

APPENDIX G

PRELIMINARY AERONAUTICAL IMPACT ASSESSMENT - STRATEGIC AIRSPACE



Preliminary Aeronautical Impact Assessment

Airports (Protection of Airspace) Regulations

for

505-523 George Street, Sydney

Doc v3.1

22 Sep 2014

by



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I. Executive Summary

Mirvac has engaged Strategic Airspace to prepare a preliminary aeronautical assessment in relation to proposed amendment to the height limits at **505-523 George Street, Sydney, NSW to 260 metres Above Ground Level (AGL)**. This proposed development is located within southern part of the City of Sydney.

The development is approximately 7.8 km (4.23 NM), at an approximate bearing of 17°T, from the VOR/DME at Sydney Airport. **The proponent will be seeking approval for a development on the site with a maximum elevation of 260m AGL, equivalent to a maximum elevation of 278.4m AHD at the north-eastern corner of the tower building envelope.**

The elevation of the proposed building envelope would exceed the Obstacle Limitation Surface (OLS), as defined in the Airports (Protection of Airspace) Regulations 1996 as amended, which is 151m above the site, by approximately 127.4m. With the concurrence of the Civil Aviation Safety Authority (CASA) and their recommendations regarding appropriate obstacle lighting, this does not preclude approval of the proposal.

Since early 2014 CASA are have become more critical of applications that exceed the OLS height limit and appear to be imposing more restrictive heights and conditions. In the Sydney CBD region however it is more likely that they will approve buildings based on precedence, supported by a safety case that demonstrates that the development would not increase the risk to aviation safety, regularity or efficiency. As such, because the proposed building height exceeds the limiting Obstacle Limitation Surface and it would also be taller than most other buildings in the CBD, it is probable that a safety case would have to be prepared as part of the airspace height application in order to obtain approval from the aviation authorities.

The other facet of the Airports Regulations refers to PANS-OPS “surfaces”. These surfaces are complex in nature and protect aircraft operations in all weather. Calculations in an appendix to this document indicate that these surfaces would not be infringed by the proposed tower building envelope of 278.4m. However, consideration will need to be given to keeping the cranes required to construct the building beneath a maximum limit of 310m AHD which is imposed by the current PANS-OPS surfaces. A commitment to this effect would be required as part of the airspace height application for the development.

The proposed building envelope is not likely to detrimentally affect surveillance or navigation aids nor will it affect any other aspect of operations at Sydney Airport.

Therefore, based on the provisions of the Airports (Protection of Airspace) Regulations 1996 as amended, the only possible impediment to obtaining approval from the Department of Infrastructure and Regional Development for a building up to 291.8m AHD would be the approval from CASA for such a tall building. It is probable that CASA will require a safety case to assist their evaluation of the application.

2. Introduction

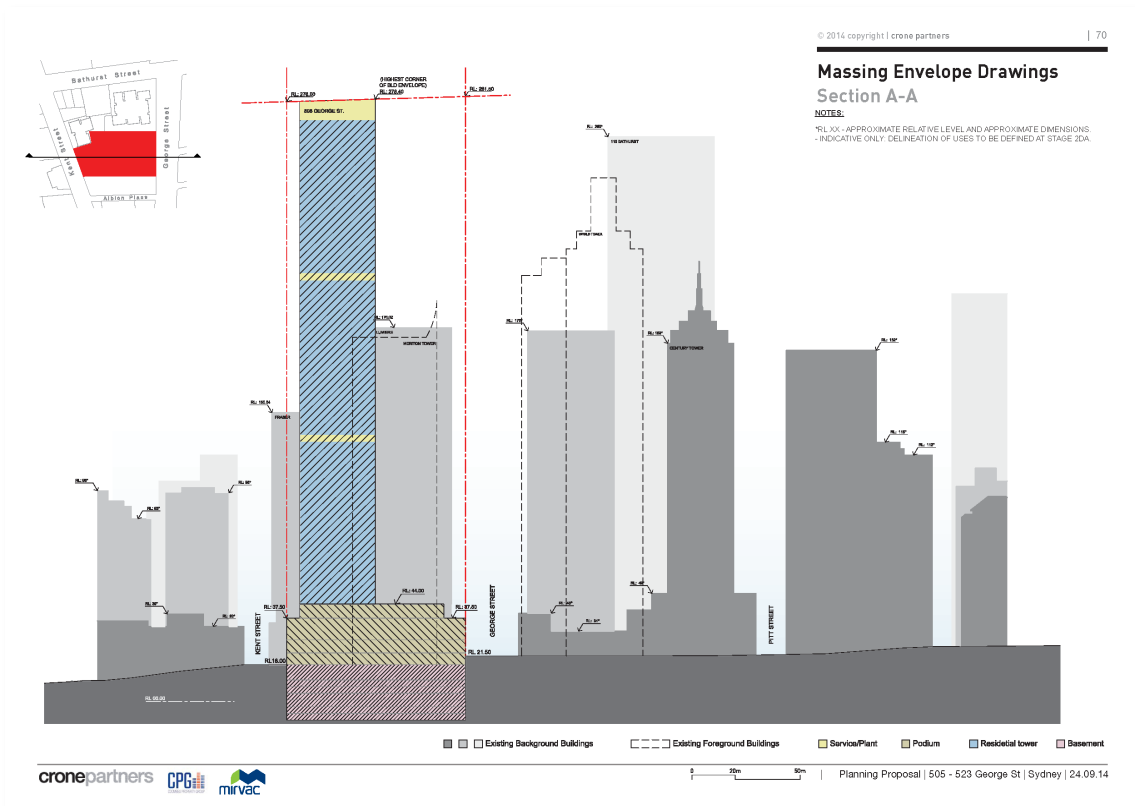
Mirvac has engaged Strategic Airspace to prepare an aeronautical assessment in relation to proposed development at **505 George Street, Sydney NSW**, within the southern part of Sydney Central Business District.

The **proposed height** of the development considered in this report is **278.4m AHD**. At this elevation, the development would penetrate the OLS of Sydney Airport. Specifically, it will penetrate the Outer Horizontal Surface (OHS) which is 151m AHD over the CBD.

The proposed development is approximately 7.8km for the VOR/DME navigation aid near the centre of Sydney Airport. Thus, due to proximity to the airport and the proposed maximum building height of the development, the proposal is subject to the Airports (Protection of Airspace) Regulations 1996.

This **preliminary report** is for the purposes of supporting a planning proposal varying the height control applying to the site. It may also form the basis of the technical analysis required for a later **application to the Department of Infrastructure and Regional Development (DOI&RD, or Infrastructure)**, via Sydney Airport Corporation Limited (SACL), for a **height approval for the proposed development under the Airport (Protection of Airspace) Regulations 1996 (APARs)**.

Figure 2-1: View of 505 George St Tower at RL260m AGL in CBD Buildings Context



ICAO recommends, in Annex 14 paragraph 4.2.20 and paragraph 4.2.21 that obstacles which penetrate the Outer Horizontal Surface may be permitted "... (if) after an aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations by airplanes." (The Australian regulations for OLS are based upon ICAO Annex 14.)

3. Methodology

The preliminary version of this report includes only the technical analysis of PANS-OPS and OLS surfaces. More complete assessment of the potential impact upon operations at Sydney Airport would need to be included in the report presented for the application for approval by the aviation authorities.

3.1 Methodology as Basis of Study

The report considers the existing Sydney International Airport facilities only.

In respect to the influence on the proposed development, the prescribed airspace surrounding the Airport comprises two components:

- the Obstacle Limitation Surfaces (OLS); and
- the Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) surfaces.

In this instance the OLS plans produced by Sydney Airport were referenced. In addition to Airservices Australia Departure & Approach Plates (charts) effective at 6-March-2014 as published on the Airservices AIP (Aeronautical Information Publication) website.

The aeronautical assessment was undertaken in phases, as described below:

Table 3-1 Methodology

#	Phase	Description
1	Obstacle Limitation Surfaces	The extent of penetration of the Obstacle Limitation Surfaces by the proposed developments was determined accurately based on the siting (building zone footprint) and height data provided by the client. See section 4 below.
2	Instrument Approach Procedures	The relevant instrument approach procedures were examined to determine whether the development would impose any restriction on those procedures. Based on the requirement of the Airports (Protection of Airspace) Regulations any restriction on the instrument approach procedures would preclude further consideration of the application. See section 5 below.
3	Summary & Conclusions	A concise summary of findings and conclusion as to whether the proposal should be approved. See section 6 below.

3.2 Location of the Proposed Development

For the purpose of the analysis below an approximate WGS84 coordinate (in latitude and longitude) for the South West corner of the proposed development was obtained from GoogleEarth. The coordinate used in all calculations is: 33 52 31 S 151 12 20 E.

4. Analysis of Obstacle Limitation Surfaces (OLS) & Shielding by Existing Obstacles

The analysis of the proposed building envelope in relation to the Obstacle Limitation Surfaces (OLS) and any relief that may be provided by shielding of the development by existing obstacles has been done with reference to the CASA Standards for Obstacle Restriction and Limitation¹ — known as MOS Part 139.

4.1 OLS Analysis

The prevailing OLS restriction on building heights in the Sydney CBD over the development site is the OLS Outer Horizontal Surface.

The proposed height of 291.8.0m AHD penetrates the Outer Horizontal Surface, as shown in the table below.

Table 4-1 Proposed Building Elevations & Penetrations of OLS Conical Surface

<i>Proposed Site / Feature</i>	<i>Outer Horizontal Surface Height at Location Metres AHD</i>	<i>Penetration *</i> <i>Metres</i>	<i>Clearance**</i> <i>Metres</i>
Apartment Development	151.0m	127.4m	—

* **Penetration:** rounded up to nearest 0.1m

** **Clearance:** rounded down to nearest 0.1m

5. Analysis of PANS-OPS Surfaces

Assessment of impact by the proposed building envelope was undertaken with respect to:-

- The Circling Minima for existing PANS-OPS procedures
- The discrete minima for the Instrument Approach Procedures for Sydney International Airport, as published in the Departure and Approach Procedures (DAP), up to Amendment 138 (dated 6-March-2014).
- Missed Approaches — as part of the evaluation of Approach Procedures
- The existing Standard Instrument Departure Procedures (SIDs)

1 CASA RPA, and Manual of Standards Part 139 — Aerodromes, Chapter 7 Obstacle Restriction and Limitation, <http://www.casa.gov.au/rules/1998casr/139/139m07.pdf>

The proposal was assessed as being laterally outside the protected airspace for all other procedures.

The aeronautical assessment was undertaken in phases with the results summarised as follows:

Table 5-1 Impact Summary

<i>Procedure</i>	<i>NO Impact</i>	<i>Impact</i>	<i>Issues & Comments</i>
MSA	✓	Nil	Below protection surface
Circling Minima (Cat A,B,C&D)	✓	Nil	
Approach Procedures & Missed Approaches			
All Approaches, Missed Approaches & Arrival Procedures	✓	Nil	While a building of 278.4m would be beneath or outside all surfaces, cranes required to construct the proposed building would probably not be beneath all surfaces. The maximum height allowed by the Missed Approach associated with the RWY 34R ILS approaches is only 310m. While the regulations allow temporary penetration (up to three months) of this surface, the current attitude of CASA, Sydney Airport and the Department to such temporary penetrations is likely to mean that obtaining approval for cranes greater than 310m will not be possible.
Departures			
➤ Radar Departure	✓	Nil	Minimum surface height above proposed development is 310.8m
➤ Other SIDS	✓	Nil	As Above. Lower than other Restrictions, or Outside of Protection Areas

5.1 Minimum Sector Altitudes (MSAs)

In the location of the proposed development, the circling minimum is more restrictive than the MSA: thus, there is no impact on the MSA.

5.2 Circling Minima

The proposed development lies within the circling exclusion area and so is not subject to any height limitation for circling.

5.3 Instrument Approaches, Missed Approaches & Arrivals

All instrument approach procedures were considered. The detailed results of these considerations are shown in Appendix 2.

The proposed development was assessed as being outside the tolerance areas for, or below the restrictive heights imposed by, all approach segments of the procedures.

In addition, the missed approaches were considered for all approach procedures, as well as the arrival procedures. In all cases the development was either outside the protection areas or below the critical heights.

5.4 Departures

All published Standard Instrument Departures (SID) are Based on the Radar SID. The proposed development is beneath the obstacle clearance surfaces for all Radar SIDs.

6. Conclusion

This preliminary study concludes that:

- The **proposed 505-523 George Street** building envelope **penetrates the OLS** (the Outer Horizontal Surface), **by 127.4m**. The only hindrance to approval might be a possible negative attitude by CASA to another very tall building in the CBD which is higher than the majority of surrounding buildings. A safety case would probably be required to support the airspace height application for the development.
- **The proposed building envelope (at 278.4m AHD) would not infringe any PANS-OPS surface**, and thus may be considered approvable under the Airports (Protection of Airspace) Regulations. The height of the most limiting PANS-OPS surface above the site is approximately 310m AHD. Cranes would have to be constrained to a top height no higher than 310m AHD to obtain approval. A commitment to this effect would be required as part of the building height application.

Therefore, based on the provisions of the Airports (Protection of Airspace) Regulations 1996 as amended, the only possible impediment to obtaining approval from the Department of Infrastructure and Regional Development for a building up to 278.4m AHD would be the approval from CASA for such a tall building. It is probable that CASA will require a safety case to assist their evaluation of the application.

APPENDIX 1 — ABBREVIATIONS

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

Abbreviation	Meaning
AC	Advisory Circular (document supporting CAR 1998)
ACFT	Aircraft
AD	Aerodrome
AERU	Airspace & Environmental Regulation Unit
AGL	Above Ground Local (Height)
AHD	Australian Height Datum
AHT	Aircraft Height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Services
ALARP	As Low As Reasonably Practicable
ALC	Airport Lease Company
Alt	Altitude
AMAC	Australian Mayoral Aviation Council
AMSL	Above Minimum Sea Level
ANEF	Australian Noise Exposure Forecast
ANSP	Airspace and Navigation Service Provider
APACL	Australia Pacific Airports Corporation Limited, owner of Melbourne and Launceston Airports
APARs, or A(PofA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ASDA	Accelerated Stop Distance Available
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BAC	Brisbane Airport Corporation
BCC	Brisbane City Council
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
CBD	Central Business District
CNS/ATM	Communications, Navigation, Surveillance / Air Traffic Management
CPA	Cairns Port Authority, Operators Of Cairns Airport
DAP	Departure and Approach Procedures (published by AsA)
DER	Departure End (of the) Runway
DEVELMT	Development
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DoD	Department of Defence
DODPROPS	Dependent Opposite Direction Parallel Runway OPERations
DOI&T	Department of Infrastructure and Transport (sometimes also abbreviated as Infrastructure)
EIS	Environmental Impact Study
ELEV	Elevation (above mean sea level)
ENE	East North East

Abbreviation	Meaning
ERSA	EnRoute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
Ft	Feet
GBAS	Ground-Based Augmentation System, a GNSS augmentation system to provide vertical guidance and additional precision to non-precision approaches
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GP	Glide Path
GRAS	Ground-based Regional Augmentation System: enables improved precision for enroute and for approaches to regional airports, using a similar signal to GBAS.
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
IAS	Indicated Air Speed
IPA	Integrated Planning Act 1997, Queensland State Government
ISA	International Standard Atmosphere
IVA	Independent Visual Approach
Km	Kilometres
Kt	Knot (one nautical mile per hour)
LAT	Latitude
LDA	Landing Distance Available
LLZ	Localizer
LONG	Longitude
LSALT	Lowest Safe ALTitude
M	Metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MDP	Major Development Plan
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual Of Standards, published by CASA
MP	Master Plan
MVA	Minimum Vector Altitude
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
NPR	New Parallel Runway (Project, Brisbane Airport)
OAR	Office of Airspace Regulation
OCA	Obstacle Clearance Altitude (in this case, in AMSL)
OCH	Obstacle Clearance Height
ODPROPS	Opposite Direction Parallel Runway OPERations
OHS	Outer Horizontal Surface, an Obstacle Limitation Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation – Operations, ICAO Doc 8168
RAAF	Royal Australian Air Force

Abbreviation	Meaning
PRM	Precision Runway Monitor
RAPAC	Regional Airspace users Advisory Committee
REF	Reference
RL	Relative Level
RNAV	Area NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart
RWY	Runway
SACL	Sydney Airport Corporation Limited
SID	Standard Instrument Departure
SODPROPS	(Independent) Simultaneous Opposite Direction Parallel Runway Operations
SPP	State Planning Policy, Queensland (specifically SPP 1/02: Development in the Vicinity of Certain Airports and Aviation Facilities)
SSR	Secondary Surveillance Radar
STAR	Standard Arrival
TAR	Terminal Approach Radar
TAS	True Airspeed
THR	Threshold (of Runway)
TMA	Terminal Area
TNA	Turn Altitude
TODA	Take-off Distance Available
TORA	Take-Off Runway Available
V _n	Aircraft critical velocity reference
VOR	Very high frequency Omni-directional Range
WAC	Westralia Airports Corporation, operators of Perth Airport
WAM	Wide-Area Multilateralism

APPENDIX 2 - PANS-OPS ANALYSIS

Calculations for the procedures are shown in the table below.

APPROACHES & ARRIVALS

Table 6-1 Approach Procedure Obstacle Clearance, including Calculations

<i>Procedure</i>	<i>Impact</i>	<i>Max Perm-issible Obstacle Elev (AHD)</i>	<i>Comment</i>
STARs			
All	None – outside protection areas or too high over city precinct to affect building heights	N/A	
Approaches			
DME or GPS Arrivals	Nil – beneath final segment and circling area protection surfaces	428.2	505 George Street is within Sector A and is beneath the protection area after final step-down to MDA. Closest corner of proposed development is 4.23 NM from VOR/DME. Max Obst Elev = Step Alt – MOC = 1700ft – 90m = 518.2m – 90m = 428.2m
ILS Approaches			
RWY 07 ILS-Y OR LOC-Y ILS-Z OR LOC-Z	Nil – outside lateral extent of protection surfaces	N/A	The development would be outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localizer Only protection areas.
RWY 25 ILS OR LOC	Nil – outside lateral extent of protection surfaces	N/A	The development would be outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localizer Only protection areas.
RWY 16R & PRM ILS OR LOC	Nil – outside lateral extent of protection surfaces	N/A	The development would be outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localizer Only protection areas.
RWY 34L & PRM ILS OR LOC	Nil – outside lateral extent of protection surfaces	N/A	The development would be outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localizer Only protection areas.
RWY 16L & PRM ILS-Y OR LOC-Y ILS-Z OR LOC-Z	Nil – outside lateral extent of protection surfaces	N/A	The development would be outside the lateral extent of the Basic ILS surfaces, standard OAS surfaces, OAS surfaces modified to cater for A380 and Localizer Only protection areas.

<i>Procedure</i>	<i>Impact</i>	<i>Max Permissible Obstacle Elev (AHD)</i>	<i>Comment</i>
RWY 34R & 34R PRM ILS-Y ILS-Z	Nil - beneath the missed approach surfaces associated with the OAS surfaces. Clear of Basic ILS	Missed Appr 310m	Using current published procedure with 3.3% climb gradient. SE Corner : Approx distance to edge of turn init area = 5375m Surface height = $182.9m + 5375 * 0.033 - 50m$ = $182.9m + 177.4m - 50m$ = 310.2m
RWY 34R LOC-Y & LOC-X	Nil - beneath the missed approach surfaces.	Missed Appr Approx 380m	
VOR Approaches			
RWY 07 VOR	Nil – outside lateral extent of protection surfaces	N/A	
RWY 16R VOR	Nil – outside lateral extent of protection surfaces	N/A	
RWY 25 VOR	Nil – outside lateral extent of protection surfaces	N/A	
RWY 34L VOR	Nil – outside lateral extent of protection surfaces	N/A	
RNAV (GNSS) Approaches			
RNAV-Z (GNSS) RWY 07	Nil – outside lateral extent of missed approach protection surfaces	N/A	
RNAV-Z (GNSS) RWY 16L	Nil – outside lateral extent of missed approach protection surfaces	N/A	
RNAV-Z (GNSS) RWY 16R	Nil – outside lateral extent of missed approach protection surfaces	N/A	
RNAV-Z (GNSS) RWY 25	Nil – outside lateral extent of missed approach protection surfaces	N/A	
RNAV-Z (GNSS) RWY 34L	Nil – outside lateral extent of missed approach protection surfaces	N/A	

<i>Procedure</i>	<i>Impact</i>	<i>Max Perm-issible Obstacle Elev (AHD)</i>	<i>Comment</i>
RNAV-Z (GNSS) RWY 34R	Nil - beneath the missed approach surfaces.	Approx 380m	

DEPARTURES

Table 6-2 Departure Procedure Obstacle Clearance, including Calculations

<i>Procedure</i>	<i>Impact</i>	<i>Max Perm-issible Obst Elev (AHD)</i>	<i>Comment</i>
SIDS			
SYDNEY THREE DEPARTURE (RADAR)			
RWY 07	Nil – beneath protection area	317.1m	Turn Alt = 182.9m Dist from Turn Init Area to closest point = 4771m MOC at furthest point = (3655m + 4771m)*0.008 = 67.5m therefore use MOC = 90m Dist from Turn Init Area = 4771m Max Obst Height = 182.9m + 4771m*0.047 – 90m = 182.9m + 224.2m - 90m = 317.1m
RWY 16R	Nil – beneath protection area	398.6m	Dist from Turn Init Area (600m from start of take-off) = 7153m Max Obst Height = 152.4m + 7153m *0.047 – 90m = 152.4m + 336.2m - 90m = 398.6m
RWY 16L	Nil – beneath protection area	480.7m	Dist from Turn Init Area (600m from start of take-off) = 8899m Max Obst Height = 152.4m + 8899m*0.047 – 90m = 152.4m + 418.3m - 90m = 480.7m
RWY 25	Nil – beneath protection area	558.4m	Dist from Turn Init Area (600m from start of take-off) = 7225m Max Obst Height = 243.8m + 7225m*0.056 – 90m = 243.8m + 404.6m - 90m = 558.4m
RWY 34R	Nil – beneath protection area	310.8m	Turn Alt = 152.4m Dist from Turn Init Area = 5175m Max Obst Height = 152.4m + 5175m*0.048 – 90m = 152.4m + 248.4m - 90m = 310.8m
RWY 34L	Nil – aircraft not	N/A	Because aircraft are prohibited from turning

<i>Procedure</i>	<i>Impact</i>	<i>Max Permissible Obst Elev (AHD)</i>	<i>Comment</i>
	permitted to turn right		right after reaching 600ft altitude and until they achieve 1500ft they cannot fly over the city precinct.
Other SIDs			
All	Nil	N/A	All other SIDs are based upon the Radar SIDs so none should have any greater effect upon the proposed development