For

Development Proponent

UNION FENOSA

CROOKWELL DEVELOPMENT PTY LTD

Aeronautical Impact Assessment (PANS-OPS & OLS): Crookwell 3 Wind Farm

(Doc v1.0) FINAL REPORT

3 June 2010

By

strategic airspace

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Purpose / Abstract:	*This report forms the basis of the development height application by the proponent, Crookwell Development Pty Limited (CPDL), and provides an aeronautical assessment as supporting material for consideration of the application by the authorities to be consulted as part of the evaluation process. The scope of this study is limited to the assessment of OLS and PANS-OPS under CASRs MOS Part 139 and MOS Part 173.*		
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APPENDICES

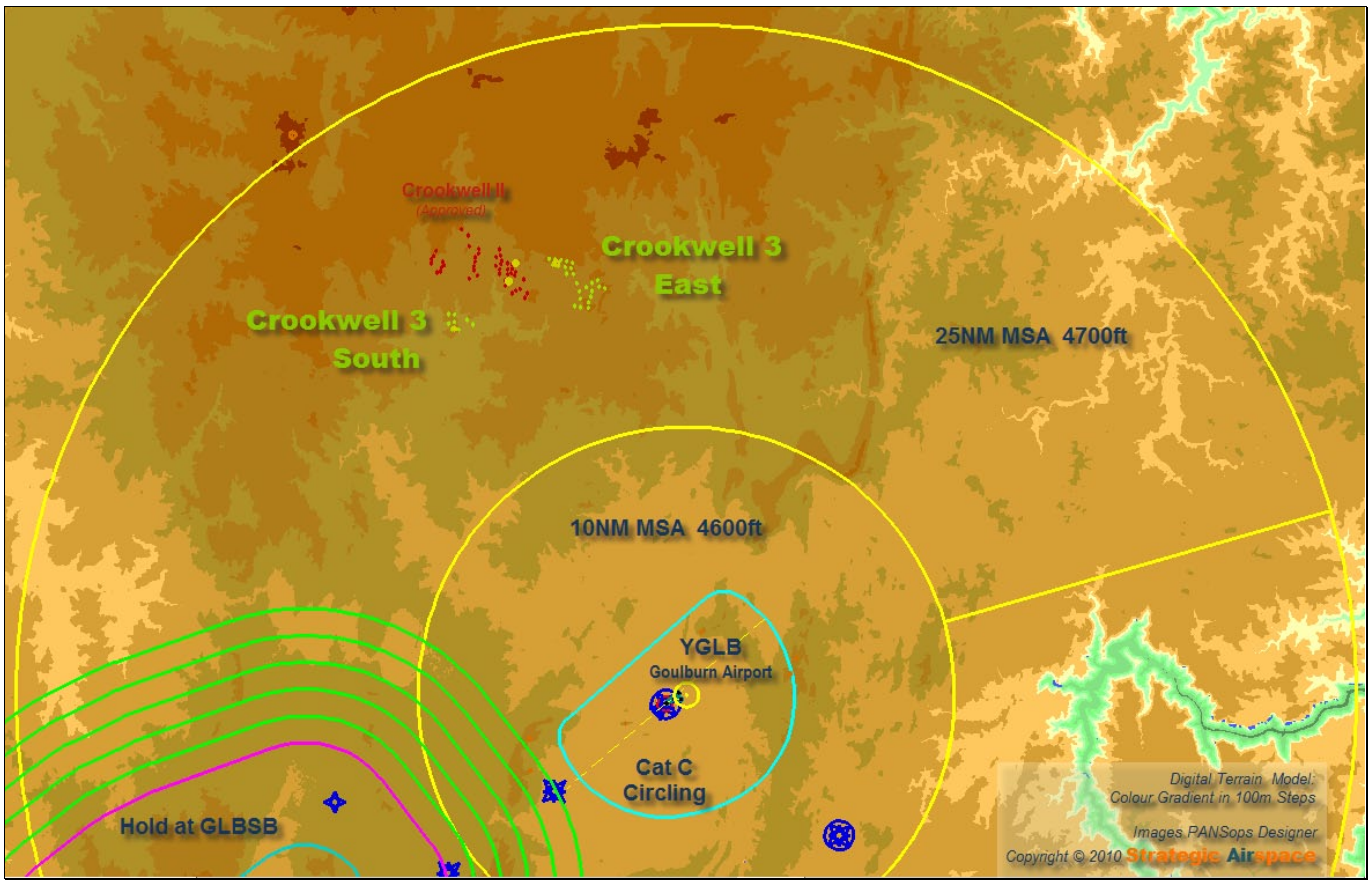
1. Introduction & Executive Summary

Strategic Airspace has prepared this report to supplement the Aviation Projects aeronautical assessment report for the proposed Crookwell 3 Wind Farm, a development of Crookwell Development Pty Limited, part of the Union Fenosa group.

As per the brief, this report focuses on potential impact of the development in relation to PANS-OPS instrument flight procedures (IFP) and Obstacle Limitation Surfaces (OLS) that relate to any aerodrome within 30km of the development site.

Goulburn Airport (ICAO Identification: YGLB) is the nearest and only registered aerodrome within 30km of the development site[1]. There are no other aerodromes within 30 nautical miles (NM) of any part of the development which have instrument flight procedures (IFPs): hence Goulburn is the only one assessed herein.

Figure 1-1 Crookwell 3 Development Context: Goulburn Airport, Key Procedures & Terrain



The proposed Crookwell 3 Wind Farm (CW3) development — comprising 33 wind turbines of up to 152m high — is located north-north-west of Goulburn Airport at a

1 The town of Crookwell, approximately 17km (9NM) to the north-west of the development area, has an unlicensed airfield but no instrument flight procedures and is thus outside the scope of this assessment.

distance of approximately 27km (15NM). The development is split into two separate sites: Crookwell 3 East (CW3-E, 25 turbines), and Crookwell 3 South (CW3-S, 8 turbines).

These sites straddle an already approved wind farm — the Crookwell II Wind Farm (46 128m high turbines) — on which construction on site commenced in mid 2009 and a smaller existing wind farm (Crookwell I) further to the north-west.

Refer to Section 2 Background & Site Description (p4) and Appendix 3 — Development Plan in Context & Wind Turbine Coordinates for further details.

The methodology applied to the preparation of this report focuses on the consideration of the influence of the development, if approved, on existing:

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

This scope of aeronautical assessment — for Goulburn Airport, as the only applicable aerodrome — was undertaken with the results summarised in the table below.

Table 1-1 Impact Summary

Procedure	*NO Impact*	*Impact*	*Issues*	*Issues & Comment*
OLS Penetration	✓	N/A		Outside OLS for Goulburn Airport, the nearest relevant airport under MOS Part 139
Shielding Surface (10%)	N/A	N/A		
GLB NDB Navaid Protection Surface	✓	N/A		Outside protection areas
MSA	✓		25NM Sector 1 Restriction: ~1132m AHD (3715ft) 10NM Inner Sector Restriction: ~1102m AHD (3615ft) Highest Obstacle A25 relevant to both sectors, but BELOW MOCA	YGLB MSA 25NM Sector 1 (published at 4700ft) CLEAR of Protection Surface 47.5m (155ft) clearance 10NM Inner Sector (published at 4600ft) CLEAR of Protection Surface 17m (55ft) clearance
Circling Minima (Cat A,B,C)	✓	N/A		Outside protection areas
Arrival, Approach Procedures & Missed Approaches				
➢ GPS Arrival	✓	N/A		Vertically and laterally separated
➢ Both published Approach Procedures	✓	N/A		Vertically and laterally separated.
Departures				
➢ None	N/A	N/A		

Procedure	*NO Impact*	*Impact*	*Issues*	*Issues & Comment*
Other Considerations				
Engine Inoperative Flight Paths	✓	N/A		Outside the usual parameters for determining engine out cases and is not assessed as a risk to this aspect of operations.

This aeronautical assessment has determined that:

- The proposed development — **Crookwell 3 — has no effect on the Obstacle Limitation Surfaces (OLS) of any airport**, the closest being Goulburn Airport (YGLB).
- **Crookwell 3 does not infringe any PANS-OPS surface** as published by Airservices Australia (DAP, Effective 03-Jun-2010).
- The proposed **development does not have a direct impact on other factors** assessed.
- Subject to development approval:
  - A separate approval may be required for the use of temporary cranes for construction, where the cranes will be higher than the maximum elevation of all turbines proposed; and
  - CASA and the RAAF AIS will have to be informed of the as-constructed details of temporary cranes during construction and thence each installed permanent wind turbine pursuant to AC 139-08(0) Reporting of Tall Structures.

Therefore, based on the scope of this assessment and the provisions of the relevant aviation regulations, there appears to be no impediment to the height approval of the development of the site as proposed, following examination of the application by the Civil Aviation Safety Authority and Airservices Australia.

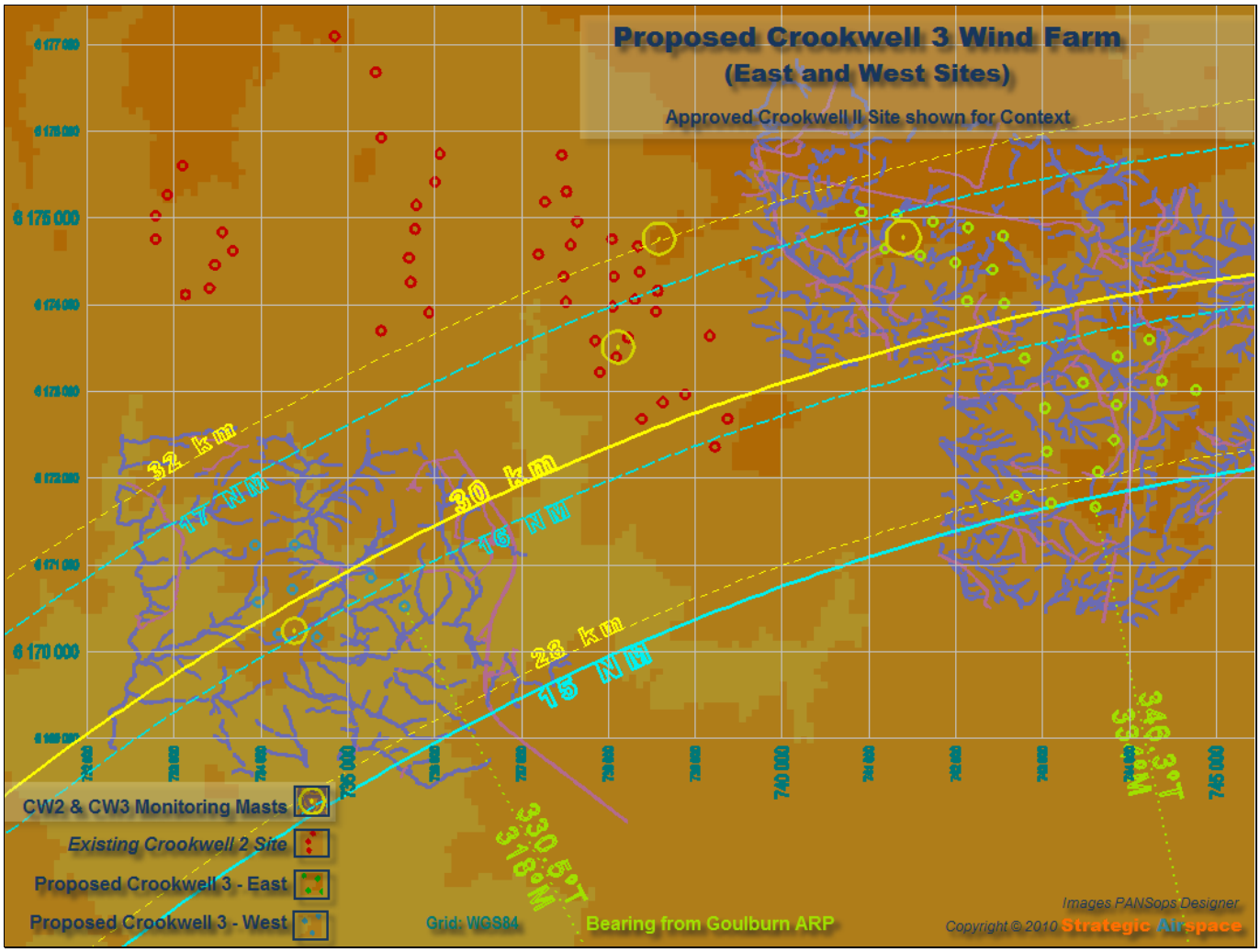
2. Background & Site Description

The proposed Crookwell 3 Wind Farm (CW3) development comprises 33 wind turbines of up to 152m high. The development site is located north-north-west of Goulburn Airport at a distance of approximately 27km (15NM).

The development is split into two separate sites: Crookwell 3 East (CW3-E, 25 turbines), and Crookwell 3 South (CW3-S, 8 turbines).

These sites straddle an already approved wind farm — the Crookwell II Wind Farm (46 128m high turbines) — on which construction on site commenced in mid 2009. The Crookwell I Wind Farm, a smaller pre-existing and operational development, is situated at the north-west corner of the Crookwell II Wind Farm.

Figure 2-1 Crookwell 3 Development - Distance & Bearing from Goulburn Airport



Wind turbine details, other site context information and full-page views of the above and other images are contained in Appendix 3 — Development Plan in Context & Wind Turbine Coordinates.

3. Methodology

3.1 Standard Methodology as Basis of Study

The report considers the existing Goulburn Airport facilities only, having confirmed that no other aerodromes required assessment within the scope of this study.

The report assumes no change to the existing configuration or pattern of the runways.

The primary types of airspace "limiting surfaces" assessed for potential impact by the proposed development relate to:

- the Obstacle Limitation Surfaces (OLS), pursuant to Civil Aviation Safety Regulations (CASR) Manual of Standards (MOS) Part 139; and
- the Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) surfaces, pursuant to CASR MOS Part 173.

Other aspects related directly to the efficacy of the above — such as navaid protection and contingency procedures — we also assessed.

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 based on the proposed turbine locations and heights provided by the proponent. Refer Section 4.
2	**Shielding by Existing Obstacles**	The potential shielding by any existing obstacles penetrating the OLS was assessed in relation to CASA standards. Refer Section 4.2.
3	**Instrument Approach Procedures**	The relevant instrument flight procedures (IFPs) were examined to determine whether the development would impose any restriction on those procedures. Refer Section 5.
4	**Contingency Procedures**	The influence that development on the site would have on contingency (CAO 20.7.1B)[2] procedures was considered. This consideration was extended to include any impediment to these procedures as a result of existing obstacles and possible and

2 In this context, this Civil Aviation Order (CAO 20.7.1B) relates to minimum requirements for clearance of obstacles by an aircraft that has suffered failure of a critical engine (engine-out performance) during a take-off. The contingency (or engine-out, or engine-inoperative) procedures analyse the minimum safe altitudes (and therefore relate to maximum permissible obstacle heights) required in such a circumstance. Refer also http://www.casa.gov.au/download/Orders/Cao20/200701b.pdf: Sections 7 Take-Off Climb Performance, and 12 Obstacle Clearance Requirements.

#	*Phase*	*Description*
		feasible flight paths from the airport over the development site. Refer Section 5.5.
5	**Other Issues**	Consideration was given to the potential feasible changes to instrument approach procedures and any influence the proposed development would have on those procedures, as well as other aspects that would support the feasibility of procedures to/from the airport. Refer Section 6.
6	**Mitigating Factors & Proposals**	Mitigating factors includes consideration of existing precedents is evaluated, if required. If applicable, options for mitigations to improve the safety impact of the proposal are also offered. *As the development had no adverse impact on existing airspace constraints on this occasion (within the scope of this study), no mitigation study was conducted.*
7	**Summary & Conclusions**	A concise summary of findings and conclusion as to whether the proposal should be approved. Refer Section 1.

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

The analysis of the proposed development in relation to the Obstacle Limitation Surfaces (OLS) and any relief that may be provided by shielding of the development by existing obstacles was conducted with reference to the CASA Standards for Obstacle Restriction and Limitation[3] — part of CASR MOS Part 139.

Analysis has determined that the proposed development has NO IMPACT on the OLS of the closest aerodrome, Goulburn.

4.1 OLS Analysis

The entire proposed development is outside the extent of the OLS for Goulburn Airport. The closest of the proposed wind turbines is more than 12.6km (6.8NM) from the edge of the OLS Outer Horizontal Surface.

4.2 Shielding

As all obstacles proposed are outside the Goulburn OLS surfaces, there is not requirement to consider shielding.

4.3 Combined OLS & Shielding Surfaces

Not applicable — refer OLS impact only.

3 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

5. Analysis of PANS-OPS Surfaces

Assessment of impact by the proposed development plan was undertaken with respect to instrument procedures for Goulburn Airport (YGLB) — as published in the AIP Departures & Approach Procedures (DAP), Amendment 123, Effective 03-Jun-2010.

These are summarised by procedure type below. Additional detail can be found in Appendix 4 — PANS-OPS Analysis.

In summary, the **proposed development has no impact on PANS-OPS procedures**.

5.1 Minimum Sector Altitudes (MSAs)

The proposed development is located wholly within the lateral area of the north-west sector of the MSA. The highest of the proposed turbines is below the minimum obstacle clearance altitude (MOCA) of the relevant MSA sectors, and thus the development has no adverse impact.

Figure 5-1 CW3 Turbines in relation to Goulburn MSA

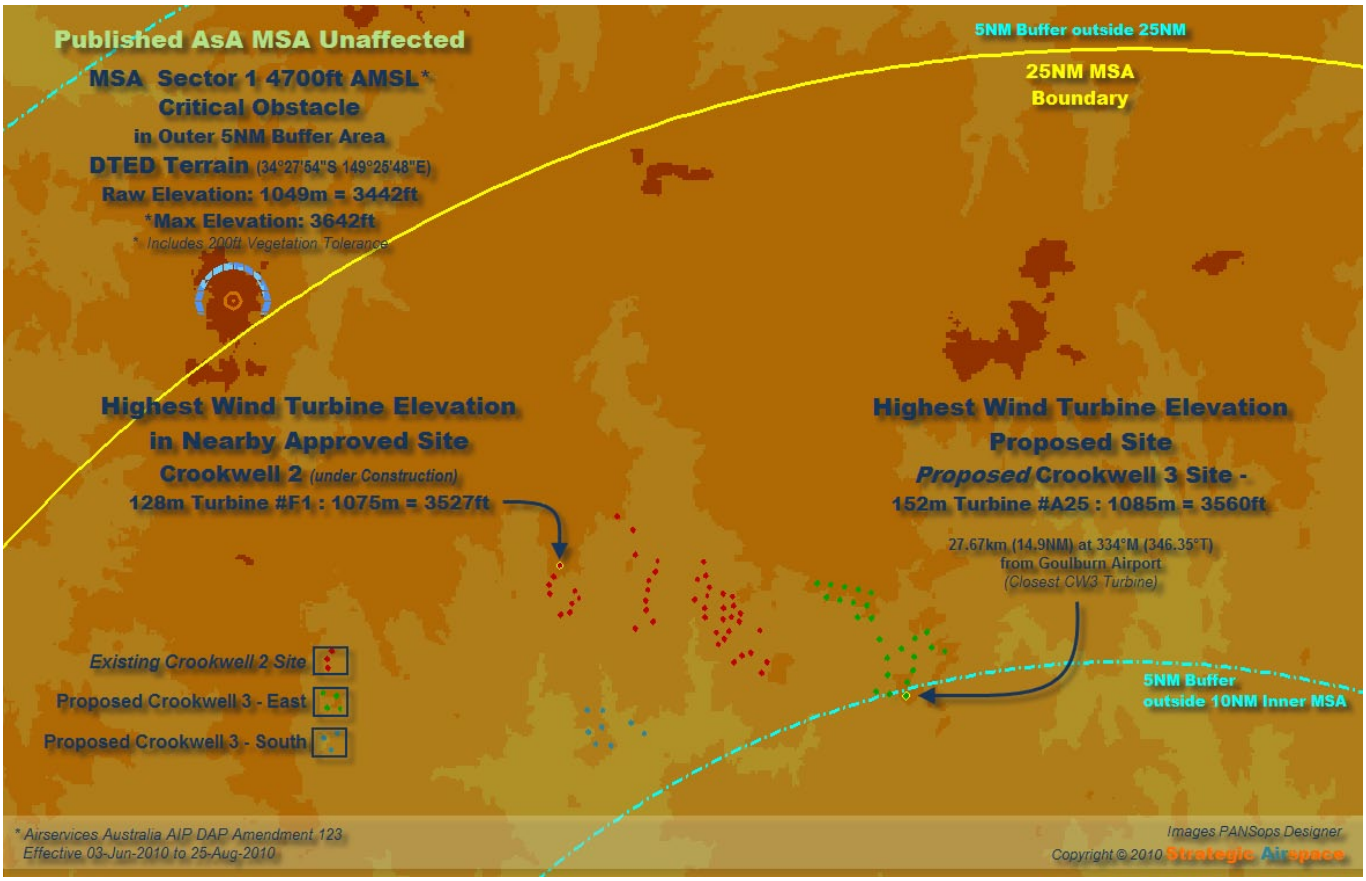


Table 5-1 Summary of Circling (Visual Manoeuvring) Impact

Procedure	*Impact*	*Max Permissible Obst Elev (AHD)*	*Comment*
MSA			
25NM Sector 1 (NW)	Nil - Below MOCA	3715 ft 1132.5 m	All obstacles within 25NM MSA Sector 1. Highest of proposed obstacles — Turbine A25, max elevation 1085m — is below the height restriction.
10NM Inner Sector	Nil - Below MOCA	3616 ft 1102.0 m	Highest of proposed obstacles — Turbine A25, max elevation 1085m — is located within the 5NM buffer area outside the 10NM sector. It is below the height restriction.

5.2 Circling Minima

All circling for Goulburn is restricted outside of 2NM north of RWY 04/22. The Crookwell 3 development is located well outside the Cat C circling area, and so there is no impact on the procedure.

Table 5-2 Summary of Circling (Visual Manoeuvring) Impact

Procedure	*Impact*	*Max Permissible Obst Elev (AHD)*	*Comment*
Circling			
Cat A, B, C	Nil	N/A	Outside protection areas

5.3 Instrument Approaches, Missed Approaches & Arrivals

All instrument approach procedures were considered.

The proposed development was assessed as being outside the protection areas for all arrival and approach procedures, as summarised below.

Table 5-3 Summary of Approach Procedure Obstacle Clearance

Procedure	*Impact*	*Max Perm-issible Obst Elev (AHD)*	*Comment*
Approaches			
NDB-A	Nil	N/A	Outside protection areas
RNAV(GNSS) RWY 04	Nil	N/A	Outside protection areas For information: nearest turbine is laterally separated from outer protection area of Hold at GLBSB by > 21.4km (11.5NM)
STARS			
GPS Arrival	Nil	N/A	Laterally (and vertically) separated

5.4 Departures

There are no published departures for Goulburn.

Table 5-4 Summary of Departure Procedure Impact

Procedure	*Impact*	*Max Perm-issible Obst Elev (AHD)*	*Comment*
SIDS			
N/A	N/A	N/A	No SIDs

5.5 Engine Inoperative Flight Paths

The development area is outside of the extent normally considered for Engine Out procedures. Additionally, given that the development lies in and on areas of rising terrain, and there are many other lower escape paths for aircraft within and around the Goulburn region, it is considered that the development poses no impact on such contingency requirements.

6. Other Issues

6.1 Radar Interference & Shadowing

In consideration of the proposed development height, location and distance from radar and associated control zones, it is considered that the development will be considered approvable by Airservices Australia.

6.2 Minimum Enroute & Minimum Vector Altitudes

It is considered, based on available data, that the proposed maximum elevation of the turbines in this development will not affect the minimum altitudes associated with published routes or radar traffic due to coverage by the Goulburn MSA, and additionally due to existing approved obstacles and terrain in the vicinity.

6.3 Future Developments

Given the terrain and built environment around Goulburn Airport, and the existing runway configuration, it is considered highly unlikely that the proposed development would preclude the introduction of new safe and efficient IFPs (conventional, RNAV and RNP) to/from Goulburn Airport.

APPENDIX 1 — PROJECT RESOURCES

THE PROJECT TEAM

The consultants involved in the preparation of this report for the Strategic Airspace comprise personnel with extensive experience in and knowledge of PANS-OPS procedure design criteria and its application in Australia under MOS Part 173 as well as ICAO Annex 14 and Obstacle Limitation Surfaces under MOS Part 139.

DATA

Aerodrome, instrument flight procedure and waypoint data were sourced from the Airservices AIP, including ERSA, DAH and DAP, Effective 03-Jun-2010.

The wind turbine and monitoring mast coordinates, plus background mapping and 1m topographic contour data was provided by the proponent, Union Fenosa.

Additional digital terrain model (DTM) data sourced from SRTM v2.1, formatted as DTED Level 1, was also used for 3D analysis of terrain by software.

The 1m topographic data and the DTM data were compared and found to be consistent within a maximum vertical variation of approximately 2m.

The consultants generated all other graphic data as part of their 3D aeronautical analyses.

SOFTWARE TOOLS USED

Strategic Airspace's ***PANSops Designer*** and ***OLSplanner*** were used for analysis and design of sample procedures. Copyright of any images produced from this software, included herein or provided separately, remains with Strategic Airspace. Permission is granted to the project client - the proponent, Crookwell Development Pty Ltd and Union Fenosa – to use these as deemed necessary in relation to the subject matter of this report and the overall objectives of this project.

APPENDIX 2 — 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
APARs, or A(PofA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
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
DAH	Designated Airspace Handbook (published by AsA)
DAP	Departure and Approach Procedures (published by AsA)
DER	Departure End (of the) Runway
DEVELMT	Development
DITRDLG	Department of Infrastructure, Transport, Regional Development and Local Government
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DoD	Department of Defence
DODPROPS	Dependent Opposite Direction Parallel Runway OPerations
EIS	Environmental Impact Study
ELEV	Elevation (above mean sea level)
ENE	East North East
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

Abbreviation	*Meaning*
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GP	Glide Path
GPI	Glide Path Inoperative
IAC	Instrument Approach Chart
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
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
LLZ	Localizer
LNAV	Lateral Navigation (RNAV procedure not using VNAV)
LONG	Longitude
LSALT	Lowest Safe ALTitude
M	Metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MDP	Major Development Plan
MEA	Minimum Enroute Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOCA	Minimum Obstacle Clearance Altitude
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
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
PBN	Performance Based Navigation
RAAF	Royal Australian Air Force
PRM	Precision Runway Monitor
RAPAC	Regional AirsPace users Advisory Committee
REF	Reference
RL	Relative Level

Abbreviation	*Meaning*
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RNP-AR	Required Navigation Performance — Authorisation Required
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart
RWY	Runway
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
V_n	Aircraft critical velocity reference
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR	Very high frequency Omni-directional Range
WAM	Wide-Area Multilateration

APPENDIX 3 — DEVELOPMENT PLAN IN CONTEXT & WIND TURBINE COORDINATES

LOCATION CONTEXT

The Crookwell 3 Wind Farm proposed development is split into two separate sites: Crookwell 3 East (CW3-E) and, to the south-west, Crookwell 3 South (CW3-S).

The development is located at approximately 27km (15NM) from Goulburn Airport (YGLB). The nearest point of the development (the northern point of CW3-S) is also located approximately 15km (8NM) at a bearing 150°T of the small community of Crookwell, which has an unlicensed landing airfield.

The two sites straddle an already approved wind farm — the Crookwell II Wind Farm, on which construction on site commenced in mid 2009. The existing and operational Crookwell I Wind Farm lies to the north of Crookwell II. The interrelationship between the Crookwell II and proposed Crookwell 3 sites, and the turbines in each development, are depicted in Figure 1-1 and Figure 2-1 (see the next pages for full page versions).

The following table summarises the extent of each development site, as illustrated in the images below, in relation to Goulburn Airport.

Table 6-1: Distances & Bearings of Site from Goulburn Airport

	Distance from Goulburn Airport				*Bearing from Goulburn Airport*	
	Closest Turbine		*Furthest Turbine*		*Western Turbine*	*Eastern Turbine*
Site	*(km)*	*(NM)*	*(km)*	*(NM)*	*(°T)*	*(°T)*
CW-E	27.7	14.9	31.6	17.1	342.9	349.2
CW-S	29.3	15.8	30.8	16.6	327.7	330.5

** Distances and Bearings measured from Goulburn Airport's Aerodrome Reference Point (ARP).*

COORDINATES & ELEVATIONS OF PROPOSED TURBINES

The data provided in the table below are based on data provided by the developer. WGS84 coordinates were calculated from the MGA94 UTM Easting and Northing coordinates provided. Maximum Elevations for each feature is based on the ground elevation provided and the maximum feature height AGL.

Source data files were:

- 20100519 - Crookwell 3, Mast Coordinates for Assessment by Airservices Australia.xls
- 20100312 - Crookwell 3, Turbine Coordinates v1.xls
- 20081204 - Crookwell II, Turbine Coordinates (for Reference Only).xls

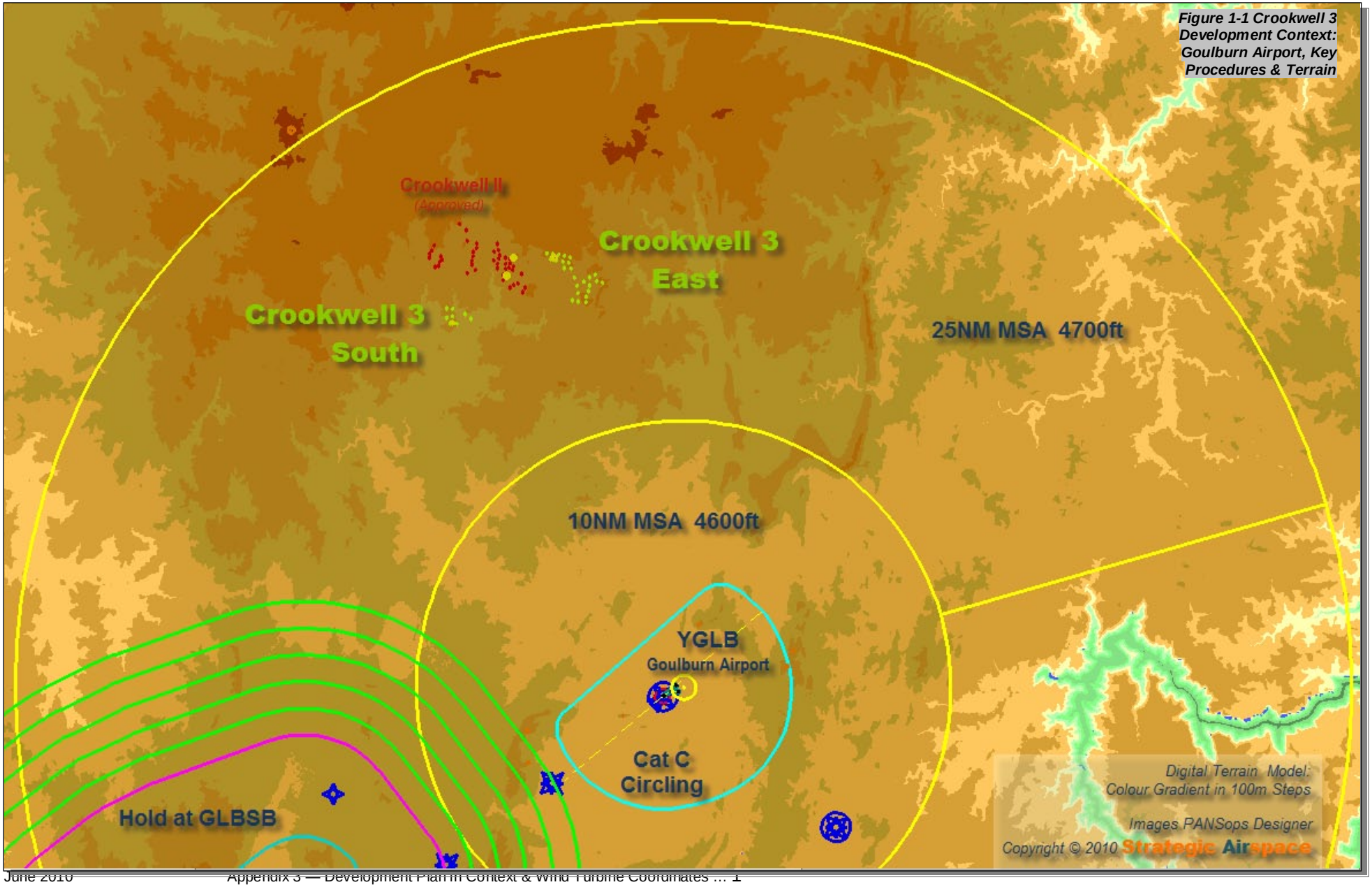


Figure 1-1 Crookwell 3 Development Context: Goulburn Airport, Key Procedures & Terrain

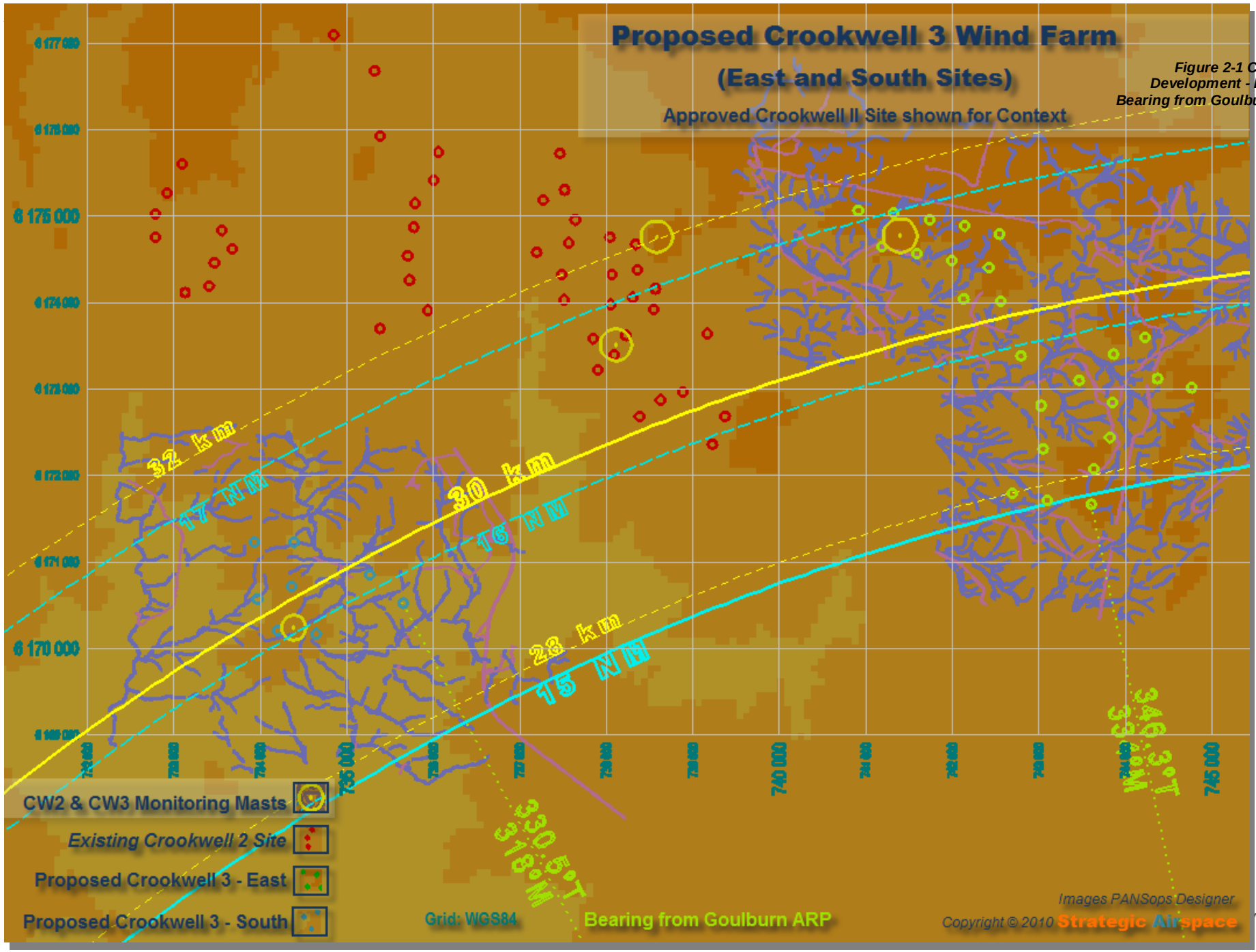


Figure 2-1 Crookwell 3 Development - Distance & Bearing from Goulburn Airport

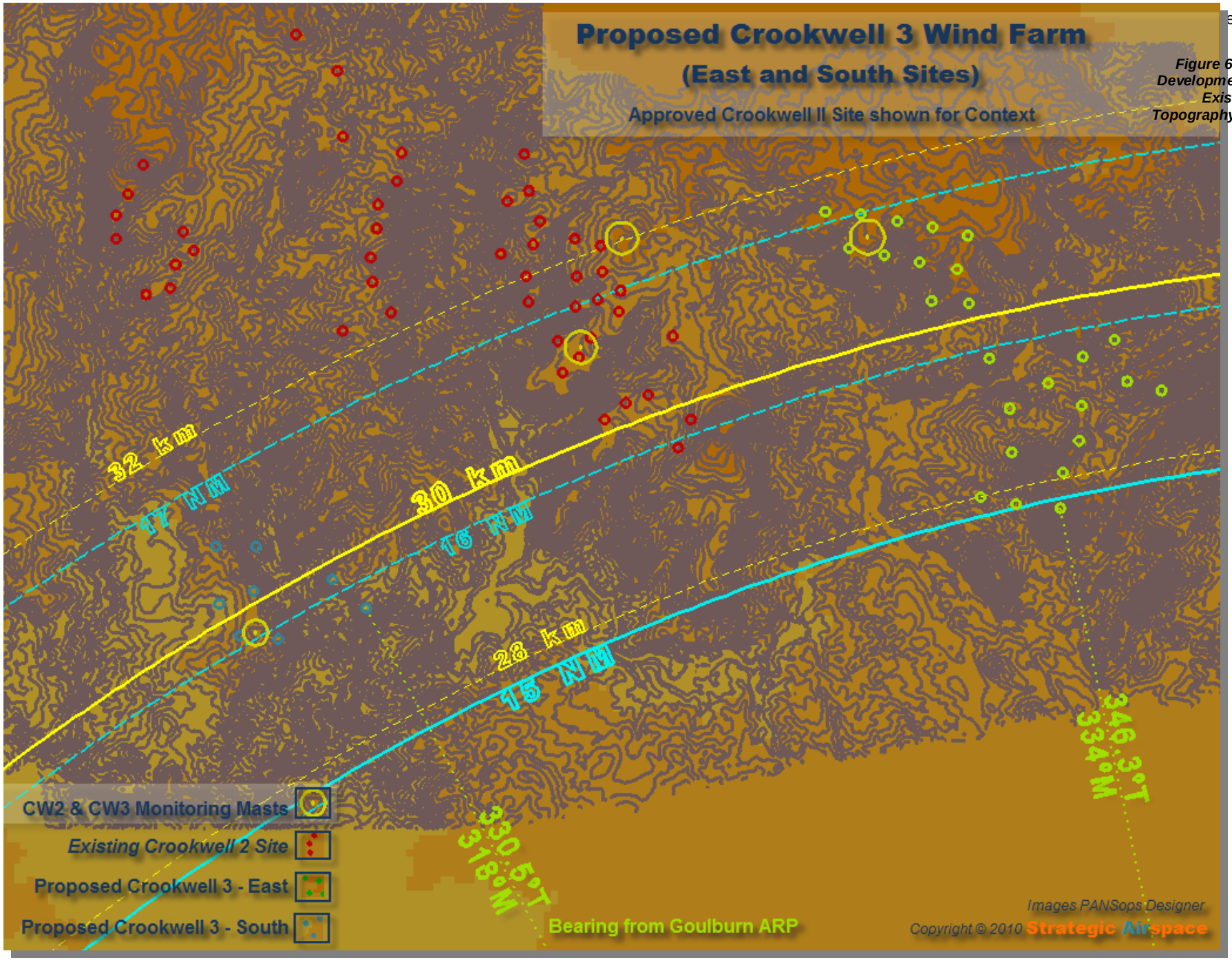


Figure 6-1 : Crookwell 3 Development in relation to Existing CWII Site & Topography (5m Contours)

Table 6-2: Actual, Approved & Proposed Turbine & Monitoring Mast Details

					WGS84 Lat/Long					WGS84 Lat/Long								MGA94	
TurbineID	*Status*	*Type*	*Description*	*Lighting*	*Latitude (text)*	*Longitude (text)*	*Top Elev m AMSL*	*Ground Elev m AMSL*	*Mast Hgt AGL*	*Lat*	*Lat Deg*	*Lat Min*	*Lat Sec*	*Long*	*Long Deg*	*Long Min*	*Long Sec*	*UTM-X Easting (m)*	*UTM-Y Northing (m)*
Wind Monitors - Installed																			
CW2-Monitor	Installed	Mast-WindMonitor	Tubular (with guy wires and anchors on 4 sides)	N	S343228.48	E1493559.36	953	953	40	S	34	32	28.4761	E	149	35	59.3607	738584	6174759
CW2-Monitor	Installed	Mast-WindMonitor	Lattice (with guy wires and anchors on 3 sides)	N	S343309.25	E1493542.19	953	953	80	S	34	33	9.2458	E	149	35	42.1940	738114	6173514
CW3-Monitor Nth	Installed	Mast-WindMonitor	Tubular (with guy wires and anchors on 4 sides)	N	S343225.60	E1493749.55	975	975	60	S	34	32	25.5954	E	149	37	49.5536	741396	6174775
CW3-Monitor Sth	Installed	Mast-WindMonitor	Tubular (with guy wires and anchors on 4 sides)	N	S343458.38	E1493319.30	884	884	60	S	34	34	58.3845	E	149	33	19.3045	734386	6170244
Crookwell 3 Development Proposal																			
A1	Proposed	WindTurbine	CW3 - East	UNK	S343216.60	E1493730.21	1063	911	152	S	34	32	16.6006	E	149	37	30.2109	740910	6175065
A2	Proposed	WindTurbine	CW3 - East	UNK	S343217.13	E1493746.23	1063	911	152	S	34	32	17.1320	E	149	37	46.2283	741318	6175038
A3	Proposed	WindTurbine	CW3 - East	UNK	S343219.27	E1493802.81	1071	919	152	S	34	32	19.2733	E	149	38	2.8062	741739	6174961
A4	Proposed	WindTurbine	CW3 - East	UNK	S343221.30	E1493818.67	1075	923	152	S	34	32	21.2996	E	149	38	18.6748	742142	6174888
A5	Proposed	WindTurbine	CW3 - East	UNK	S343224.04	E1493834.57	1068	916	152	S	34	32	24.0387	E	149	38	34.5662	742545	6174793
A6	Proposed	WindTurbine	CW3 - East	UNK	S343229.89	E1493741.41	1048	896	152	S	34	32	29.8924	E	149	37	41.4137	741185	6174648
A7	Proposed	WindTurbine	CW3 - East	UNK	S343232.08	E1493757.29	1042	890	152	S	34	32	32.0815	E	149	37	57.2879	741588	6174570
A8	Proposed	WindTurbine	CW3 - East	UNK	S343234.43	E1493813.21	1063	911	152	S	34	32	34.4314	E	149	38	13.2066	741992	6174487
A9	Proposed	WindTurbine	CW3 - East	UNK	S343236.76	E1493829.99	1066	914	152	S	34	32	36.7620	E	149	38	29.9878	742418	6174404
A10	Proposed	WindTurbine	CW3 - East	UNK	S343248.78	E1493819.15	1045	893	152	S	34	32	48.7769	E	149	38	19.1504	742132	6174041
A11	Proposed	WindTurbine	CW3 - East	UNK	S343249.10	E1493835.79	1050	898	152	S	34	32	49.0982	E	149	38	35.7904	742556	6174020
A12	Proposed	WindTurbine	CW3 - East	UNK	S343309.59	E1493845.73	1038	886	152	S	34	33	9.5876	E	149	38	45.7348	742793	6173382
A13	Proposed	WindTurbine	CW3 - East	UNK	S343318.13	E1493912.40	1020	868	152	S	34	33	18.1276	E	149	39	12.4039	743466	6173101
A14	Proposed	WindTurbine	CW3 - East	UNK	S343307.93	E1493927.65	1027	875	152	S	34	33	7.9301	E	149	39	27.6517	743863	6173405
A15	Proposed	WindTurbine	CW3 - East	UNK	S343301.36	E1493941.80	1048	896	152	S	34	33	1.3584	E	149	39	41.7981	744229	6173598
A16	Proposed	WindTurbine	CW3 - East	UNK	S343327.88	E1493855.34	1023	871	152	S	34	33	27.8773	E	149	38	55.3364	743023	6172812
A17	Proposed	WindTurbine	CW3 - East	UNK	S343326.10	E1493927.76	1032	880	152	S	34	33	26.1012	E	149	39	27.7592	743851	6172845
A18	Proposed	WindTurbine	CW3 - East	UNK	S343316.64	E1493947.78	1055	903	152	S	34	33	16.6429	E	149	39	47.7766	744369	6173123
A19	Proposed	WindTurbine	CW3 - East	UNK	S343319.77	E1494003.53	1082	930	152	S	34	33	19.7712	E	149	40	3.5272	744768	6173016
A20	Proposed	WindTurbine	CW3 - East	UNK	S343344.10	E1493856.87	1032	880	152	S	34	33	44.1027	E	149	38	56.8710	743049	6172311

					WGS84 Lat/Long					WGS84 Lat/Long								MGA94	
TurbineID	*Status*	*Type*	*Description*	*Lighting*	*Latitude (text)*	*Longitude (text)*	*Top Elev m AMSL*	*Ground Elev m AMSL*	*Mast Hgt AGL*	*Lat*	*Lat Deg*	*Lat Min*	*Lat Sec*	*Long*	*Long Deg*	*Long Min*	*Long Sec*	*UTM-X Easting (m)*	*UTM-Y Northing (m)*
A21	Proposed	WindTurbine	CW3 - East	UNK	S343339.30	E1493926.88	1048	896	152	S	34	33	39.2960	E	149	39	26.8847	743818	6172439
A22	Proposed	WindTurbine	CW3 - East	UNK	S343351.23	E1493920.05	1056	904	152	S	34	33	51.2253	E	149	39	20.0462	743634	6172076
A23	Proposed	WindTurbine	CW3 - East	UNK	S343400.98	E1493843.28	1013	861	152	S	34	34	0.9809	E	149	38	43.2836	742689	6171800
A24	Proposed	WindTurbine	CW3 - East	UNK	S343403.29	E1493859.36	1024	872	152	S	34	34	3.2930	E	149	38	59.3631	743097	6171718
A25	Proposed	WindTurbine	CW3 - East	UNK	S343404.45	E1493919.33	1085	933	152	S	34	34	4.4491	E	149	39	19.3292	743605	6171669
A26	Proposed	WindTurbine	CW3 - South	UNK	S343426.62	E1493300.36	977	825	152	S	34	34	26.6195	E	149	33	0.3621	733928	6171235
A27	Proposed	WindTurbine	CW3 - South	UNK	S343426.50	E1493318.52	943	791	152	S	34	34	26.4991	E	149	33	18.5243	734391	6171227
A28	Proposed	WindTurbine	CW3 - South	UNK	S343448.19	E1493302.51	951	799	152	S	34	34	48.1886	E	149	33	2.5123	733966	6170569
A29	Proposed	WindTurbine	CW3 - South	UNK	S343442.96	E1493318.01	971	819	152	S	34	34	42.9638	E	149	33	18.0082	734365	6170720
A30	Proposed	WindTurbine	CW3 - South	UNK	S343459.58	E1493311.96	962	810	152	S	34	34	59.5767	E	149	33	11.9640	734198	6170212
A31	Proposed	WindTurbine	CW3 - South	UNK	S343500.47	E1493329.65	976	824	152	S	34	35	0.4718	E	149	33	29.6492	734648	6170173
A32	Proposed	WindTurbine	CW3 - South	UNK	S343437.91	E1493353.28	955	803	152	S	34	34	37.9072	E	149	33	53.2840	735268	6170853
A33	Proposed	WindTurbine	CW3 - South	UNK	S343448.23	E1493408.55	951	799	152	S	34	34	48.2306	E	149	34	8.5508	735649	6170525
Crookwell II (Adjacent Site) - Approved, Construction Commenced (for Context)																			
F1	Approved	WindTurbine	CW2	UNK	S343205.44	E1493223.54	1075	947	128	S	34	32	5.4352	E	149	32	23.5418	733099	6175609
F2	Approved	WindTurbine	CW2	UNK	S343216.58	E1493216.90	1039	911	128	S	34	32	16.5752	E	149	32	16.8995	732921	6175270
F3	Approved	WindTurbine	CW2	UNK	S343224.50	E1493211.77	1028	900	128	S	34	32	24.5033	E	149	32	11.7672	732784	6175029
F4	Approved	WindTurbine	CW2	UNK	S343233.29	E1493212.27	1016	888	128	S	34	32	33.2878	E	149	32	12.2692	732790	6174758
F5	Approved	WindTurbine	CW2	UNK	S343230.20	E1493242.14	1010	882	128	S	34	32	30.1994	E	149	32	42.1395	733554	6174834
F6	Approved	WindTurbine	CW2	UNK	S343236.91	E1493247.21	1002	874	128	S	34	32	36.9090	E	149	32	47.2073	733678	6174624
F7	Approved	WindTurbine	CW2	UNK	S343242.43	E1493239.14	999	871	128	S	34	32	42.4321	E	149	32	39.1391	733468	6174459
F8	Approved	WindTurbine	CW2	UNK	S343251.11	E1493237.13	1000	872	128	S	34	32	51.1067	E	149	32	37.1283	733410	6174193
F9	Approved	WindTurbine	CW2	UNK	S343253.74	E1493226.23	1000	872	128	S	34	32	53.7354	E	149	32	26.2259	733130	6174119
F10	Approved	WindTurbine	CW2	UNK	S343115.81	E1493330.69	1040	912	128	S	34	31	15.8065	E	149	33	30.6912	734850	6177095
F11	Approved	WindTurbine	CW2	UNK	S343128.91	E1493349.60	1020	892	128	S	34	31	28.9105	E	149	33	49.6001	735322	6176679
F12	Approved	WindTurbine	CW2	UNK	S343153.18	E1493352.74	1023	895	128	S	34	31	53.1848	E	149	33	52.7367	735383	6175929
F16	Approved	WindTurbine	CW2	UNK	S343305.44	E1493354.95	997	869	128	S	34	33	5.4446	E	149	33	54.9547	735383	6173701
F17	Approved	WindTurbine	CW2	UNK	S343258.08	E1493416.50	994	866	128	S	34	32	58.0786	E	149	34	16.4975	735938	6173914
F18	Approved	WindTurbine	CW2	UNK	S343246.90	E1493407.84	998	870	128	S	34	32	46.9023	E	149	34	7.8385	735726	6174264
F19	Approved	WindTurbine	CW2	UNK	S343237.91	E1493406.62	1020	892	128	S	34	32	37.9059	E	149	34	6.6206	735702	6174542
F20	Approved	WindTurbine	CW2	UNK	S343227.11	E1493409.19	1013	885	128	S	34	32	27.1096	E	149	34	9.1909	735776	6174873
F21	Approved	WindTurbine	CW2	UNK	S343218.05	E1493409.34	998	870	128	S	34	32	18.0519	E	149	34	9.3439	735787	6175152

					WGS84 Lat/Long					WGS84 Lat/Long								MGA94	
TurbineID	Status	Type	Description	Lighting	Latitude (text)	Longitude (text)	Top Elev m AMSL	Ground Elev m AMSL	Mast Hgt AGL	Lat	Lat Deg	Lat Min	Lat Sec	Long	Long Deg	Long Min	Long Sec	UTM-X Easting (m)	UTM-Y Northing (m)
F22	Approved	WindTurbine	CW2	UNK	S343209.31	E1493417.70	1007	879	128	S	34	32	9.3081	E	149	34	17.7028	736007	6175416
F23	Approved	WindTurbine	CW2	UNK	S343158.59	E1493419.45	994	866	128	S	34	31	58.5941	E	149	34	19.4516	736060	6175745
F24	Approved	WindTurbine	CW2	UNK	S343158.11	E1493514.46	1021	893	128	S	34	31	58.1130	E	149	35	14.4559	737463	6175724
F25	Approved	WindTurbine	CW2	UNK	S343211.69	E1493516.99	1006	878	128	S	34	32	11.6896	E	149	35	16.9939	737517	6175304
F26	Approved	WindTurbine	CW2	UNK	S343215.65	E1493507.55	1010	882	128	S	34	32	15.6544	E	149	35	7.5476	737273	6175188
F27	Approved	WindTurbine	CW2	UNK	S343222.91	E1493522.17	999	871	128	S	34	32	22.9061	E	149	35	22.1652	737640	6174955
F28	Approved	WindTurbine	CW2	UNK	S343231.40	E1493519.60	994	866	128	S	34	32	31.3983	E	149	35	19.6045	737568	6174695
F29	Approved	WindTurbine	CW2	UNK	S343235.44	E1493505.10	989	861	128	S	34	32	35.4379	E	149	35	5.1006	737195	6174580
F30	Approved	WindTurbine	CW2	UNK	S343243.50	E1493516.72	995	867	128	S	34	32	43.4996	E	149	35	16.7241	737485	6174324
F31	Approved	WindTurbine	CW2	UNK	S343252.85	E1493517.96	985	857	128	S	34	32	52.8524	E	149	35	17.9552	737509	6174035
F32	Approved	WindTurbine	CW2	UNK	S343307.26	E1493531.66	992	864	128	S	34	33	7.2629	E	149	35	31.6595	737847	6173582
F33	Approved	WindTurbine	CW2	UNK	S343228.99	E1493538.12	1002	874	128	S	34	32	28.9930	E	149	35	38.1199	738042	6174757
F34	Approved	WindTurbine	CW2	UNK	S343242.99	E1493539.30	1006	878	128	S	34	32	42.9877	E	149	35	39.2996	738061	6174325
F35	Approved	WindTurbine	CW2	UNK	S343254.12	E1493539.21	999	871	128	S	34	32	54.1210	E	149	35	39.2139	738050	6173982
F36	Approved	WindTurbine	CW2	UNK	S343231.50	E1493549.85	1016	888	128	S	34	32	31.5021	E	149	35	49.8460	738339	6174672
F37	Approved	WindTurbine	CW2	UNK	S343240.83	E1493550.92	1023	895	128	S	34	32	40.8258	E	149	35	50.9203	738359	6174384
F38	Approved	WindTurbine	CW2	UNK	S343251.31	E1493549.13	1011	883	128	S	34	32	51.3139	E	149	35	49.1284	738305	6174062
F39	Approved	WindTurbine	CW2	UNK	S343247.92	E1493559.30	1017	889	128	S	34	32	47.9169	E	149	35	59.2988	738567	6174160
F40	Approved	WindTurbine	CW2	UNK	S343255.72	E1493558.64	1012	884	128	S	34	32	55.7197	E	149	35	58.6395	738544	6173920
F41	Approved	WindTurbine	CW2	UNK	S343305.65	E1493546.51	1002	874	128	S	34	33	5.6489	E	149	35	46.5146	738227	6173622
F42	Approved	WindTurbine	CW2	UNK	S343313.16	E1493541.37	999	871	128	S	34	33	13.1576	E	149	35	41.3741	738090	6173394
F43	Approved	WindTurbine	CW2	UNK	S343318.73	E1493534.17	996	868	128	S	34	33	18.7304	E	149	35	34.1728	737902	6173227
F44	Approved	WindTurbine	CW2	UNK	S343304.12	E1493623.30	1016	888	128	S	34	33	4.1183	E	149	36	23.2981	739166	6173645
F45	Approved	WindTurbine	CW2	UNK	S343326.41	E1493613.05	1000	872	128	S	34	33	26.4052	E	149	36	13.0494	738887	6172965
F46	Approved	WindTurbine	CW2	UNK	S343329.45	E1493602.79	991	863	128	S	34	33	29.4475	E	149	36	2.7883	738623	6172878
F47	Approved	WindTurbine	CW2	UNK	S343335.97	E1493553.50	987	859	128	S	34	33	35.9738	E	149	35	53.4984	738381	6172683
F48	Approved	WindTurbine	CW2	UNK	S343335.01	E1493632.38	1014	886	128	S	34	33	35.0142	E	149	36	32.3825	739373	6172687
F50	Approved	WindTurbine	CW2	UNK	S343345.74	E1493626.99	1005	877	128	S	34	33	45.7416	E	149	36	26.9903	739227	6172360

APPENDIX 4 — PANS-OPS ANALYSIS

Analysis of the extent and relevance of PANS-OPS protection areas and minimum obstacle clearance altitudes for current procedures for Goulburn Airport (YGLB) — Airservices Australia DAP Am 123, Effective 03-Jun-2010 — was also conducted using the *PANSops Designer* software tool.

The entire development area is outside (laterally separated from) the protection areas for:

- ✈ the arrival,
- ✈ the circling (visual manoeuvring) area (no circling outside 2NM to the north of RWY 04/22); and
- ✈ the two (2) published instrument approach procedures — including the holding pattern at GLBSB, associated with the RNAV(GNSS) approach to RWY 04.

The only PANS-OPS surfaces relevant to the proposed development are the Minimum Sector Altitudes for the published approach procedures.

Table 6-3 Approach Procedure Obstacle Clearance

Procedure	*Published Minima*	*MOC*	*Max Perm-issible Obst Elev (AHD)*	*Assessed Obstacle Elev (AHD)*	*Assessed Obstacle **Clearance** (AHD)*	*Comment*
MSA						
25NM Sector 1 (NW)	4700 ft 1432.5 m	300 m	3715 ft 1132.5 m	3560 ft 1085 m	155 ft 47.5 m	Proposed Turbine A25 - highest in proposed development - CLEAR, BELOW MOCA
10NM Inner Sector	4600 ft 1402.0 m	300 m	3615 ft 1102.0 m	3560 ft 1085 m	55 ft 17.0 m	Proposed Turbine A25 - highest in proposed development - in 5NM buffer outside 10NM sector - CLEAR, BELOW MOCA

* *Values in bold are the determining figures, and the equivalent value in the other unit system (feet or metres) is a calculated value based on the ICAO Annex 5 conversion value of 0.3048. All converted results between feet and metres are rounded conservatively.*