Aeronautical Impact Assessment

Building Development
19A Evans Avenue
Eastlakes, NSW

Crown Group

LB00325

Final Version 4
14 October 2019

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Draft 001	Draft report for submission to Client	PWW	12 April 2019	CA
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Final V1	Final Report	PWW	15 May 2019	
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Final V3	Updated to reflect current state	PWW	11 October 2019	
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Contents

1 Introduction

1.1 The Development

Crown Group Pty Ltd has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) for a proposed building development at 19A Evans Avenue, Eastlakes, NSW.

The development comprises a mixed-use building with a maximum height of 60.60 m AHD at the corner of Evans and Barber Avenue, Eastlakes.

A previous iteration of this development, with a higher maximum elevation, infringed Sydney Airport's Prescribed Airspace and was not granted the required aviation system approval.

Two tower cranes are planned to be erected and operated beneath the PANS OPS limit of 60.64 m AHD. These tower cranes will not be any higher than the maximum height of the building during construction of the building up to the last two floors.

The remaining concrete floors and roof slabs will be constructed using formwork hoists and man/material hoists. Limited mobile cranage may be required to lift oversize or exceptionally heavy materials and equipment. The use of mobile cranes will be coordinated with Sydney Airport on each occasion that they may be required.

Table 1 shows the distances from the development to the various airports in the vicinity, and **Figure 1** shows the development in relation to Sydney Airport.

Airport	Direction and distance from 19A Evans Avenue
Sydney Airport	2.4 km southwest
Bankstown Airport	19.8 km West
Western Sydney Airport (Under development)	44 km North west

Table 1: Airports in the vicinity

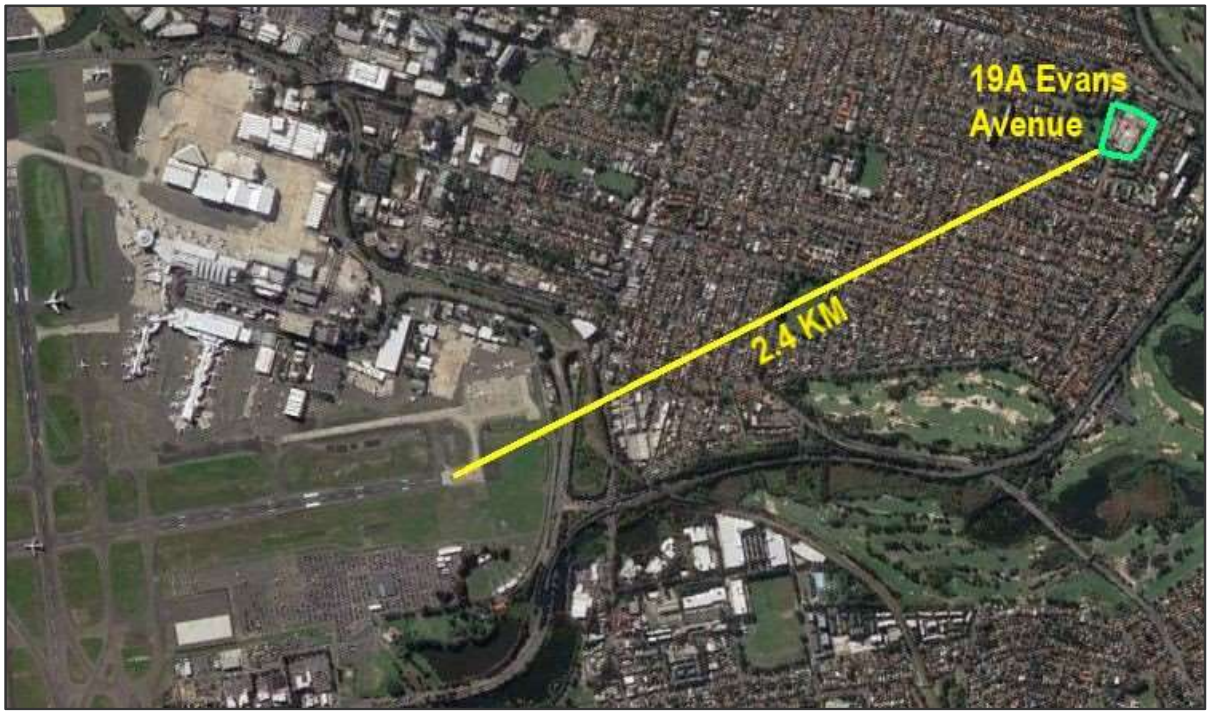

Figure 1: Location in relation to the threshold of Runway 27 at Sydney Airport

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 an 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 PANS OPS surfaces are designed beneath instrument approach flight paths to a runway and instrument departure flight paths from a runway with a prescribed minimum obstacle clearance above all obstacles or terrain within the lateral limits of these surfaces.

They provide an obstacle free flight path to enable safe and efficient aircraft operations in Instrument Meteorological Conditions (IMC).

The RTCC provides Air Traffic Control (ATC) with a minimum safe altitude, above terrain and obstacles, in an area surrounding major airports in which an ATC surveillance service is provided which enables safe and efficient flight operations during high cockpit workload periods immediately after take-off and during aircraft configuration changes as the aircraft intersects the runway's final approach track.

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.

Infringement of PANS OPS or RTCC protection surfaces are not supported by the aviation authorities.

2.2 PANS OPS

All Sydney basin airports' PANS OPS surfaces were assessed for this proposed development. The PANS OPS surfaces for all airports, other than Sydney Airport, are well above the maximum height of this proposed development and accompanying construction activity.

A detailed assessment of Sydney Airport's PANS OPS surfaces revealed the following.

The development site is located beneath the Final Approach Segment (FAS) surface related to the RNAV-Z (GNSS) RWY 25 at an elevation of 37.5 m AMSL. Infringements of the FAS are permitted but the Decision Altitude (DA) for the procedure must be increased to allow for any infringement by a permanent or temporary structure.

To avoid any increase to the Descent Altitude (DA) for this procedure, the elevation of the building must be no higher than 60.64 m AHD. An increase to the DA may cause operational limitations on the use of this approach, and therefore is unlikely to be supported by the authorities.

An assessment by Airservices Australia is necessary to obtain the exact PANS OPS surface heights above the proposed development to understand the impact that the development may have on the approach procedure. The aviation authorities can then determine whether an adjustment to the procedure can be considered to allow urban development in this sector.

Table 2 shows the lowest of the PANS OPS surface heights for Sydney Airport above the development site and the clearance (in green) or infringement (in red) of the building on each surface.

Figure 2 depicts Sydney Airport's Master Plan 2015 diagram of the PANS OPS surfaces with the location of the development marked in green. This chart does not contain any data related to the VNAV minima on the RNAV-Z (GNSS) procedures at Sydney Airport, which have been implemented since the publication of the 2015 Master Plan.

Sydney Airport Approach, Departure or Circling Procedure	Surface Height (m AHD)	Clearance above 19A Evans Avenue (60.60m AHD)
RWY 25 ILS	81.4	20.8
RWY 25 RNAV-Z (GNSS)	**60.64**	**0.04**
Sydney One Departure RWY 07	107.8	47.2
RWY 07 ILS Missed Approach Segment	100.4	39.8
RWY 07 RNAV-Z (GNSS) Missed Approach Segment	>101.8 (MDA-MOC)	>41.2
Circling Cat A/B	126	65.4
Circling Cat C/D	184	123.4
RTCC	152	91.4

Table 2: PANS OPS Surface Heights and result

Figure 2: PANS OPS Surface Diagram and Development Site (SACL Masterplan 2015)

2.2.1 Result of Assessment

The proposed development at a maximum height of 60.60 m AHD:

- 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.

2.3 OLS

The proposed development site is located laterally within the Sydney Airport OLS, but is located more than 15 km from any other airport with an OLS. The OLS for Sydney Airport is the only one relevant.

The outer segments of the OLS for airports with Type B, 3D instrument approaches, such as Sydney Airport, extends to 15 km from the airport's Aerodrome Reference point.

The development site is located beneath the Inner Horizontal Surface (IHS) of Sydney Airport's OLS. This surface is 45 m above the elevation of the airport, which in Sydney Airport's case the IHS has an elevation of 51m AHD.

Table 3 identifies Sydney Airports' OLS and the infringements in red.

Airport	Prescribed Airspace Surface	Height of OLS (m AHD)	Infringement by building @ 60.60 m (in metres)
Sydney	Inner Horizontal Surface	51	9.60

Table 3: Sydney OLS assessment

Figure 3 depicts Sydney Airport's Master Plan 2015 diagram of the OLS surfaces with the location of the development shown in green.

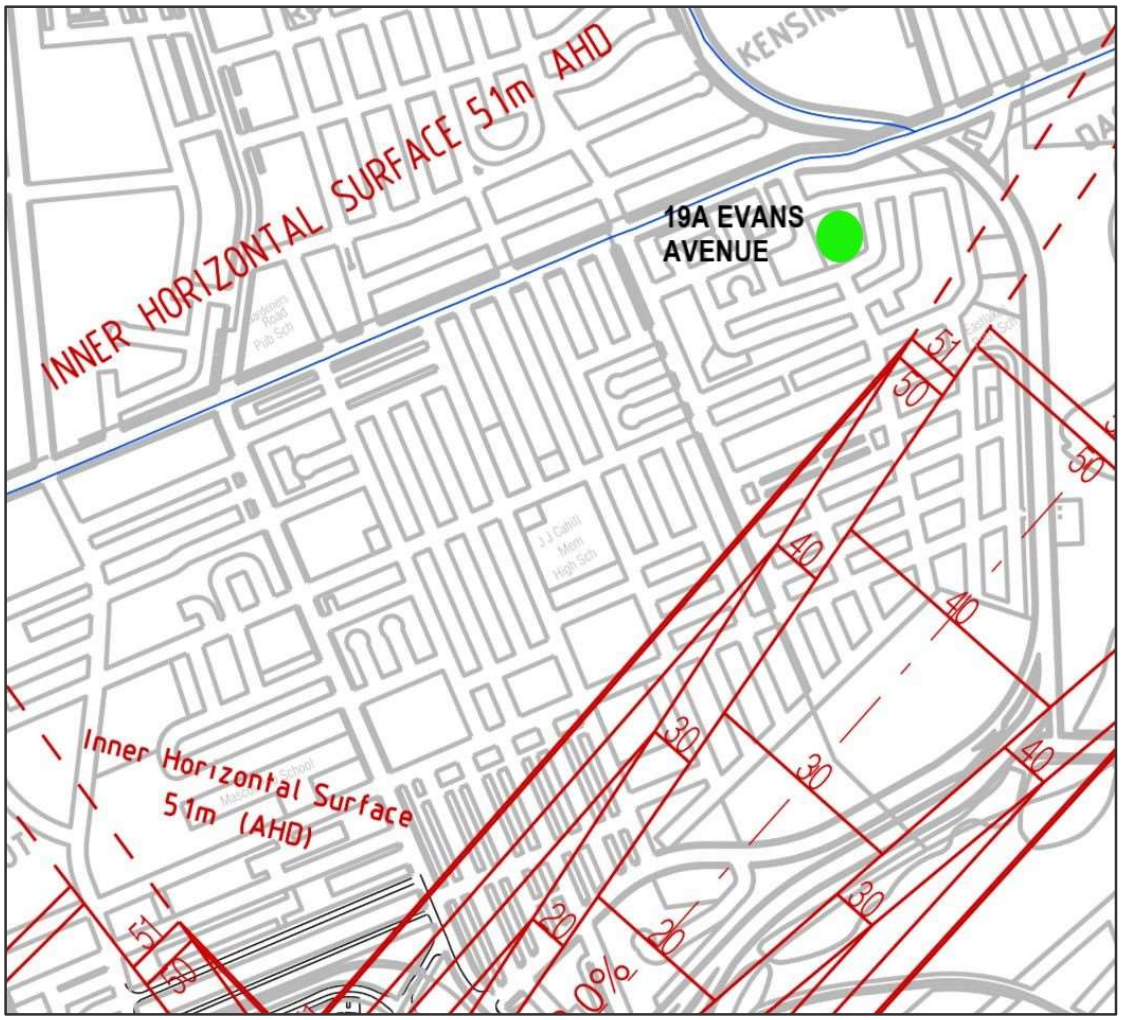

Figure 3: Development location within the Inner Horizontal Surface boundary (SACL Masterplan 2015)

The proposed building development infringes the Inner Horizontal Surface component of the OLS for Sydney Airport.

The following Aeronautical study and Safety Case demonstrate that the infringement of the OLS does not adversely affect safety or significantly affect the regularity of aircraft operations at Sydney Airport.

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 60.60 metres AHD would not adversely affect safety or significantly affect the regularity of aircraft operations as per ICAO Annex 14 requirements.

The Inner Horizontal Surface was originally established by ICAO to restrict obstacle growth in the vicinity of airports, and therefore protect circling the airport in less than visual flight conditions prior to landing from uncontrolled obstacle growth.

When these surfaces were initially established, instrument approaches were generally only provided to one runway at the airport, and aircraft were not equipped for straight in approaches with vertical guidance apart from the ILS. A circling approach from an instrument approach was often required for landing on one of the other runways due to local winds or other conditions.

A study by the Flight Safety Foundation found that a majority of aircraft accidents in the vicinity of airports occurred during the conduct of a circling approach.

The International Civil Aviation Organisation (ICAO) Assembly's Resolution A33-16 ICAO Global Aviation Safety Plan (GASP) recognised the need to prevent CFIT accidents by implementing a worldwide program whereby National Aviation Authorities provide a straight in approach to each runway used by airline aircraft. In Australia, this program is complete for the major airports. At Sydney Airport, each runway is provided with more than one straight in approach with vertical guidance.

The promulgation of straight in instrument approaches has reduced the area in which aircraft are likely to operate during approach procedures. Therefore, the requirement to overly restrict obstacle growth in areas where aircraft no longer operate during normal operations is reduced.

ICAO has acknowledged the limitations imposed by the current OLS layout, and has formed the OLS TASK FORCE to review and update the OLS and align them with the PANS OPS surfaces. 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 Inner Horizontal Surface can be infringed in accordance with the recommendations of ICAO 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 Sydney Airport

With the implementation and extensive use of straight-in (runway aligned) instrument approach procedures (ILS, GLS, RNP, RNAV (GNSS), and VOR), the use of circling approaches has decreased considerably.

Due to the high number of airline movements, and noise constraints in the vicinity of Sydney Airport, the use of a circling procedure is only permitted in emergency situations, or for ATC separation purposes. These occur very rarely.

All jet aircraft, and any aircraft above 5,700 kg maximum take-off weight (MTOW) are subject to noise abatement procedures which limit the possible flight paths around Sydney.

Each airline and aircraft operator design and implement their own contingency procedures for safe emergency flight paths that may be required in the event of a critical engine failure after take-off. Public schools and multi-storey flats in the vicinity of the Eastlakes development would be taken into consideration during the design of these contingency procedure and are unlikely to occur above the development site.

2.4.3 Examination of Circling Approaches

The proposed development, at the maximum height of 60.60 m AHD, was examined to confirm that the PANS OPS surfaces associated with the published circling minimum altitudes would not be affected.

19A Evans Avenue is located underneath the CAT A/B and CAT C/D IFR circling areas for Sydney airport.

The aircraft category (CAT) depends on a number of aircraft performance parameters and is published in ICAO Doc 8168 PANS OPS.

The minimum descent altitudes (MDA) published for circling approaches at Sydney are:

- CAT A and B aircraft: 710 feet AMSL, and
- CAT C and D aircraft: 1000 feet 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, and
- CAT C and D: Area radius 5.28 nautical miles, MOC 394 feet.

The MOC is subtracted from the MDA to produce the PANS OPS surface height.

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

Aircraft Category	Height of PANS OPS Surface (m AHD)	Result for development height of 60.60 m AHD (in metres)
A and B	126.4	65.8
C and D	184	123.4

Table 4: Circling Area PANS OPS heights

3 ATC Surveillance System Performance

This assessment identified two radars in relative proximity to the development at 19A Evans Avenue, Eastlakes: the Sydney Airport Terminal Area Radar (TAR), and the Cecil Park TAR.

The proposed development at Evans Avenue, at a height of 60.60 m AHD, will not infringe the Sydney Airport TAR clearance plane.

Airservices Australia will also assess any likely 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 4 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 (in metres)	Antenna Elevation (m AHD)	Clearance Plane Elevation at Evans Avenue Distance x Tan 0.5° + TAR elevation	Clearance for development at 60.60 m AHD (m)
Sydney Airport TAR	3800	38.2	71.36	10.76
Cecil Park TAR	34890	200.51	754.6	694

Table 4: Impact of development on ATC Surveillance System Performance

4 Navigation Aid Performance

There are a number of navigation aids installed at Sydney Airport, including ILS, GBAS and DME.

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

Navigation Aid	Distance from Development Site (in m)	Result
SY DME	3067	Beyond maximum BRA radius.
SY GBAS	4775	Beyond maximum BRA radius.
RWY 25 ILS LOC	4945	Beyond lateral limits of BRA.
RWY 07 ILS LOC	2130	Points away from development site and beyond lateral limits of BRA.

Table 5: Navigation Aid Clearance Plane Impacts

4.1 Result of Assessment

The development site is located outside of all BRA for all navigation aids in the Sydney area.

5 Roof Top Exhaust Plumes

Exhaust plumes in excess of 4.3 m/s can create sufficient turbulence to upset the stability of aircraft during take-off and landing operations.

Roof top exhaust plume rises in excess of 4.3 m/s must be referred to CASA for their assessment of risk to aircraft operations.

6 Obstacle Lighting

The proposed building development will not infringe the OLS or the PANS OPS surfaces and therefore CASA is unlikely to require Obstacle Lighting be provided for it.

Obstacle lighting for the building, if required by CASA, will be in accordance with the Manual of Standards Part 139 – Aerodromes, Chapter 9.4 *Obstacle Lighting*.

Shielding of the lights to avoid distraction to residents may be installed, however the lights must remain visible above a horizontal plane.

7 Cranes

A separate application to SACL will be made at a later date for the construction cranes, once height requirements and duration of operations are known.

As the building is proposed up to the PANS OPS (CASA) limit, any constructions cranes above the building will infringe the Prescribed Airspace of Sydney Airport and require approval from DIRDC. Such approval is unlikely and DIRDC may decline approval of the building unless a Construction Methodology that avoids infringement of the runway 25 and 07 PANS OPS surfaces during any operational requirements for the use of either of those runways, ie at night during curfew or in conditions that preclude the use of Runway 07/25 during instrument approach operations.

8 Conclusion

The proposed development at 19A Evans Avenue, Eastlakes, to a maximum height of 60.60 m AHD:

- will infringe the OLS for Sydney Airport, but not the Circling Area MDA;
- will not infringe the Sydney Airport PANS OPS surfaces;
- will not infringe any BRA for navigation aids at Sydney Airport;
- will not infringe the Sydney TAR clearance planes; and
- will not infringe the RTCC protection surface above the site.

An application to the aviation authorities for infringement of the Inner Horizontal Surface of the OLS will be required to be submitted to SACL.

As the development site is located in an area that is not used regularly by aircraft and has a maximum height that does not infringe the PANS OPS surfaces, the application should be successful.

Appendix A

Building Height and Site Layout Diagrams

Maximum Building Heights – West and East Elevations (Source: Crown Group)

Maximum building heights – North and South Elevations (Source: Crown Group)

For Approval

Site Layout (Source: Crown Group)

Appendix B

Construction Management Plan – Crane Operations

Extract from Construction Management Plan – Revision 4: 11 October2019

6. Site Management

(A) Deliveries / Materials handling / Cranage

The Principal Contractor will ensure that no deliveries will occur outside the site working hours without prior approval from Council. All off loading and loading of vehicles will be done within the site boundaries. Through the entire re-construction works, all weather roads will be created within the site. During demolition and excavation stage, mobile cranes would be used on an as needs basis. This is expected to be minimal.

During the construction stage from the lowest basement level, a maximum of two tower cranes are planned to be erected and operated under the PAN-OPS – CASA height limit of RL 60.64, located in a mid-site position (one North, One South), The lifting path will not exceed the surrounding streets. The buildings will be constructed as high as possible with these two cranes. The cranes will then be removed from site and the remaining two concrete floors and roof slabs constructed using formwork hoists and man / materials hoists. Limited mobile cranage may be required to lift oversize or exceptionally heavy materials and equipment (subject to separate approvals being obtained for each occasion from CASA. Hoist and forklifts will be used for the loading and unloading of materials.

Appendix C

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.

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 D

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.

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