine the height limitation. Height limitations will be slightly higher than these 'closest corner' heights at other locations within the Metro Quarter.

The *Sydney Airport Master Plan 2033* and the *Sydney Airport Master Plan 2039 preliminary draft* were also reviewed for potential future impact (refer also 2.2.3.1 above, p28). The Master Plans do not forecast any changes to procedures that would, to our best knowledge, make the airspace above the Metro Quarter any more constraining than that resulting from analysis of the current PANS-OPS procedures.

Analysis determined that the Metro Quarter is not constrained by protection surfaces related to approach flight procedures to runways at Sydney Airport, and although the Metro Quarter is under the protection surfaces for some missed approach and departure procedures, the effective height limit imposed on the site is by the surface related to the Circling Procedure for Category A and B Aircraft.

Table 4 below provides a quick-reference summary of the PANS-OPS height constraints overhead the Metro Quarter, in reverse order of height. The lowest height is the applicable constraint; others are shown for information purposes only. More detail about the assessment of these PANS-OPS surfaces is provided below.

Table 4: PANS-OPS Height Limit Summary

Procedure	Height Limit (Metres AHD)	Description
Circling	**126.4**	**Category A & B Circling** — out to the extent of 3DME (a measurement from an on-aerodrome navaid, expressed in Nautical Miles; 3DME is approximately 5.6 kilometres), after which Circling is not permitted.
Approaches and Missed Approaches to all Runways	N/A or >220+	Outside the lateral protection areas of approach procedures for the closest runways - RWY 16L, 07 and 25. The missed approach surfaces for RWY 34R missed approach procedures are all higher than 220 metres at the SE corner of the site.
Departures	~198.6+	The most restrictive departure surface is that for the RWY 34R departure. This surface has an elevation of 198.6 metres at the SW corner of the site and is higher over the rest of the site.
Minimum Sector Altitude (MSA)	335.2	10NM Inner MSA of 2100 feet.

Figure 13: PANS-OPS & RTCC/MVA Height Constraints overhead the Metro Quarter

2.2.6.1 "Area" Procedures

A Minimum Sector Altitudes (MSAs)

The height restrictions imposed by Minimum Sector Altitudes are higher than the limits imposed by other procedures.

B Circling Minima

These are areas that define where and how low aircraft are allowed to circle the airport before landing. They are only applicable to some of the approach procedures.

The Metro Quarter site is entirely covered by the circling restriction applicable to Category A and B aircraft. It extends from the airport, across the site, until a location 3DME (a measurement from an on-aerodrome navaid, expressed in Nautical Miles; 3DME is approximately 5.6 kilometres) from the airport, beyond which circling is not permitted.

In the area not covered by the circling restriction (the northern portion of the adjacent Waterloo Estate SSP), the surface heights associated with other the instrument approach and departure procedures are applicable — except where other surfaces are more restrictive (see 2.2.7 Other Assessment Considerations, p38).

Procedure	Feature and / or Restriction	Description
Cat A & B Circling	Horizontal Surface: • Covers the entire Metro Quarter: **126.4 metres**	See **Figure 13** above. Covers most of the site, with the exception of the north-eastern top of the Waterloo Estate. Category A & B Circling — out to the extent of 3DME (a measurement from an on-aerodrome navaid, expressed in Nautical Miles; 3DME is approximately 5.6 kilometres), after which Circling is not permitted

The above limit cannot be changed according to the regulations.

Potential Option to Propose Removal of No Circling Distance & Circling-related Constraint

It is also noted that the implementation of the No Circling Area after 3DME applicable only in the north-east quadrant between the eastern parallel runway RWY16L/34R and the cross runway RWY 07/25 does not comply with the international PANS-OPS standard. Therefore, any future height application for the Metro Quarter could potentially include a proposal, supported by a technical argument and safety case, for the removal of the circling area within that specific quadrant (which overlays the Metro Quarter). In such case, the next highest height constraint would apply — i.e. most limiting of the next PANS-OPS surface height limit or the RTCC surface height limit.

2.2.6.2 Instrument Approaches & Missed Approaches

The impact of each of the relevant PANS-OPS protection surfaces for current approach and missed approach procedures for Sydney Airport are provided below.

Note also that where specific guideline height limits are provided, they are relevant only to the specific procedure. Other procedures mentioned in this report may impose more restrictive height limits over the same location.

Note that the measurement point used for height assessments was the southern-most point of the adjacent Waterloo Estate precinct, which means that the resultant procedure height limits reported here in relation to the Metro Quarter are conservative.

The height restrictions due to the instrument approach procedures vary across the site, but for the most part are irrelevant because the PANS-OPS surface height of 126.4 metres, associated with the circling minima, is more restrictive.

A Approach Procedures to RWY 16L and RWY 25

The Metro Quarter is laterally clear of the protection surfaces of the following procedures:

- RWY 16L RNAV(GNSS) Approach
- RWY 16L ILS and GLS Approaches – outside the lateral extent of the Basic ILS surfaces
- Runway 25 RNAV(GNSS) Approach
- RWY25 ILS and GLS Approaches – outside the lateral extent of the Basic ILS surfaces.

B Missed Approach Segments of Approach Procedures for RWY 07 and RWY 34R

The following procedures do not impose any height limit on the site, either because the limiting heights are so high (higher than other more restrictive surfaces) or the site is laterally outside the protection surfaces. The lowest of the height limits from any of the following procedures is higher than 185 metres AHD at the southern-most point of the adjacent Waterloo Estate. The limiting heights related to departures increase across the precinct.

- RWY 07 RNAV(GNSS) Missed Approach – outside the lateral extent of the missed approach
- RWY 07 ILS and GLS Missed Approaches – outside the lateral extent of the Basic ILS surfaces
- RWY 34R RNAV(GNSS) Missed Approach: higher than 265 metres
- RWY 34R ILS and GLS Missed Approaches
- 2.5% Missed Approach: higher than 249 metres AHD
- 4.0% Missed Approach: higher than 222 metres AHD

2.2.6.3 Departures

Height limitations are imposed by departure procedures from both RWY34R and RWY07. The height calculations for departure procedures use the same measurement point as used for assessment of impact of the approach and missed approach procedures. The height constraints from these procedures are:

- RWY 34R: higher than 199 metres AHD
- RWY 07: higher than 234 metres AHD

2.2.7 Other Assessment Considerations

The following table provides a brief assessment of other considerations.

Table 5: Other Assessable Height Limitations — including the RTCC MVA Limit

Procedure	Height Limit (Metres AHD)	Description
RTCC / MVA	**152.4**	This height constraint is applicable over the entire Metro Quarter. This is the limit related to the 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.
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.
Strategic Helicopter Landing Sites	N/A	The precinct is sufficiently distant from the nearest Strategic Helicopter Landing Site (SHLS), which is located at the Royal Prince Alfred Hospital, and is laterally clear of the preferred flight paths and their associated protection areas.

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

2.2.7.1 Radar Terrain Clearance Chart (RTCC) / Minimum Vector Altitude (MVA) Surface

The surface depicted in Sydney Airport's RTCC overhead the Metro Quarter protects the airspace used by air traffic controllers as the lowest MVA they can use for vectoring aircraft.

The RTCC / MVA height limit overhead the entire study area is 152.4 metres AHD. This surface constraint becomes the effective limit where it is lower than surface heights related to PANS-OPS procedures. In this case, it comes into effect over the north-east portion of the neighbouring Waterloo Estate, outside the area where the Circling Surface limit is more constraining. This is depicted in **Figure 13** above.

*NOTE (*refer *also 0, p35):*
If the PANS-OPS Circling Area surface height, which currently constrains development in the Metro Quarter was to be removed, this RTCC surface height would become the constraining height applicable across the entire Metro Quarter.

2.2.7.2 Proximity to Emergency Helicopter Landing Site & Flight Paths

The Metro Quarter, at the closest point of the site, is approximately 1.7 kilometres from the *Strategic Helicopter Landing Site* (SHLS) at the nearby Royal Prince Alfred Hospital. The *helicopter emergency management services* (HEMS) to this facility are provided by the NSW Ambulance helicopter service. Whilst not formally part of the Prescribed Airspace of Sydney Airport, the requirement that new developments not interfere with such facilities and their associated HEMS flight paths was added, as Guideline H, to the *National Airports Safeguarding Framework* (NASF) in 2018. As such, the potential impact of new developments is now included as part of set of the key factors to be considered when evaluating airspace approvability under the APAR.

In this instance, the Metro Quarter is laterally clear of the HEMS flight paths to and from this SHLS (as illustrated in the Figure 11), and their associated flight path protection areas (not shown). Thus, the Concept Plan would have no adverse impact in this regard.

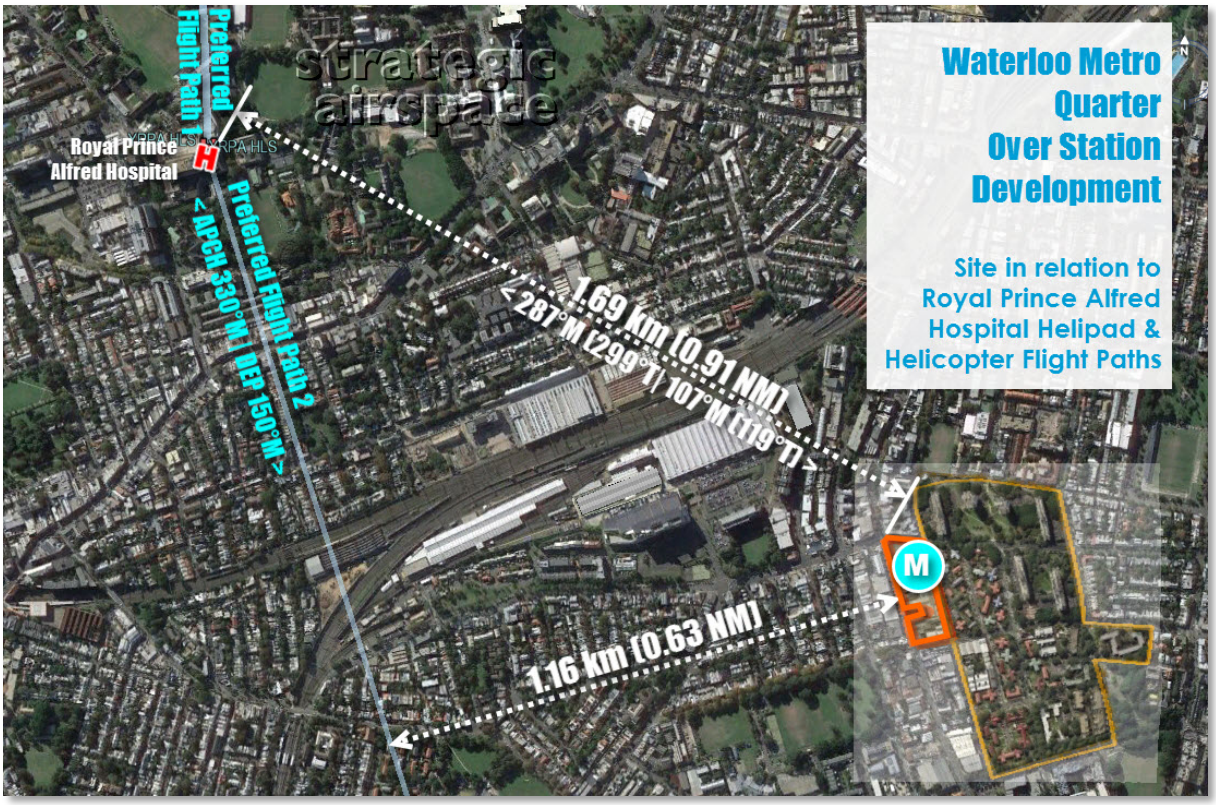


Figure 14: Metre Quarter in relation to the nearest Emergency HLS (at Royal Prince Alfred Hospital)

2.2.8 Other Approvability Measures in relation to Sydney Airport Operations

Other short-term (i.e. during construction) and long-term factors to consider that could potentially impact on aviation operations, and therefore ultimately approvability from the aviation point of view, include the nature of the materials used externally (e.g. reflectivity), lighting and contribution to wind turbulence. The approvability in relation to environmental impact due to aircraft noise overhead the site is excluded from this assessment.

Based on the location of the site in relation to the airport, the aspect of the taller buildings in relation to runway alignments, the maximum proposed heights, the configuration of the buildings within the site and the nature of the development as a mixed-use development:

- It is noted that the entire Metro Quarter is outside the zones defined in the *Civil Aviation Safety Regulations* (CASR MOS Part 139) as requiring special external lighting constraints — thus no adverse impact from this point of view.
- The proposed development would not contribute any negative impact on aviation operations in terms of reflectivity.

Finally, based on the relatively low height of the buildings and their configuration within the site, taken together with the location of the site in relation to the runway, no wind turbulence that is measurable to a level where it would provide an adverse impact on aviation operations is anticipated.

2.2.9 Proposed Development: Building Height Clearances & Cranes

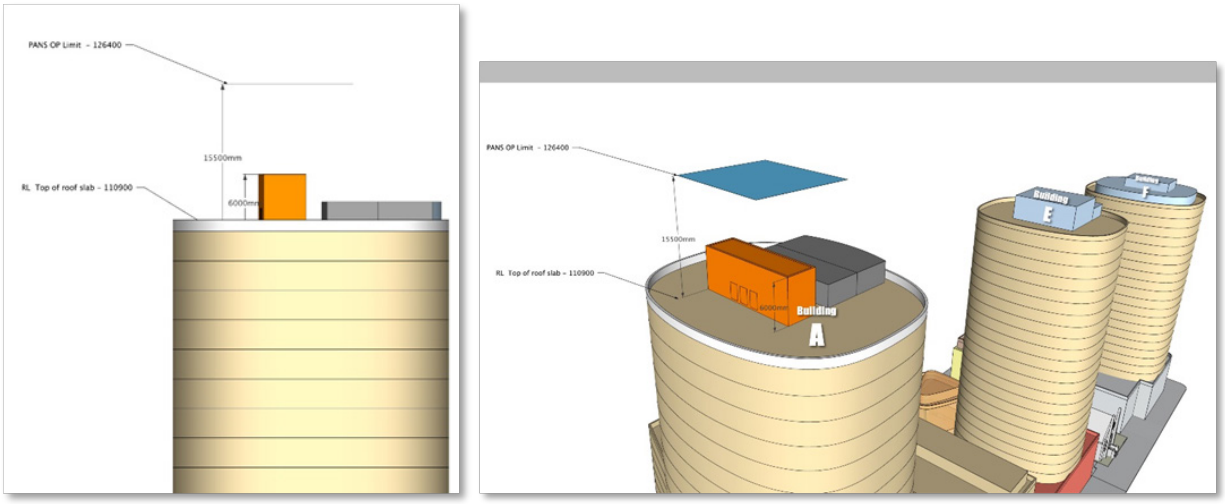
The maximum heights of all proposed buildings in the Metro Quarter are below the limiting surface height of the Category A and B Circling Area protection surface which is 126.4 metres AHD. The gap between tops of these buildings and the Circling protection surface can accommodate cranes for the construction of the buildings using conventional construction materials, techniques and crane technologies. This requirement has been taken into account in the concept designs and in the current stage of construction planning.

The proposed height of each building and its clearance from the Category A and B Circling surface is summarised in Table 6 below.

Table 6: Analysis Summary: Proposed Building Heights and Airspace Height Clearances

Building	Proposed Max Height (Metres AHD)	Clearance (Metres) from Restrictive Height: PANS-OPS Category A and B Circling Surface Height 126.4 Metres AHD	Constructability Comment
A – Northern Building	**116.9** **110.9 Top of Roof**	**9.5** **15.5**	No crane impact anticipated. Architectural plans have made allowance for construction techniques that would allow this building to be constructed using cranes that would not penetrate the PANS-OPS Circling Height. See also Figure 15 below
B	71.6	54.8	OK
C	49.8	76.6	OK
D	56.2	70.2	OK
E – Central Building	**104.2**	**22.2**	No crane impact anticipated. May be constructed with cranes below PANS-OPS Circling Height
F – Southern Building	**96.9**	**29.5**	No crane impact anticipated. May be constructed with cranes below PANS-OPS Circling Height
G	64.1	62.3	OK
H	34.4	92.0	OK

Only Building A, the northern-most building, has a maximum planned height that could potentially be considered as requiring a crane which may need to infringe the PANS-OPS circling height constraint. The crane clearance between the top of the roof slab and the PANS-OPS height constraint is sufficient for construction of the building and for the rooftop overruns for the lift tower and plant. Contingency plans are also in place to ensure construction materials and techniques could be employed for the top of the building if necessary to ensure that the PANS-OPS constraint would not be infringed overhead this building.



Source: Turner
Figure 15: Building A Crane Clearance

3.0 Consultation

Both SACL and the CASA were consulted during the preparation of this report.

In early August, a copy of the aeronautical impact report for the Waterloo SSP Study was provided for background information and review, and these organisations were also briefed in summary on the Metro Quarter concept proposal for the SSD Application and the associated SEARs.

The specific responses of each organisation are documented in the following subsections.

In short, both organisations agreed that any building that would penetrate the OLS would be required to be referred (at the appropriate time) to Airservices Australia and CASA for assessment, prior to being sent to DIRD for a determination (of an application for a height approval) under the *Airports (Protection of Airspace) Regulations*. Neither organisation indicated any factors that would prevent a successful application; at the same time, they also indicated verbally that they could not make such a determination themselves until a formal application for a height approval was submitted for detailed assessment.

3.1 SACL Response

SACL was aware of this project, having previously responded to DPE in response to the Request for SEARs.

The airport's Airfield Design Manager provided a written response on Tue 8th August 2018 (their reference 18/0432), as follows:

> *The Obstacle Limitation Surface (OLS) over the site ranges in height from 60 – 70m Australian Height Datum (AHD)*
>
> *The Proposed Development (Building A) you have advised as having a proposed maximum height of 116.9m AHD and will penetrate the OLS by approx. 50 – 60 metres.*

As a number of the buildings penetrate the OLS, they will need to be referred to Airservices & CASA for assessment prior to being sent to DIRD for a determination.

For Sydney Airport to proceed, we will require elevation diagrams of each building showing the overall height of the buildings, footprint/location diagrams with the building footprints detailed in MGA94 co-ordinates.

We previously received a request for SEARS from NSW Planning. The same, or similar, comments were sent to them.

In short, SACL's assessment mirrors the assessment results of the Waterloo SSP Study and this report.

3.2 CASA Response

CASA's response to a request for consultation, issued by their Air Navigation, Airspace and Aerodromes Branch on 20th August 2018, as follows:

The Obstacle Limitation Surface (OLS) over the site ranges in height from 60 – 70m Australian Height Datum (AHD)
CASA has reviewed the Waterloo Metro Quarter Aeronautical Impact Assessment 1.4.1 July 2018. This review is at a 'strategic level' - CASA does not have the resources to review Planning Proposals in detail. Our review is focussed on building and crane heights, infringements and assessment aspects.

CASA has no major issues with the Aeronautical Impact Assessment. Although not checked in detail; the content on building and crane heights, infringements and assessment in the Aeronautical Impact Assessment is logical, well presented and incorporates nothing significantly controversial.

As advised in the Aeronautical Impact Assessment, the proposal will require a controlled activity approval from the Department of Infrastructure, Regional Development and Cities (DIRDC). DIRDC administers the Airports (Protection of Airspace) Regulations 1996) (the Regulations). It is expected that the proponent will eventually seek the controlled activity approval through Sydney Airports Corporation Ltd (SACL). SACL will confirm the infringement(s) and obtain comments from stakeholders including CASA and Airservices Australia and refer the application to DIRDC. CASA will assess the buildings from an obstacle perspective when a request for comment is received from SACL.

The Aeronautical Impact Assessment is undetermined on whether the crane(s) will not infringe PANS-OPS or infringe PANS-OPS for a maximum of 3 months. However, this is not an issue at this stage … the proposed crane(s) will be assessed on its/their own merits at the time. The assessment will be more straight forward if the cranes don't infringe PANS-OPS.

CASA makes no comment on future trends etc.

It is noted that the proposed WMQ buildings will be 'approximately the same height' as the existing Waterloo Estate buildings. CASA does not have an assessment of the

existing Waterloo Estate buildings to use as a precedent in CASA's recent electronic filing system. Which is not an issue as the proposed buildings will be assessed on their own merits at the time. The maximum proposed height is 116.9m AHD (Northern of 3 towers... Table 1 page 9) which is approximately 3.7m higher than the existing Waterloo Estate buildings (113.2) and approximately 8m lower than Green Square (as assessed). 1.9m according to page 11.

It is noted that the buildings will be lower and further away from Sydney Airport than Green Square (125m AHD at last assessment) and not near take-off or approach splays…. 'midway between the straight-in flight paths to the closest runways'. Although aircraft departing on runway 34R will normally turn towards the east after reaching a certain height and there could be a case for a curved take off surface at Sydney. Note that this review does not consider aircraft noise issues.

There was no reference to helicopter operations in the Aeronautical Impact Assessment[1]*. Which is not an issue, because there appears to be no helipads, hospitals or helicopter lanes in the area.*

There was no reference to mitigations for the OLS infringement, such as obstacle lighting. Which is not an issue … if the proposal is approved, DIRDC will include conditions.

CASA concurs with Sydney airports comments.

[1] The reference to helicopter operations in the vicinity was added to a version subsequent to the one issued to CASA for consultation. That analysis is also included in this report in Section 2.2.7.2 above.

3.3 Consultation with DIRD

DIRD was consulted in late August 2018 via telephone. The Director, Airspace Protection, was aware of the project. Discussion covered the potential options of a) making an early APAR application for the Metro Quarter as a whole, using a single cap height for the site (rather than on a building-by-building basis); or b) submitting one or more applications for specific buildings based on detailed designs and construction plans. Regardless of which option was to be adopted, he advised that consultation in advance with Sydney Airport and the aviation agencies would be beneficial to the future of the project.

4.0 Conclusion

The Metro Quarter is located in the small virtual corridor, commencing from the quadrant between the extended centrelines of the two nearest runways of Sydney Airport (RWY 7/25 and RWY 16L/34R) through to the Sydney CBD, which has been and continues to be a focus of urban redevelopment. The Metro Quarter is situated under an OLS which slopes up across the site and which will determine which of the proposed buildings would ultimately require prior airspace height approvals. At the same time the site, in this location, is relatively unaffected by height constraints of the PANS-OPS surfaces that protect the approach, missed approach and departure procedures for Sydney Airport. The constraining PANS-OPS surface overhead the site is a horizontal (flat) surface at an elevation of 126.4 metres AHD. This defines the maximum allowable height for proposed buildings.

Based on the concept proposal for the Metro Quarter, the three taller buildings (and possibly two other buildings) would infringe the OLS and would thus require prior airspace approvals. This assessment has been confirmed by both SACL and CASA, as noted in section 3.0 Consultation above. Such an application may require additional documentation to demonstrate the feasibility of constructing Building A (because of its maximum proposed height and the small clearance height available for cranes) in such a way that a crane would not infringe the PANS-OPS height limit. All other buildings clearly have sufficient allowances for crane operations.

Although technically not shielded (as defined by the kind of “straight line shadowing effect defined in the MOS Part 139 Regulations) by the mass and height of buildings in the GSTC, the location of the Metro Quarter to the north (away from the airport) means that flight procedures and operational practices already require aircraft to vertically clear the GSTC buildings in the event of departures, or circling, or being vectored (directed by air traffic controllers) overhead. The same applies to the buildings in the CBD for departing aircraft. Both are clear for aircraft approaching the airport. In addition, the proposed Metro Quarter OSD development does not have a concentration of tall buildings that could be perceived as increasing risk to aviation safety. Therefore, the proposed Metro Quarter would be logically protected and would have nil impact on the air transport operations of Sydney Airport

To summarise, the combination of the location of the Metro Quarter in relation to the airport, and the nature, massing and maximum heights of the concept proposal, mean that the proposed development would not contribute any measurable adverse effect to the safety, regularity or efficiency of air traffic to and from Sydney Airport now or in the foreseeable future.

As such, there is no technical impediment to approval of the building envelopes proposed as part of the Metro Quarter OSD. An application under the APAR, supported by a full aeronautical assessment and safety case, would be required to be made and would be expected to be approved by DIRD.