Aeronautical Impact Assessment

Western Sydney University
Bankstown City Campus Development, Bankstown, NSW.

Client

Archerfield Partners

LB00294

Final V1

26 March 2019

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Contents

1 Introduction

1.1 The Development

Archerfield Partners (the Client) on behalf of Western Sydney University has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) for the proposed Western Sydney University Bankstown City Campus Development (BCCD) at 74 Rickard Road, Bankstown, New South Wales.

The BCCD project aims to increase the University's presence within the Bankstown CBD that will help transform the city centre, enhance the University's reputation, provide future University growth and support the transition of the Milperra Campus into the Bankstown CBD.

The development comprises a building with a maximum height of 106.78 m AHD.

Construction crane activity is planned up to a maximum height of 125 m AHD.

Table 1 shows the distance from the development to Sydney and Bankstown airports, and **Figure 1** shows the development in relation to them.

Airport	Direction and distance from development
Sydney Airport	12.4 km South East
Bankstown Airport	4.45 km South West

Table 1: Development site in relation to Bankstown and Sydney Airports

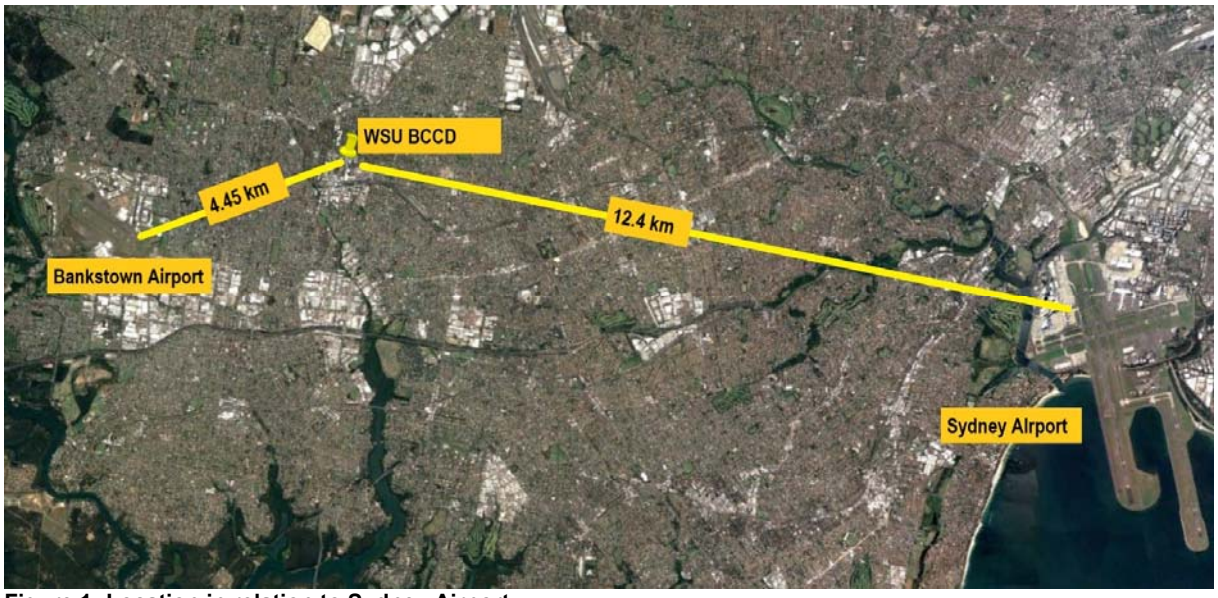


Figure 1: Location in relation to Sydney Airport

2 Prescribed Airspace

2.1 Overview

Prescribed Airspace for an airport is the airspace above any facet of the Obstacle Limitation Surfaces (OLS) or the PANS OPS (Procedures for Air Navigation Services – Aircraft Operations) surfaces for a Federally Leased Airport such as Bankstown Airport, or the Radar Terrain Clearance Chart (RTCC) protection surfaces.

The OLS are conceptual surfaces associated with runways that are designed to protect aircraft operations from unrestricted obstacle growth.

The OLS comprises the following:

- outer horizontal surface (OHS);
- conical surface;
- inner horizontal surface (IHS);
- approach surface;
- inner approach surface;
- transitional surface;
- inner transitional surface;
- baulked landing surface; and
- take-off climb surface.

The outer segments of the OLS for airports with Type B, 3D instrument approaches, such as Sydney Airport, extend to 15 km from the airport's Aerodrome Reference Point (ARP). Bankstown Airport has a future OLS surface extending to 15 km from the ARP.

The PANS OPS surfaces are designed beneath instrument approach and departure flight paths to and from a runway with a prescribed minimum obstacle clearance above the obstacles or terrain. They provide an obstacle free flight path to enable safe and efficient aircraft operations in Instrument Meteorological Conditions (IMC). The PANS OPS surfaces extend out to 55 km (30 nm) from the airport.

The RTCC provides Air Traffic Control (ATC) with a minimum safe altitude above terrain and obstacles above which they can provide surveillance services to aircraft in the area around major airports. A protection surface below the useable heights contains obstacle growth. Infringement by a building or crane into Prescribed Airspace requires the approval of the aerodrome operator, the Civil Aviation Safety Authority (CASA), and the Department of Infrastructure, Regional Development and Cities (DIRDC) where the airport is on federally leased land. An RTCC exists within 40 nm of Sydney Airport.

Infringement of PANS OPS or RTCC protection surfaces are not supported by the aviation authorities. However, infringements for a maximum period of 3 months may be authorised in circumstances where the aerodrome operator, Airservices Australia and CASA determine that aviation safety and regularity are not affected.

2.2 PANS OPS and RTCC

All Sydney basin airports' PANS OPS surfaces were assessed for this proposed development.

A detailed assessment of Bankstown Airport's PANS OPS surfaces revealed that the lowest PANS OPS surface above the development site is 108.1 m AHD. It is applicable to the Category A/B Circling Area Minimum Descent Altitude (MDA).

The next highest PANS OPS surface above the development site is approximately 140 m. It is applicable to the Standard Instrument Departure (SID) Bankstown Eight Departure – Runway 11C/29C.

Sydney Airport's lowest PANS OPS surfaces above the site is 335.2 m and is related to the 10 nm Minimum Safe Altitude (MSA).

The PANS OPS protection surfaces for all other airports are well above the maximum height of this proposed development and accompanying construction activity.

The protection surface height for the RTCC above the development site is 152 m AHD.

The proposed building at a maximum height of 106.78 m AHD:

- will not infringe the PANS OPS surfaces of Sydney Airport;
- will not infringe the PANS OPS surfaces of Bankstown Airport;
- will not infringe any PANS OPS surfaces at any other airport; and
- will not infringe the RTCC protection surface.

Construction cranes to a maximum height of 125 m AHD:

- will infringe the PANS OPS surfaces for the Category A/B Circling MDA at Bankstown Airport;
- will not infringe the PANS OPS surfaces of Sydney Airport
- will not infringe any PANS OPS surfaces at any other airport; and
- will not infringe the RTCC protection surface.

Construction cranes will require approval from Bankstown Airport, CASA and DIRDC.

Infringements of the PANS OPS surfaces by temporary cranes can be approved for a period of a maximum of 3 months if the location does not impact upon safe flight operations at Bankstown Airport. Any request for construction cranes higher than 108.1 m AHD beyond 3 months duration will not normally be approved.

As a possible mitigating action in response to the infringement of the cranes on the PANS OPS, Airservices may temporarily increase the Category A/B Circling MDA by approximately 17 m. This increase will not have a significant impact upon Instrument Flight Rules (IFR) aircraft operating at Bankstown as it will not reduce safety and not affect flight arrival regularity due to the availability of straight in approaches to runway 11C with MDA similar to the Circling MDA. The Circling MDA was previously much higher prior to Airservices Australia reducing it in 2016. IFR aircraft regularly used the higher MDA effectively until it was amended. Circling MDAs are generally higher than straight in MDAs due to the larger area assessed for obstacles.

Other PANS OPS surfaces exist at Bankstown Airport but have no relevance to the development site at the proposed maximum heights that have been developed to minimise the impact upon aviation activity in the area.

2.3 OLS

The development site is located laterally within the Inner Horizontal Surface (IHS) Bankstown Airport. The Bankstown Airport IHS is at a height of 51 m AHD.

The proposed building will infringe the Bankstown IHS by 55.76 m. Refer to section 2.4 for discussion regarding infringement of this segment of the OLS.

The development site is located laterally within the Outer Horizontal Surface (OHS) of Sydney Airport's OLS. The Sydney Airport OHS is at a height of 156 m AHD and is not affected by the development or the construction cranes.

Figure 2 depicts the location of the development in relation to Bankstown Airport's OLS.

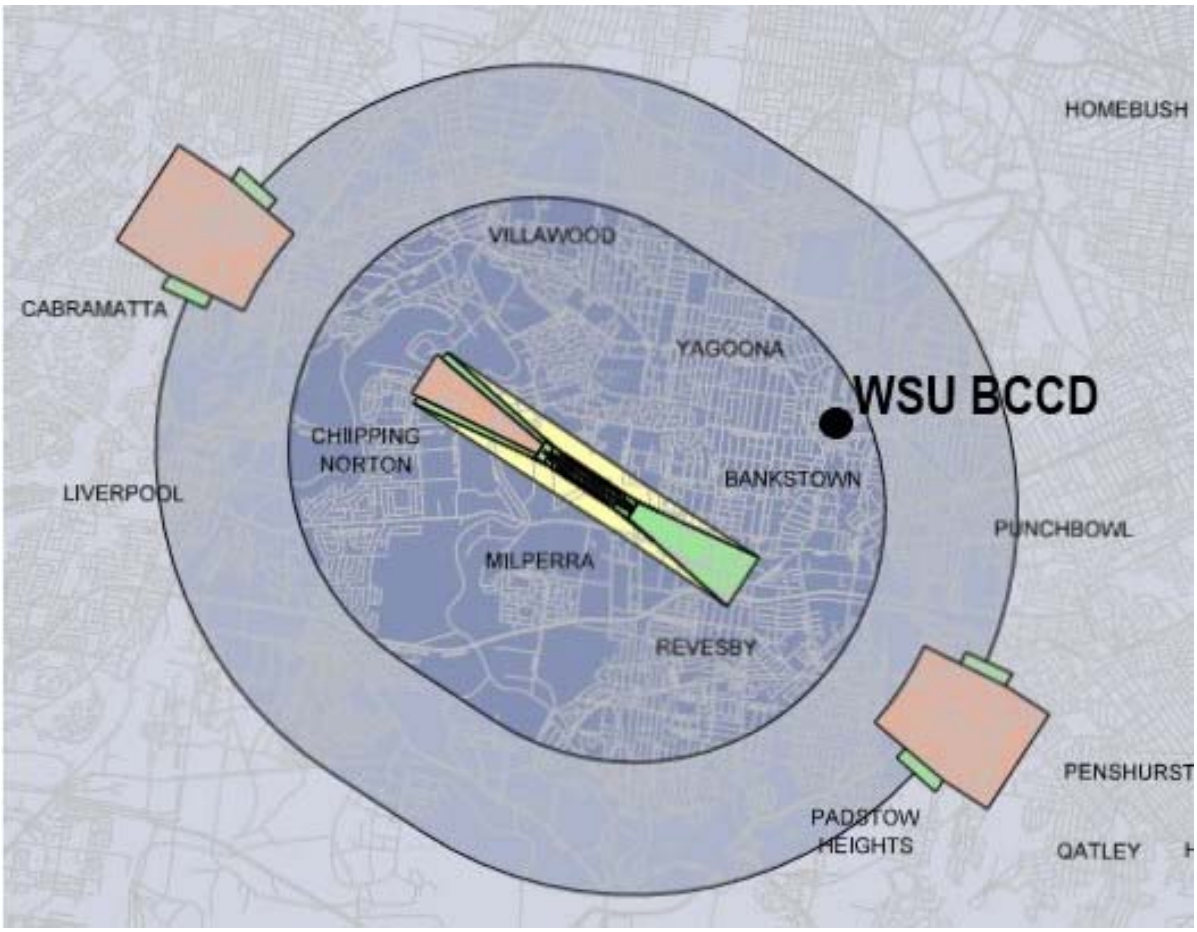


Figure 2: Development location within Bankstown Airport's Inner Horizontal Surface boundary (BAL Masterplan 2013)

2.4 Aeronautical Study and Safety Case

As part of this assessment, an aeronautical study has been conducted to demonstrate that the proposed development to a maximum height of 106.78 m AHD would not adversely affect safety or significantly affect the regularity of operations of aircraft as per ICAO Annex 14, Aerodrome Design and Operations requirements.

As noted above, the proposed development will infringe the Bankstown Airport IHS of 51 m AHD by 55.76 m. The purpose of the IHS, as described in ICAO standards, is to restrict obstacle growth in the vicinity of airports and to provide an obstacle free flight altitude for aircraft circling the airport in visual flight conditions prior to landing.

A study by the Flight Safety Foundation[1] Approach-and-Landing-Accident Reduction (ALAR) Taskforce found that circling approaches were a major causation factor in a majority of aircraft accidents in the vicinity of airports. The ICAO Assembly Resolution A33-16 Global Aviation Safety Plan (GASP) recognised the need to prevent Controlled Flight Into Terrain (CFIT) accidents by implementing a worldwide program whereby National Aviation Authorities provided a straight-in instrument approach with vertical guidance to each runway used by airline aircraft. In Australia, this program is almost complete with the introduction of Baro VNAV approaches at all certified and registered airports at which regular passenger transport aircraft operate. At Sydney Airport, each runway is provided with a straight-in approach with vertical guidance. At Bankstown Airport Runway 11C is provided with straight in approaches but without vertical guidance at this time. Bankstown Airport Limited's Master Plan provides for the provision of an Instrument Landing System installation in the future. This will provide a straight in approach with vertical guidance.

The promulgation of straight-in instrument approaches has reduced the requirement to restrict obstacle growth in areas where aircraft now do not operate due to the reduction in the frequency of circling approaches. ICAO has acknowledged the limitations imposed by the current OLS layout and has formed the OLS TASK FORCE[2] to review, update and align the OLS surfaces with the PANS OPS surfaces. In completing this work, ICAO recognises the economic balance required between terrestrial infrastructure requirements of growing cities and efficiency and safety of flight operations.

2.4.1 Infringement of the Inner Horizontal Surface – ICAO Document References

ICAO Airport Services Manual Part 6 - Control of Obstacles states in Para 1.2.2.4:

In assessing the operational effect of proposed new construction, tall structures would not be of immediate significance if they are proposed to be located in:

a) An area already substantially obstructed by terrain or existing structures of equivalent height.

b) An area which would be safely avoided by prescribed procedures associated with navigational guidance where appropriate.

The IHS can be infringed in accordance with the recommendations of ICAO Doc Annex 14 Volume 1, Aerodrome Design and Operations, Para 4.2.20, which states:

New objects or extensions of existing objects should not be permitted above the Conical Surface and the Inner Horizontal Surface except when, in the opinion of the appropriate authority, an object would be shielded by an existing immovable object, or after an aeronautical study it is determined that the object would not adversely affect safety or significantly affect the regularity of operations of aeroplanes.

2.4.2 Bankstown Airport

With the implementation and extensive use of runway aligned instrument approach procedures (RNAV and NDB), the use of circling approaches in poor weather conditions has decreased considerably.

However, during conditions when Visual Meteorological Condition (VMC) exist, IFR aircraft arriving at Bankstown must comply with ATC instructions which regularly require them to enter the visual circuit sequence

[1] Flight Safety Foundation ALAR Briefing Note 5.1
[2] https://www.icao.int/SAM/Documents/2016-SUPLIM/RPEAGA7_NI_04_Apéndice%20B_Obstacle%20Surfaces-%20the%20Concept-%20draft-%20OLSTF-5%20Final%20with%20comments.pdf

and therefore operate with visual reference to the ground and to remain within the Bankstown Control Zone (CTR).

The Central Business District (CBD) of Bankstown already comprises buildings that infringe the OLS and is considered *"an area already substantially obstructed by terrain or existing structures of equivalent height"* as permissible under the ICAO reference.

2.4.3 Examination of Circling Approaches

The proposed building development, at the maximum height of 106.78 m AHD, and the construction cranes at 125 m AHD were examined to determine if there is any effect on the published circling minimum altitudes.

The development site is located underneath the CAT A/B and CAT C IFR circling areas for Bankstown Airport.

The aircraft category (CAT) depends on a number of aircraft performance parameters and is published in the ICAO PANS OPS document.

The Minimum Descent Altitudes (MDA) published for circling approaches at Bankstown when an accurate QNH (air pressure reading) is available (100 ft reduction from published minima) are:

- CAT A and B aircraft: 650 feet (198 metres) AMSL, and
- CAT C and D aircraft: 840 feet (255 metres) AMSL.

The circling area limits from the runway thresholds, and Minimum Obstacle Clearance (MOC) for circling approaches are published in the PANS OPS document, as follows:

- CAT A and B: Area radius 2.66 nautical miles, MOC 295 feet (90 metres), and
- CAT C: Area radius 5.28 nautical miles, MOC 394 feet (120 metres).

The MOC is the prescribed margin above obstacles or terrain in the PANS OPS segment of an instrument approach procedure that determines the MDA for the particular procedure.

Note: The Aeronautical Information Publication (AIP) publishes all distances in nautical miles, and altitudes in feet for instrument flight procedures. Displays to pilots are in the same format.

Table 2 depicts the applicable circling area PANS OPS surface height and the clearance (in green) or infringement (in red) of the building on each surface.

Aircraft Category (CAT)	Height of PANS OPS Surface	Result for building height of 106.78 m AHD
A and B	108.1 m	1.32 m Clearance
C	135.9 m	29.12 m Clearance

Table 2: Circling Area PANS OPS results for the building

Table 3 depicts the applicable circling area PANS OPS surface heights and the clearance (in green) or infringements (in red) of the crane activity on each surface.

Aircraft Category (CAT)	Height of PANS OPS Surface	Result for maximum crane height of 125 m AHD
A and B	108.1 m	16.9 m infringement
C	135.9 m	10.9 m Clearance

Table 3: Circling Area PANS OPS results for construction crane activity

A temporary increase of 17 m to the CAT A/B Circling MDA is likely to result in an acceptable temporary CAT A/B Circling MDA for the instrument flight procedures published for Bankstown Airport that should not impact upon flight safety or regularity of flight operations. IFR aircraft were not impeded when the Circling MDA was much higher prior to Airservices Australia reducing the MDA in 2016.

2.4.4 Visual Flight Operations

The majority of aircraft operating at Bankstown Airport are operating under the Visual Flight Rules (VFR) which requires pilots to navigate by visual reference to the ground and at prescribed minimum altitudes (304 m AMSL) until descending to the runway for landing or climbing from the runway after departure. The Aeronautical Information Publication (AIP) Enroute Supplement Australia (ERSA) lists a condition that circuit operations are to be confined within 2 nm radius of the Aerodrome Reference Point (ARP). As the building and crane activity are 2.4 nm (4.45 km) from the ARP aircraft conducting circuit operations should not be overhead the development site. The Bankstown Railway Station provides a good reference point for pilots to recognise that limit and remain within the 2 nm limit.

2.4.5 Aeronautical Study Conclusion

The proposed development would be unlikely to have a significant impact upon flight operations at Bankstown Airport as its maximum height does not infringe the IFR Circling Area MDA and is outside of the normal visual circuit area.

3 ATC Surveillance System Performance

Buildings and/or terrain that infringe radar clearance planes have the potential to cause signal shadows in areas where ATC need to provide a surveillance information or advisory service to aircraft.

This assessment identified two radars in relative proximity to the development site: the Sydney Airport Terminal Area Radar (TAR), and the Cecil Park TAR. The presence of multiple surveillance systems at different locations that provide overlapping coverage will reduce the potential of shadow effects should buildings or terrain shield radar signals.

The proposed development, at a height of 106.78 m AHD, will infringe the Sydney Airport TAR clearance plane but not the Cecil Park TAR clearance plane. Other buildings in the area are likely to also infringe the Sydney TAR clearance plane.

The infringement of the Sydney TAR is unlikely to affect ATC surveillance services due to the coverage of the Cecil Park TAR and recently installed Automatic Dependent Surveillance–Broadcast (ADS-B) that provides a similar service to the TAR installations.

Construction cranes are not considered to have an impact on the performance of ATC surveillance equipment.

Airservices Australia will conduct their own assessment to determine any impact that the proposed development may have on the Sydney Airport TAR, or other surveillance systems such as ADS-B, along with any mitigating effect of the other installations.

Table 3 depicts the impact of the development on the performance of the ATC Surveillance System Performance with the clearance (in green) or infringement (in red).

Surveillance System	Distance from development	Antenna Elevation (AHD)	Clearance Plane Elevation at development site Distance x Tan 0.5° + TAR elevation	Result for development height of 106.78m AHD
Sydney Airport TAR	1400 m	38.2 m	50.42 m	56.36 m Infringement
Cecil Park TAR	18700 m	200.5 m	363.7 m	256.92 m Clearance

Table 3: Impact of development on ATC Surveillance System Performance

4 Navigation Aid Performance

There is one navigation aid installed at Bankstown Airport - NDB.

The Building Restricted Areas (BRA) describes a sensitive zone that exists to a radius of 3000 m from the navigation aid antenna sites. The building development limitations within the BRA is specified in the Airservices Australia document Navigation Aid Building Restricted Areas and Siting Guidance AEI-7.1613 Issue 2.

Table 4 lists the navigation aids and the assessment result in accordance with the BRA documents.

Navigation Aid	Distance from Development Site	Result
BK NDB	4595 m	Beyond maximum BRA radius.
ALL SYDNEY AIRPORT NAVIGATION AIDS	>12 km	Beyond maximum BRA radius.

Table 4: Navigation Aid Clearance Plane Impacts

The development site is located outside of all BRA for all navigation aids in the Bankstown and Sydney area and therefore should not have an impact upon their operation.

5 Roof Top Exhaust Plumes

Exhaust plumes in excess of 4.3 m/s which have potential to exist in either OLS or PANS OPS surfaces can create sufficient turbulence to upset the stability of aircraft during take-off and landing operations.

Should any roof top exhaust plume rises in excess of 4.3 m/s infringe any of the above mentioned OLS or PANS OPS surfaces, they must be referred to CASA for their assessment of risk to aircraft operations.

6 Consultation with Aviation Authorities

An application for approval for the permanent infringement of the Bankstown Airport OLS by the proposed building will be required to be submitted to Bankstown Airport. The application will include details of the crane operation.

Bankstown Airport will consider the application and provide the details to CASA and Airservices Australia, who will then assess the proposal and comment on any perceived safety implications and this AIA and advise Bankstown Airport of their decision. Bankstown Airport will then provide that information to DIRDC for final approval. The advice provided by CASA and Airservices Australia will be paramount in DIRDC's final decision.

The aviation approval process can take approximately 6 - 8 weeks.

7 Conclusion

The proposed WSU BCCD at Bankstown, to a maximum height of 106.78m AHD:

- will infringe the Inner Horizontal Surface of the OLS for Bankstown Airport;
- will not infringe the OLS for Sydney Airport or any other airport;
- will not infringe Bankstown Airport or Sydney Airports' PANS OPS surfaces;
- will not infringe the PANS OPS surfaces for any other airport in the vicinity;
- will not infringe any BRA for navigation aids at Sydney or Bankstown Airports;
- will infringe the Sydney TAR clearance plane but not the Cecil Park TAR clearance plane; and
- will not infringe the RTCC protection surface above the site.

The proposed construction crane activity to a maximum height of 125 m AHD:

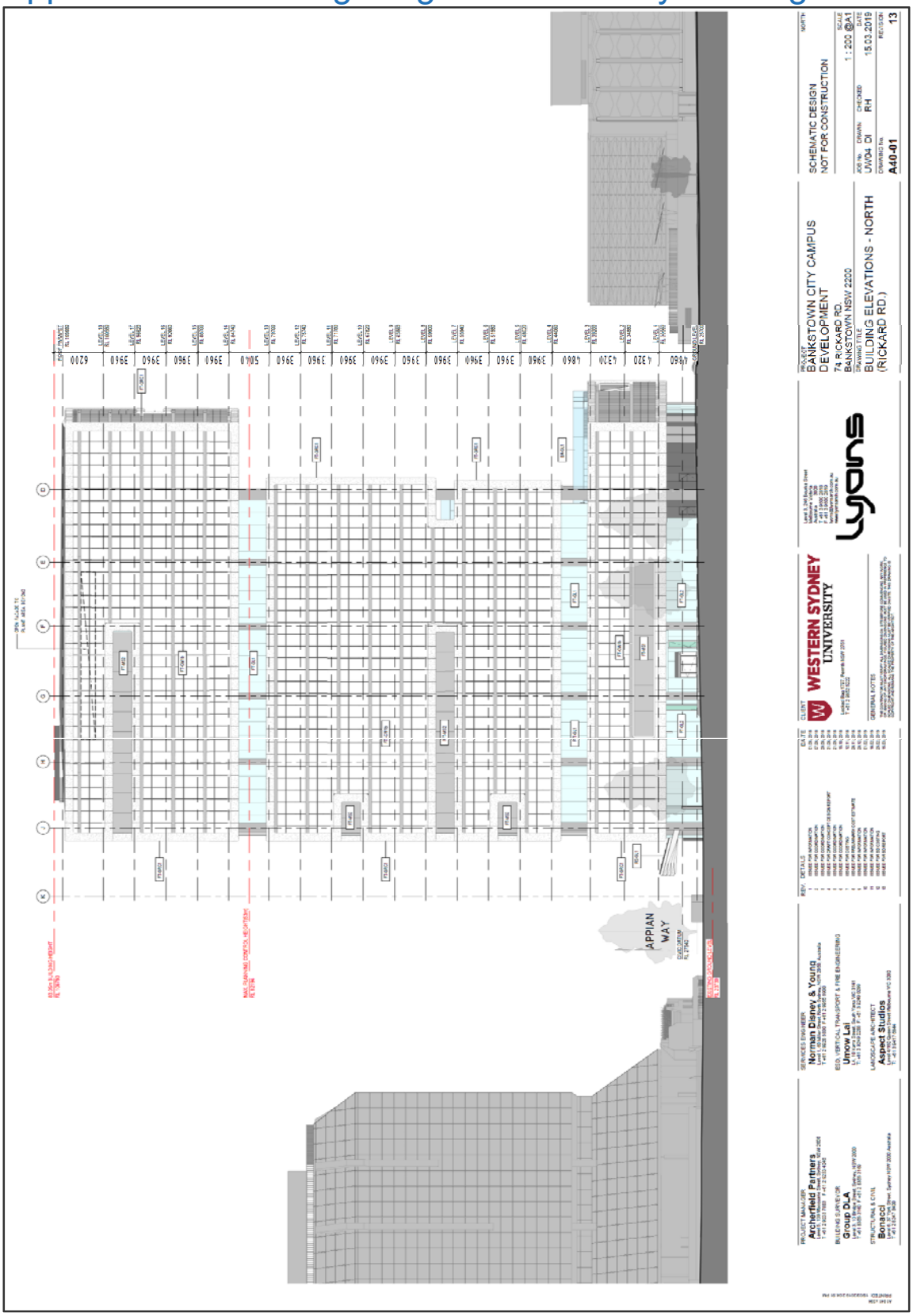
- will infringe the Inner Horizontal Surface of the OLS for Bankstown Airport;
- will infringe the CAT A/B Circling Area MDA (PANS OPS) surface but a temporary increase in this MDA will not adversely affect flight safety or regularity;
- will not infringe any other PANS OPS surfaces at Bankstown Airport;
- will not infringe the OLS for Sydney Airport or any other airport;
- will not infringe Sydney Airports' PANS OPS surfaces;
- will not infringe the PANS OPS surfaces for any other airport in the vicinity;
- will not infringe any BRA for navigation aids at Sydney or Bankstown Airports;
- will infringe the Sydney TAR clearance plane but not the Cecil Park TAR clearance plane; and
- will not infringe the RTCC protection surface above the site.

Based on the information provided throughout this report:

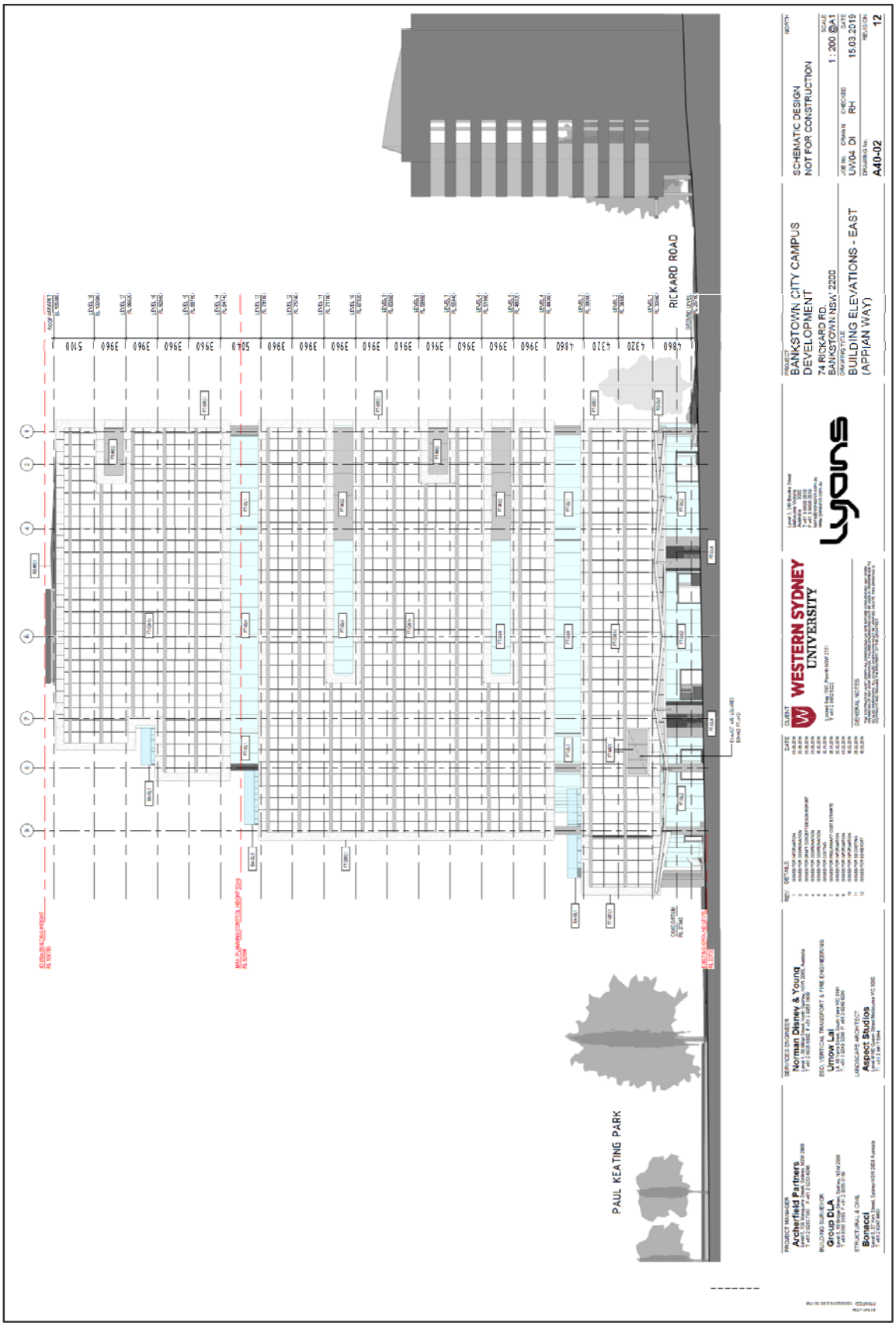
- the infringements to the OLS and the Sydney Airport TAR clearance plane by the building are not considered significant and approval for the building is likely to be achieved; and
- the temporary infringement of the OLS and the PANS OPS surface by the construction cranes do not adversely affect the safety or regularity of flight operations in the area and approval for those infringements for a maximum period of 3 months should be forthcoming.

It will be necessary to gain approval for the infringements via an application to Bankstown Airport Limited.

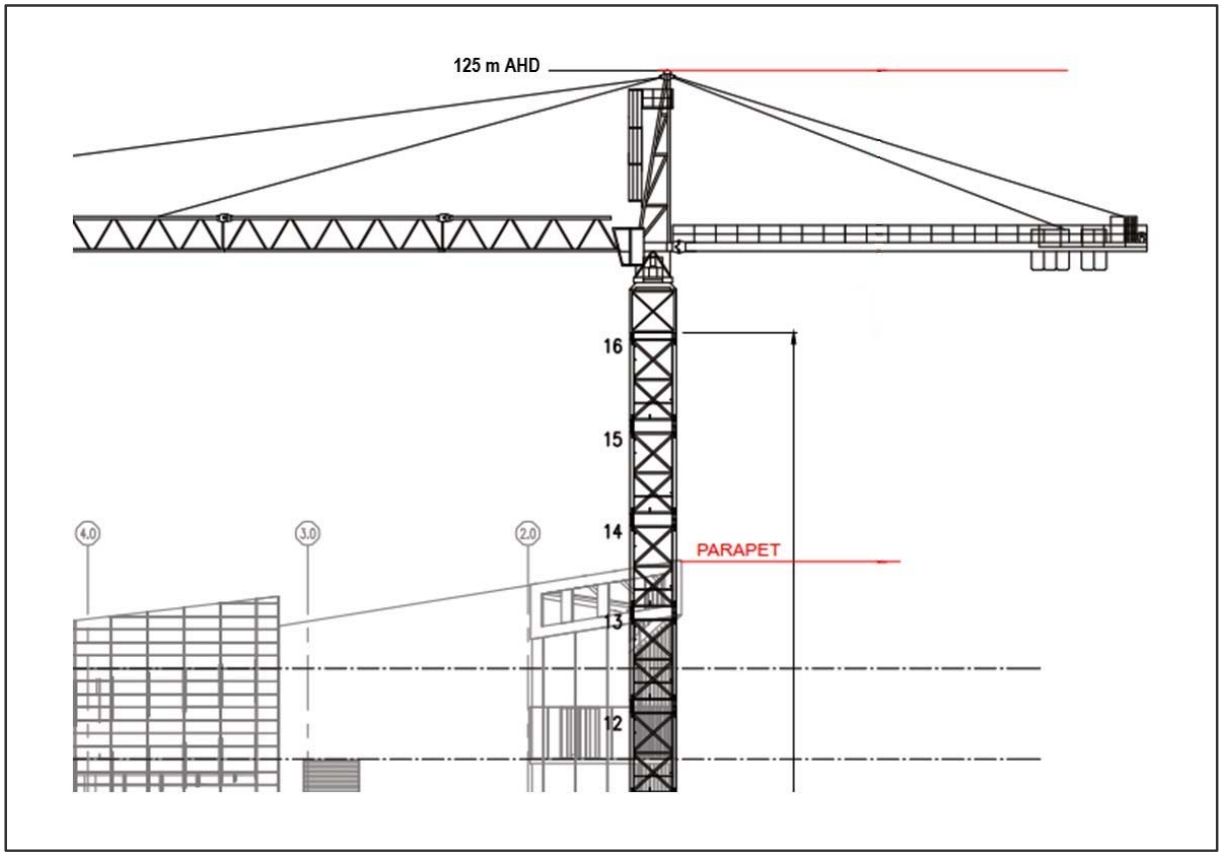
Appendix A – Building Height and Site Layout Diagrams



North Elevation (Source: Lyons/ WSU)



North Elevation (Source: Lyons/ WSU)



Crane Configuration Diagram (Lyons/WSU)

Appendix B – Assessment Methodology

In preparing aeronautical impact assessments associated with airport safeguarding and protection, it is necessary to observe the requirements of the relevant aviation authorities including:

- The Department of Infrastructure, Regional Development and Cities (DIRDC);
- The Civil Aviation Safety Authority of Australia (CASA);
- Airservices Australia (ASA);
- Airport Operators; and
- Department of Defence where appropriate.

The *Airports Act 1996* and *Airports (Protection of Airspace) Regulations 1996* prescribes the volumes of airspace surrounding Federally Leased Airports that protect aircraft operations into those airports, in order to ensure the safety and regularity of airline and other flight operations.

Bankstown Airport's and Sydney Airport's Prescribed Airspace comprises:

- Obstacle Limitation Surfaces (OLS) that restrict obstacle growth in the vicinity of takeoff and landing paths; and
- PANS OPS surfaces that provide a buffer between flight paths and terrain or obstacles.

Relevant Acts and Regulations applicable to developments near airports and air traffic routes were referenced during this assessment.

The major relevant documents include:

- The Airports Act 1996, Airports (Protection of Airspace) Regulations 1996;
- Civil Aviation Safety Regulation (CASR) Part 139 Manual of Standards – Aerodromes;
- Aeronautical Information Publication (AIP);
- Airservices Australia's Airways Engineering Instruction – Navigation Aid Building Restricted Areas and Siting Guidance (BRA);
- International Civil Aviation Organisation (ICAO) DOC 8168 Procedures for Air Navigation – Aircraft Operations (PANS OPS).

A Glossary of Aeronautical Terms and Abbreviations is shown at Appendix C.

Appendix C – Glossary of Aeronautical Terms and Abbreviations

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies.

AC (Advisory Circulars) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

AIPs (Aeronautical Information Publications) are publications promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. They contain details of regulations, procedures and other information pertinent to flying and operation of aircraft. In Australia, AIP is issued by Airservices Australia on behalf of CASA.

Air routes exist between navigation aid equipped aerodromes or waypoints to facilitate the regular and safe flow of aircraft operating under IFR.

Airservices Australia is the Australian government-owned corporation providing safe and environmentally sound air traffic management and related airside services to the aviation industry.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

ATC (Air Traffic Control) service is a service provided for the purpose of:

a. preventing collisions:
    1. between aircraft; and
    2. on the manoeuvring area between aircraft and obstructions; and
b. expediting and maintaining an orderly flow of air traffic.

CASA (Civil Aviation Safety Authority) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation safety standards. As Australia is a signatory to the ICAO *Chicago Convention,* CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

CASR (Civil Aviation Safety Regulations) are promulgated by CASA and establish the regulatory framework *(Regulations)* within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

ICAO (International Civil Aviation Organization) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention.*

IFR (Instrument Flight Rules) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals. It is also referred to as, “a term used by pilots and controllers to indicate the type of flight plan an aircraft is flying,” such as an IFR or VFR flight plan. Pilots must hold IFR qualifications and aircraft must be suitably equipped with appropriate instruments and navigation aids to enable flight in IMC.

IMC (Instrument Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, less than the minimum specified for visual meteorological conditions.

LSALT (Lowest Safe Altitudes) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude

that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

MDA (Minimum Descent Altitude) is the lowest altitude that can be used during a non-precision approach in IMC. Flight below the MDA reduces the clearance above obstacles and is not permitted in IMC.

MOS (Manual of Standards) comprises specifications (Standards) prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation.

NOTAMs (Notices to Airmen) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

Obstacles. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

OLS (Obstacle Limitation Surfaces) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

PANS OPS (Procedures for Air Navigation Services - Aircraft Operations) is an Air Traffic Control term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) or Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS OPS may vary from country to country.

PANS OPS Surfaces. Similar to an Obstacle Limitation Surface, the PANS OPS protection surfaces are imaginary surfaces in space which guarantee the aircraft a certain minimum obstacle clearance. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to infringe the OLS, they cannot be permitted to infringe any PANS OPS surface, because the purpose of these surfaces is to guarantee pilots operating under IMC an obstacle free descent path for a given approach.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Radar Terrain Clearance Chart (RTCC) is a chart that provides air traffic controllers with the lowest usable altitude that they can vector an aircraft using prescribed surveillance procedures within controlled airspace. There is a protection surface below this usable altitude which is shown in airport master plans.

Regulations (Civil Aviation Safety Regulations)

VFR (Visual Flight Rules) are rules applicable to the conduct of flight under VMC. VFR allow a pilot to operate an aircraft in weather conditions generally clear enough to allow the pilot to maintain visual contact with the terrain and to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima. If the weather is worse than VFR minima, pilots are required to use instrument flight rules. Pilots must be specifically qualified and aircraft specifically equipped to enable flight in IMC,

VMC (Visual Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima.

Abbreviations

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table.

Abbreviation	Meaning
AC	Advisory Circular (document support CAR 1998)
ACFT	Aircraft
AD	Aerodrome
ADS-B	Automatic Dependent Surveillance - Broadcast
AHD	Australian Height Datum
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALT	Altitude
AMSL	Above Mean Sea Level
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BARO-VNAV	Barometric Vertical Navigation
BRA	Building Restricted Area
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DIT	Department of Infrastructure and Transport. (Formerly Dept. of Infrastructure, Transport, Regional Development and Local Government and Department of Transport and Regional Services (DoTARS))
DOTARS	See DIT above
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix

Abbreviation	Meaning
FAP	Final Approach Point
FAS	Final Approach Surface of a BARO-VNAV approach
ft	feet
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LNAV	Lateral Navigation criteria
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
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
NOTAM	NOtice to AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface

Abbreviation	Meaning
OLS	Obstacle Limitation Surface
PANS OPS	Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
QNH	An altimeter setting relative to height above mean sea level
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
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
STAR	STandard ARrival
SGHAT	Solar Glare Hazard Analysis Tool
TAR	Terminal Approach Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
VNAV	Vertical Navigation criteria
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart