Aeronautical Impact Assessment

Building Development
20 Berry Street, North Sydney, NSW.

Client

Turner Studio

LB00435

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1 Introduction

1.1 The Development

Turner Studio has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) to support an initial planning proposal for a building development at 20 Berry Street, North Sydney, NSW.

The development comprises a 25-storey building with a maximum height of 145 m AHD, including lift overrun and roof top plant rooms.

The site is located approximately 12.5 km north of Sydney Airport and 22.3 m north east of the Bankstown Airport.

This report considers:

- Obstacle Limitation Surfaces for Sydney Airport;
- Obstacle Limitation Surfaces for Bankstown Airport;
- Procedures for Air Navigation Services – Aircraft Operations (PANS OPS) surfaces existing over the development site;
- Radar Terrain Clearance Chart (RTCC) limitations;
- Possible impact on air traffic control (ATC) communications facilities, navigational aids and radar coverage.

Building location and envelope diagrams are included at Appendix A.

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

2 Prescribed Airspace Overview

The Airports Act 1996, and the Airports (Protection of Airspace) Regulations 1996 describe a set of airspace constraints surrounding Federally Leased Airports to protect them from unrestricted obstacle growth that would be likely to have an adverse impact of the safety of flight operations and the regularity of aircraft operations at the airport.

National Airports Safeguarding Framework (NASF) Guideline F provides advice for planners and developers about working within and around protected airspace, including OLS and PANS-OPS intrusions, and how these can be better integrated into local planning processes.

Under the Airports Act, local councils with boundaries that fall within Sydney or Bankstown Airports' protected airspace are required to review all building and development applications received for any Prescribed Airspace infringements.

Flight operations at an airport are protected from uncontrolled obstacle intrusion by Obstacle Limitation Surfaces (OLS) and the PANS OPS (Procedures for Air Navigation Services – Aircraft Operations) surfaces which are published in Airport Master Planning Documents for the use of local planning authorities to show areas where building activity requires consideration of aviation requirements.

Details are also published in Aeronautical Publications for the use of pilots during pre-flight planning processes and in-flight operations to ensure that the airport can support their planned operation and that they are aware of the requirements for aircraft operations in the area and at the airport.

The OLS are conceptual surfaces associated with runways that are designed to protect aircraft operations during visual phases of flight, especially during take-off and landing, from unrestricted obstacle growth.

The PANS OPS surfaces are designed beneath instrument approach and departure flight paths 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) during which flight crews cannot necessarily see the ground or obstacles and they must rely upon aircraft instrumentation to determine their position in relation to navigation aids and runways.

Infringement by buildings or cranes into Airport Airspace requires the approval of the aerodrome operator and the Civil Aviation Safety Authority (CASA).

Permanent infringement of PANS OPS protection surfaces are not supported by the aviation authorities, however, temporary activities may be able to be approved subject to support from the airport, Airservices

Australia and CASA. If the infringement is shown to impact on aviation safety or regularity of aircraft operations, it is unlikely to be approved.

2.1 Obstacle Limitation Surfaces

The OLS at Sydney Airport and Bankstown Airport comprises:

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

2.1.1 Bankstown Airport OLS

Bankstown Airport's OLS include an OHS that extends to 15 km of the airport that is a horizontal surface at 156 m AHD.

The development is located outside of Bankstown Airport's OLS.

2.1.2 Sydney Airport OLS

The development site is located beneath the Outer Horizontal Surface of the Sydney OLS, a horizontal plane which has an elevation of 156 m AHD. **Figure 1** shows the Sydney OLS and the North Sydney area.

The building does not infringe the Outer Horizontal Surface, but construction cranes may. Buildings in the immediate vicinity of the proposed development site are considerably higher than the proposed building and are likely to infringe the Outer Horizontal Surface and therefore providing a shielding effect for the proposed development.

In any case the very tall buildings in the Sydney CBD, between the airport and North Sydney provide shielding for the proposed development and crane activity. If the cranes exceed the height of the OLS, an application to Sydney Airport would be required but approval is likely to be forthcoming due to other infringements of the OLS by higher buildings in the vicinity of the development and in the Sydney CBD, all of which would provide shielding from impacts to aviation activities in the area.

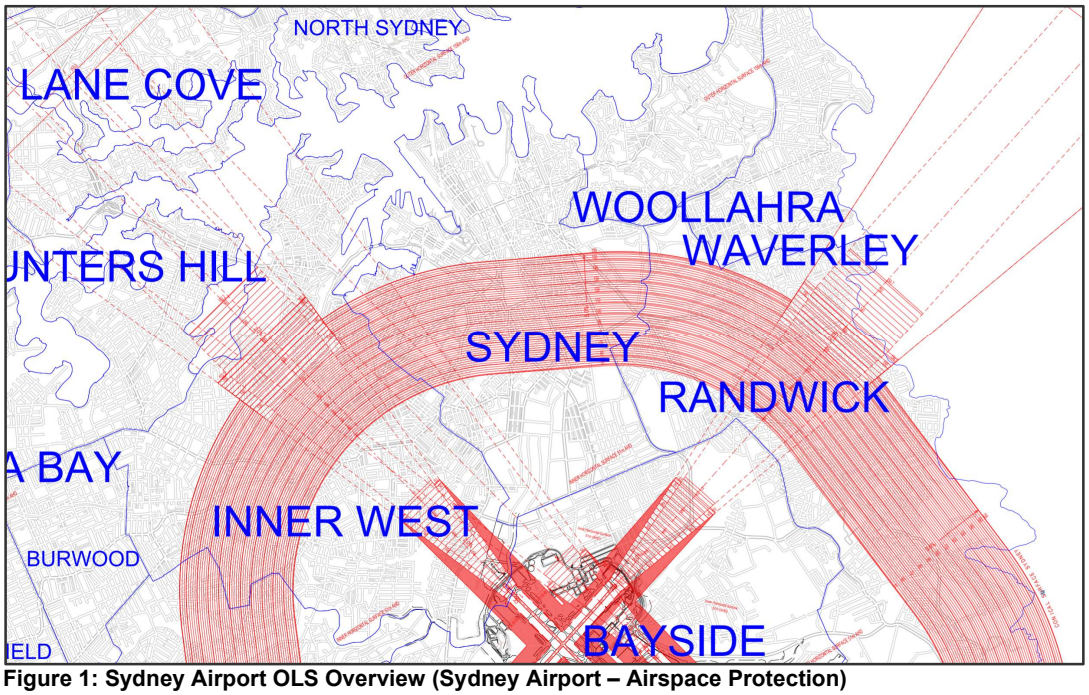


Figure 1: Sydney Airport OLS Overview (Sydney Airport – Airspace Protection)

2.2 PANS OPS Surfaces

All instrument approach procedures available at Sydney Airport have final approach segments aligned with the runway for which they are designed.

The proposed development site is located laterally outside of the PANS OPS protection surfaces for all approach procedures at Sydney Airport.

The lowest PANS OPS surface overhead the development site is related to the 25 nm Minimum Safe Altitude and has an elevation of 340 m AHD.

The building at a maximum height of 145 m AHD will not infringe any PANS OPS surface associated with Sydney Airport or any other airport.

Figure 2 shows the PANS OPS surfaces associated with the instrument approach procedures in relation to North Sydney.

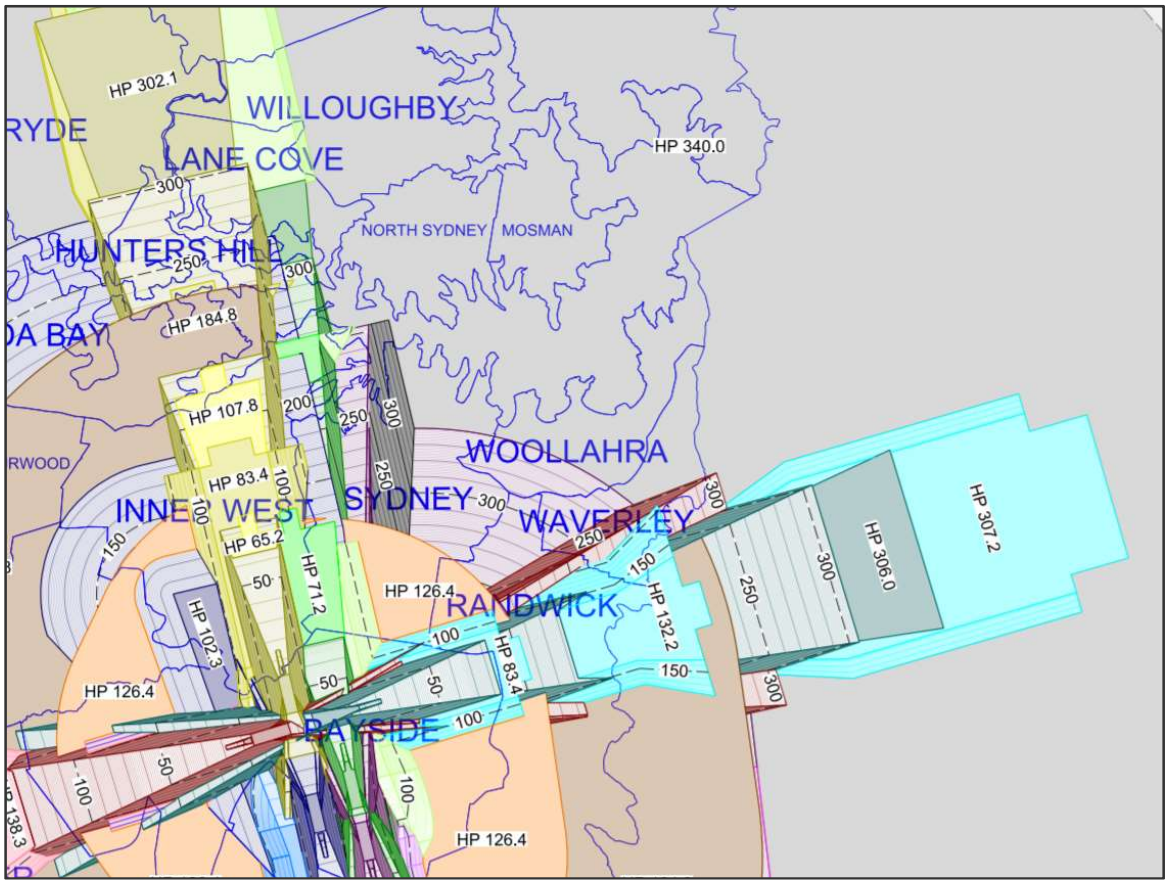


Figure 2: Sydney Airport PANS OPS Surfaces (Sydney Airport – Airspace Protection)

3 ATC Surveillance System Performance

The nearest ATC Surveillance equipment (Terminal Area Radar) is located on Sydney Airport, 12.5 km to the south of the development site.

A clearance plane of 0.5° from and the antenna protects the signals from being blocked by buildings.

Surveillance System	Distance from development	Antenna Elevation (AHD)	Clearance Plane Elevation at development site Distance x Tan 0.5° + TAR elevation	Result (m)
Sydney Terminal Area Radar (TAR)	12300 m	38.2 m	145.5 m	0.5 m Clearance
Cecil Park TAR	34200 m	200.5 m	498.9 m	353.9 m Clearance

Table 1: Impact of Development on ATC Surveillance Performance

The building will not infringe the clearance plane of the Sydney Terminal Area Radar and is shielded by taller buildings in the immediate vicinity.

Airservices Australia has commissioned Automatic Dependent Surveillance – Broadcast (ADS-B) in several locations around the Sydney Basin area, that also ensures continuous ATC Surveillance coverage in the area.

Cranes do not have an adverse impact on ATC Surveillance Systems.

The building and the cranes will not have an adverse impact on ATC Surveillance systems.

4 Navigation Aid Performance

A Building Restricted Areas (BRA) is an area surrounding the navigation aid antenna sites to protect their signal paths from potential interference. 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.

The maximum BRA for any of the navigation aids installed at Sydney or Bankstown Airports extend to a maximum distance of 3000 m from them.

As the development site is located further than 3000 m from any navigation aid it will not have any impact on the operations of any navigation aid in the area.

5 Roof Top Exhaust Plumes

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

Part 139 of the Civil Aviation Safety Regulations 1988 (CASR 1988) provides that CASA may determine that a gaseous efflux having a velocity in excess of 4.3 m/s is, or will be, a hazard to aircraft operations because of the velocity of the efflux.

Should any roof top exhaust plume with a velocity 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. In this case, any exhaust plume with a velocity in excess of 4.3 m/s from any vent on top of the building will need to be referred to CASA.

The taller buildings in the immediate vicinity of the proposed will provide a shielding effect for any exhaust plume emitted from the proposed building and therefore not impact the OLS for Sydney Airport.

6 Obstacle Lighting

Obstacle lighting for the building is not required as it does not infringe the OLS and higher buildings in the vicinity effectively shield it from overhead aircraft flight operations.

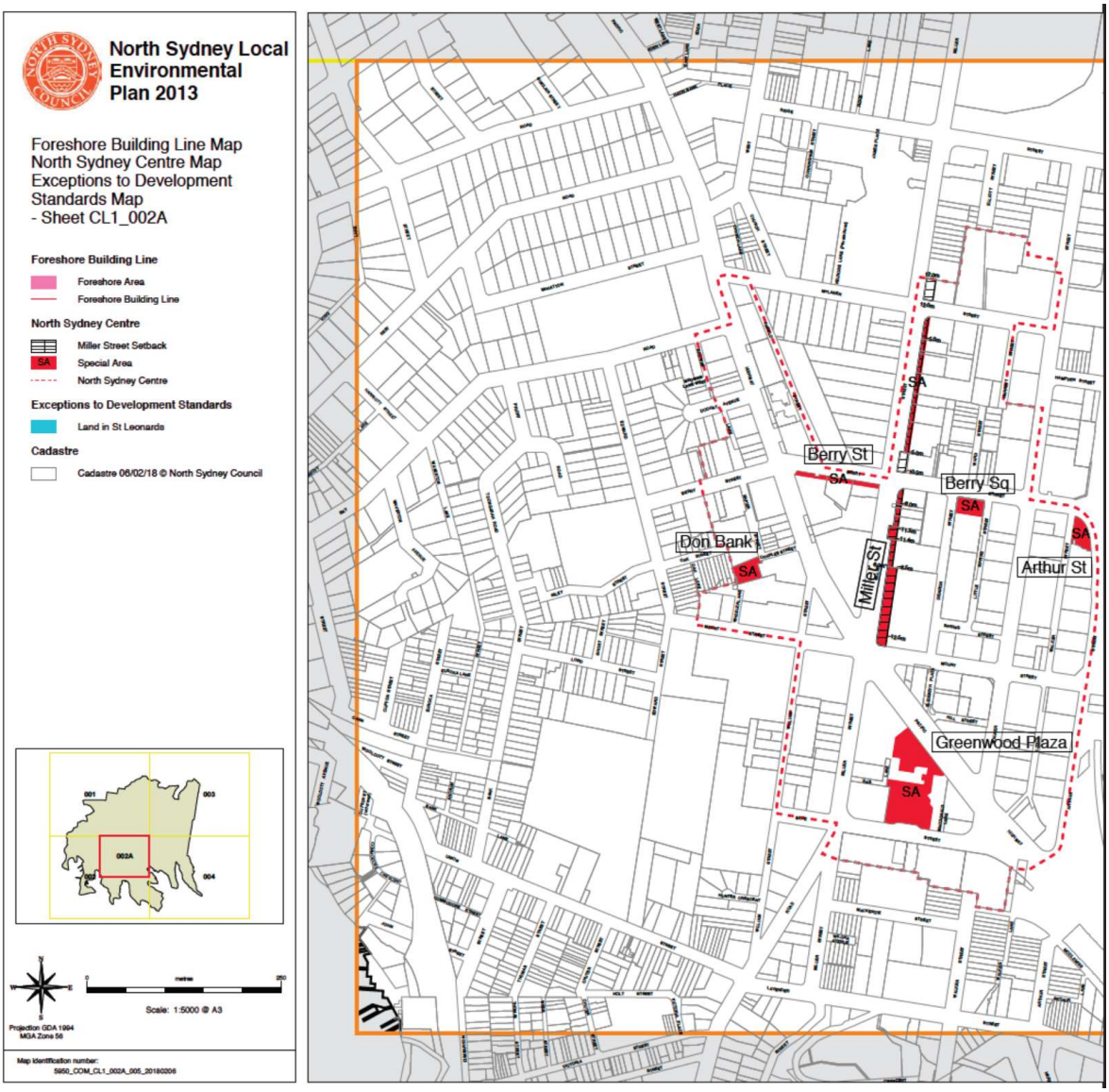
7 Conclusion

The proposed building development at 20 Berry St, North Sydney, with a building to a maximum height of 145 m AHD and temporary associated construction crane activity:

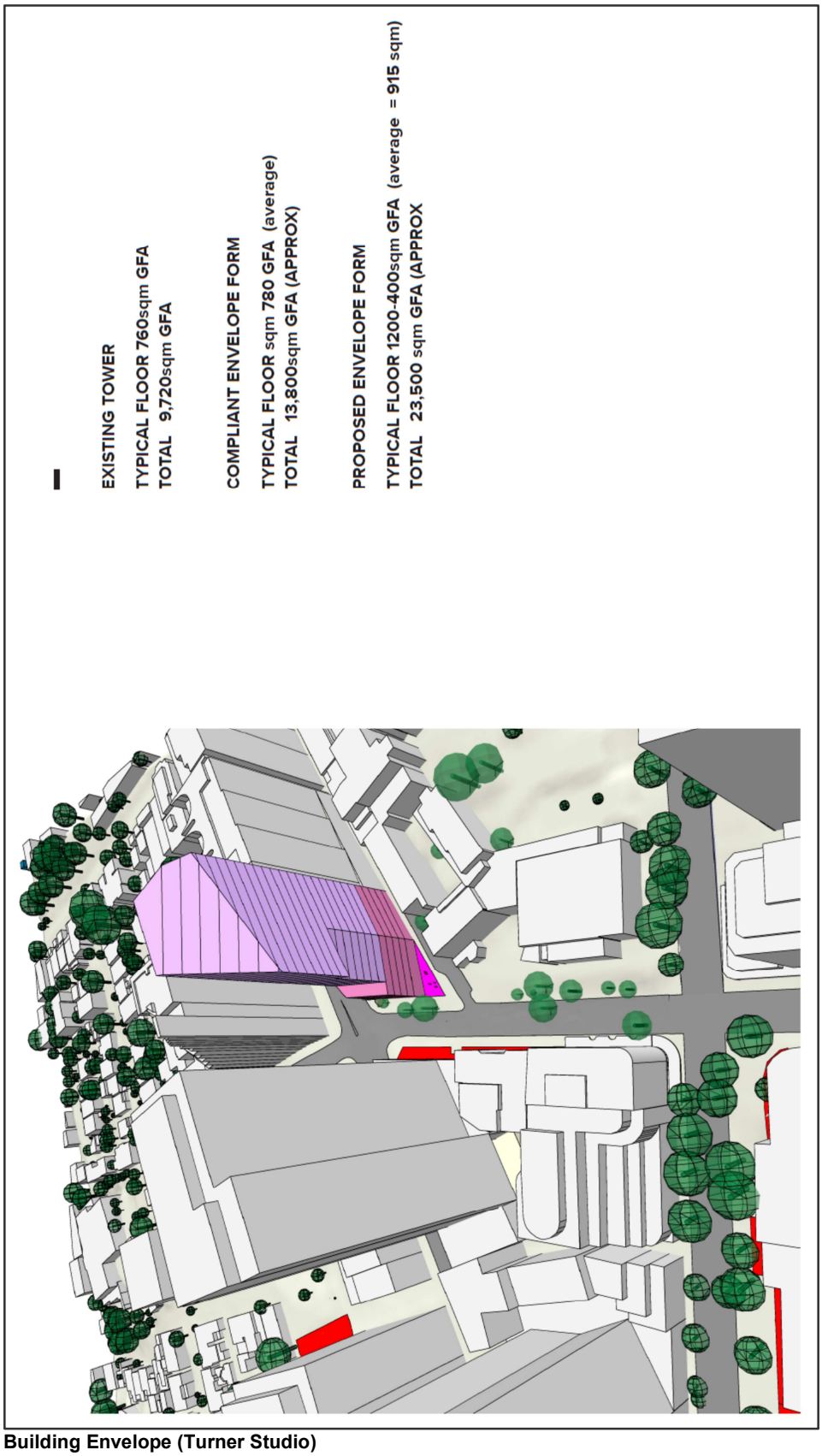
- will not infringe Sydney Airport OLS;
- obstacle lighting will not be required;
- will not infringe the Bankstown Airport OLS;
- will not infringe any PANS OPS surfaces;
- will not infringe any BRA for navigation aids;
- will not impact upon ATC Surveillance systems;
- will not impact the safety of flight operations in at Sydney Airport; and
- will not have an impact on the regularity of flight operations at Sydney Airport.

If construction cranes exceed a height of 156 m AHD, it will be necessary to gain approval for the infringement of the OLS via an application to Sydney Airport. Shielding provided by other higher buildings between the development site and Sydney Airport should ensure that the infringement is approved.

Appendix A – Building Height and Site Layout Diagrams



Building Location (Turner Studio)



Building Envelope (Turner Studio)

Preliminary Site Layout (Turner Architects)

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.

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

The major relevant documents include:

- 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);
- The Planning Secretary's Environmental Assessment Requirements (SEARS);
- Sydney Airport Masterplan;
- Bankstown Airport Masterplan.

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 (documents that 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
DITRDC	Department of Infrastructure, Transport, Regional Development and Cities
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
FAS	Final Approach Surface of a BARO-VNAV approach

Abbreviation	Meaning
ft	feet
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
GP	Glide Path
HLS	Helicopter Landing Site
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
LOC	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
OLS	Obstacle Limitation Surface

Abbreviation	Meaning
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