FINAL REPORT

MARRI WIND FARM

AVIATION IMPACT ASSESSMENT

CCP22Y

Report to:

Marri Wind Farm

8 September 2025

Chiron Aviation Consultants
Essendon Vic 3040
Australia

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DOCUMENT RELEASE APPROVAL

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Date: 8 September 2025

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DOCUMENT CONTROL

AIS

Version	Description	Date	Author	QA
V0.1	Draft for Comment	2 Dec 2024	IJ	RJJ
V0.2	Editorial	26 Feb 2025	IJ	RJJ
V0.3	AsA assessment	7 July 2025	IJ	RJJ
V0.4	Revised Layout and Tip height	14 July 2025	IJ	RJJ
V0.5	AsA assessment P2 revised layout	13 Aug 2025	IJ	RJJ

AIA

Version	Description	Date	Author	QA
V0.1	Draft for Comment	17 July 2025	IJ	RJJ
V0.2	Editorial	7 August 2025	IJ	RJJ
V0.3	AsA assessment P2 revised layout	13 Aug 2025	ÍJ	RJJ
V0.4	Layout change	26 Aug 2025	IJ	
V1.0	Final [Awaiting DoD response.]	8 Sep 2025	IJ	RJJ

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EXECUTIVE SUMMARY

The Marri Wind Farm (MWF) is situated approximately 200 km north of Perth in the Shire of Dandaragan. The project area occupies approximately 12,500 hectares of open farmland, located to the east of the Brand Highway, north of Regans Ford and approximately 15km south of Cataby. The project will utilise up to 82 turbines with a tip height up to 275m above ground level. This is one additional turbine located within the volume of airspace assessed for the 275m tip height. The original assessment was for turbines with a tip height of 247m above ground level.

The MWF, along with the existing Yandin Wind Farm, is within Military Danger Area D193 used for Military low flying training.

There are no Certified or Military aerodromes and associated protected airspace within 30nm (56km) of the MWF. There is one known Uncertified aerodrome within 16nm (30km) of the MWF. The Gin Gin Military aerodrome is just beyond 30nm and is not considered because it does not have published Instrument Approach Procedures. The MWF will not impact on the protected airspace associated with any Certified or Military aerodrome. It will not impact on the operation of the known Uncertified aerodrome within 16nm.

The MWF does not impact the Lowest Safe Altitudes of any published air routes. It is to the east of the Brand Highway but close to the published Visual Flight Rules routes from Cervantes and Jurien Bay to Perth.

The MWF is in Class G airspace and Military Danger Area D193. The airspace from Perth to Jurian Bay contains large areas of Military Special Use Airspace associated with Royal Australian Air Force (RAAF) and Royal Australian Navy (RAN) activities.

Class G airspace is non-controlled airspace where aircraft operate without an Air Traffic Control (ATC) clearance. Aircraft may operate in accordance with both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) within Class G airspace.

There are published Visual Flight Rules routes along the coast and along the Brand Highway to assist pilots flying to the Visual Flight Rules to remain clear of the Military Restricted and Danger Areas.

The MWF does not impact on known Civil Air Traffic Control Communications and Navigation facilities. It does require a *Eurocontrol* simple assessment to be conducted by the Department of Defence for the Military Radar facility at Eclipse Hill. At the date of this report the Department of Defence has not replied.

Airservices Australia have advised that the MWF will not affect any published Instrument Approach Procedures, air route Lowest Safe Altitudes or Civil Air Traffic Control Communications, Navigation and Surveillance facilities. *Note: Airservices forward a copy of their AIS assessment to CASA.*

The MWF will have minimal impact on aviation activity in the area. There are extensive

Military Operating Areas associated with Military training activities from HMAS Stirling and RAAF Pearce involving both flying and non-flying military activities. Published VFR Routes promulgated on the aeronautical charts provide corridors for General and Light Sport aviation activity between Perth and Jurien Bay. These published routes provide safe clearance from the MWF. Flying training is generally conducted in areas safely distant from the MWF. The MWF will have minimal impact on the use of aerial agricultural applications flying and the use of aircraft for firefighting in the immediate wind farm area.

Overall the risk to aircraft safety from the Marri Wind Farm is considered to be low and therefore will have minimal impact to aviation activity in the area.

1. INTRODUCTION

The Marri Wind Farm is situated approximately 200 km north of Perth in the Shire of Dandaragan. The project area occupies approximately 12,500 hectares of open farmland, located to the east of the Brand Highway, north of Regans Ford and approximately 15km south of Cataby. The project will utilise up to 82 turbines with a tip height up to 275m above ground level.

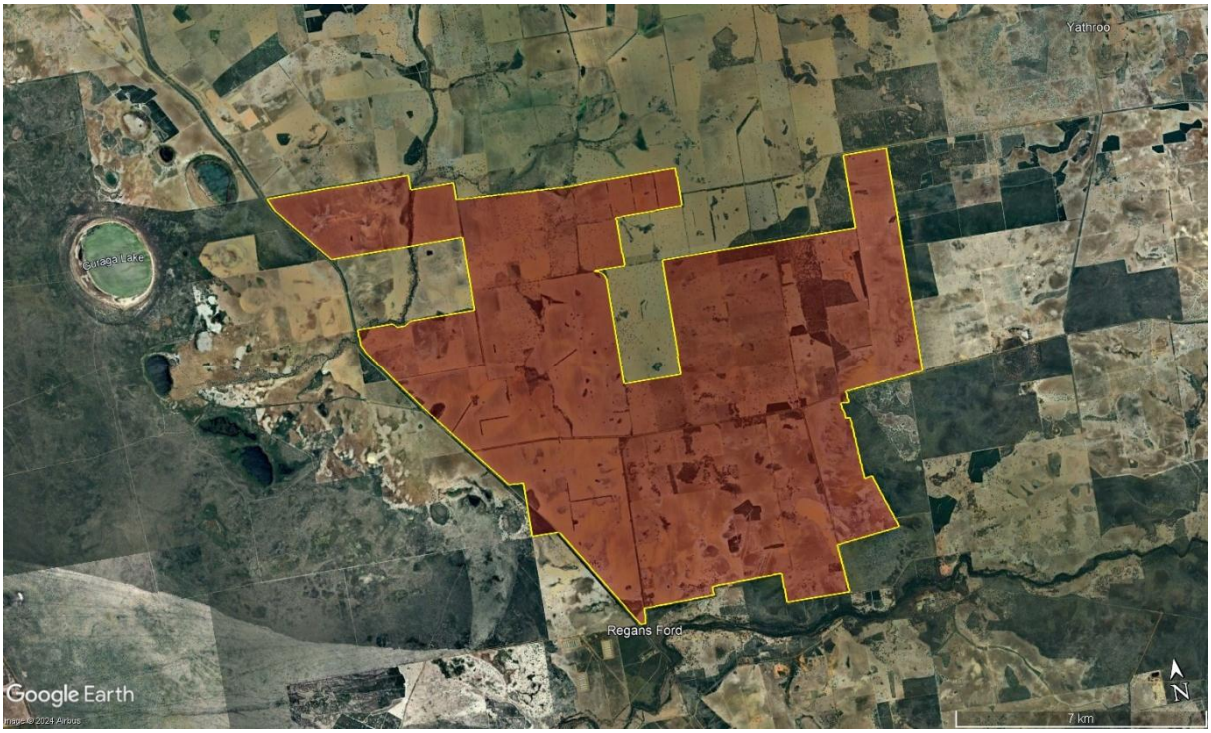

Figure 1 – Marri Wind Farm site boundary (Google Earth)

1.1 Aerodromes and Airstrips

Aerodromes fall into three categories:

- Military or Joint (combined military and civilian)
- Certified and
- Uncertified

A Military aerodrome is operated by the Department of Defence and is suitable for the operation of military aircraft. A Joint User aerodrome is a Military aerodrome used by both military and civilian aircraft, for example Darwin International and Townsville International Airports.

A Certified aerodrome is regulated under Civil Aviation Safety Regulation (CASR)

139.030. An aerodrome with a published instrument flight procedure must be Certified.

An Uncertified aerodrome is any other aerodrome, often referred to as an Aeroplane Landing Area (ALA) or airstrip. These range in capability and size from having a sealed runway with lighting capable of accommodating corporate jet aircraft to a grass paddock that is smooth enough to land a single engine light aircraft, or a purpose built aerial agricultural aircraft.

Military, Joint and Certified aerodromes are listed in the Aeronautical Information Publication[1] (AIP) and are subject to a NOTAM[2] service that provides the aviation industry with current information on the status of the aerodrome facilities. This information is held in the public domain, is available through aeronautical publications and charts and is kept current by mandatory reporting requirements.

Uncertified aerodromes are not required to be listed in the AIP, although many are, so information about them is not necessarily held in the public domain, may not be available through aeronautical publications and charts and is not required to be reported. Where Uncertified aerodrome information is published in the AIP EnRoute Supplement Australia (ERSA)[3] it is clearly annotated that a *full NOTAM service is not available*.

The AIP Designated Airspace Handbook (DAH)[4], at Section 20, lists *Aeroplane Landing Areas (ALA) without an ERSA entry – verified*. This listing of verified ALA indicates that Airservices Australia have a registered responsible person providing verified information about the ALA. These verified ALA are also depicted on AIP Charts.

ALA can come into use and fall out of use without any formal notification to CASA or any other authority. Airstrips that appear on survey maps often no longer exist; others exist but do not feature on maps. Similarly, a grass paddock used as an ALA is not usually discernable on satellite mapping services such as Google Earth.

Military, Joint and Certified aerodromes usually have Obstacle Limitation Surfaces (OLS) and Procedures for Air Navigation Services ï Aircraft Operations (PANS-OPS) surfaces prescribed to protect the airspace associated with published instrument approach and landing procedures. An uncertified aerodrome cannot have a published instrument approach and landing procedure so does not have associated prescribed airspace protected by PANS-OPS. An uncertified aerodrome is not afforded the protection of CASR Part 139 ï Aerodromes, so therefore does not have an OLS. All operations into ALA, therefore, must be conducted in accordance with the Visual Flight Rules (VFR) and in Visual Meteorological Conditions (VMC).

1.2 Aerodromes in the Area

There are no Certified or Military aerodromes within 30nm (56km) of the Marri Wind Farm (MWF). The Gin Gin (YGIG) Military aerodrome is 30.58nm (56.63km) SSE of

1 AIP; a mandatory worldwide distribution system for the promulgation of aviation rules, procedures, and information

2 NOTAM (Notice to Airmen); a mandatory reporting service to keep aerodrome and airways information current and available to the aviation industry worldwide

3 ERSA, part of the AIP that lists aerodrome information in accordance with standards and legislative requirements to ensure integrity.

4 DAH, part of the AIP that lists the pertinent de tails of Australian airspace and aerodromes

turbine WP8.

There is one known Uncertified aerodrome within 16nm (30km) of the MWF. The unverified Aeroplane Landing Area (ALA) at Moora is 15.09nm (27.94km) NE of turbine WP65.

1.3 Air Routes in the Area

Published air route Q17 passes overhead the MWF between PH VOR and OTLEG waypoints, with a Lowest Safe Altitude (LSALT) of 2700ft.

A published Visual Flight Rules (VFR) route from Jurien Bay to Walyer Walyer Hill along the Brand Highway passes within approximately 1km of the MWF. This route is published to assist VFR pilots to remain clear of Military Special Use Airspace and has an upper altitude of 4000ft.

1.4 Airspace

The MWF is in Class G airspace and Military Danger Area D193. The airspace from Perth to Jurian Bay contains large areas of Military Special Use Airspace associated with RAAF and RAN activities.

Military Danger Area D193 is used for Military low level flying training, extends from ground level to 4000ft, and is active during daylight hours Monday to Friday or as amended by NOTAM.

Military Restricted Area R155B is used for Military flying training, extends from ground level to 16,000ft, abuts D193 to the south, and is activated by NOTAM.

Class G airspace is non-controlled airspace where aircraft operate without an Air Traffic Control (ATC) clearance. Aircraft may operate in accordance with both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) within Class G airspace.

There are published Visual Flight Rules routes along the coast and along the Brand Highway to assist pilots flying to the Visual Flight Rules to remain clear of the Military Restricted and Danger Areas.

Within Class G airspace an aircraft flying in accordance with the Visual Flight Rules (VFR) away from a populous area is, when flying below 3000ft, required by Civil Aviation Safety Regulation (CASR) 91.267 to remain at 500ft above the highest point of the terrain and any obstacle on it within a radius of 300m from a point on the terrain directly below the aircraft. For a wind farm this equates to 500ft above the turbine tip height. An IFR aircraft must fly at or above the published or calculated LSALT for the route flown. This equates to a minimum of 1000ft above the MWF.

2. SCOPE

To meet the requirements of proposed Marri Wind Farm, the study required Chiron Aviation Consultants to examine the proposed development in relation to any impacts on aviation activity in the area and undertake the following tasks.

2.1 Aviation Impact Statement

Airservices Australia (AsA) require an Aviation Impact Statement (AIS) for wind farm developments. The Aviation Impact Statement is submitted to AsA and the Department of Defence for evaluation and consideration. AsA provide a copy of this report and their response to the Civil Aviation Safety Authority (CASA) for their information and records.

The AIS required the following tasks to be undertaken: -

- Provide the coordinates and elevations of the Obstacles and associated topographical drawings;
- Specify all registered and certified aerodromes within 30nm (55.6km):
  - Nominate all instrument approach and landing procedures;
  - Confirm that the obstacles do not penetrate the Annex 14 OLS;
  - Confirm that the obstacles do not penetrate the PANS-OPS;
- Specify any published air routes over or near the obstacles;
- Specify the airspace classification of the airspace surrounding the development;
- Investigate any impact on aviation Communications, Navigation and Surveillance (CNS) facilities.

Details of Aerodromes, OLS, PANS-OPS procedures, Lowest Safe Altitudes, Navigation and Airspace Surveillance facilities were obtained from the Australian Aeronautical Information Publications (AIP), AsA sources and CASA publications.

2.2 Qualitative Risk Assessment

The QRA required the following tasks to be undertaken: -

- The identification and assessment of potential aviation risk elements through:
  - Reference to CASA publications;
  - Reference to the AIP;
  - Reference to the National Airports Safeguarding Framework (NASF) guidelines;
  - Consultations with key relevant stakeholders;
- Assessment of the perceived impacts of the turbines on the operation of aerodromes and airstrips in the immediate vicinity of the wind farm;

- Assessment of the perceived impacts of the turbines on aviation activity including:
  - General Aviation training;
  - Recreational/Commercial flying activity;
  - Air Ambulance Operations;
  - Police Aviation Operations;
  - Aerial Fire Fighting Operations;
  - Aerial Agricultural Operations;
  - Known highly tra icked VFR routes;
  - Night flying for light aircraft;
- Conclusions on the degree of aviation risk posed by the above described issues with commensurate recommendations on any mitigating actions; and
- An assessment of the need, against the outcomes of the Qualitative Risk Assessment, for obstacle lighting of the wind farm.

3. METHODOLOGY

3.1 Aviation Impact Statement

To meet Airservices Australia requirements for an Aviation Impact Statement the following methodology was used: -

- The obstacle (turbines and meteorological masts) coordinates and elevations were listed to the requisite accuracy and associated drawings and charts were obtained;
- The AIP was reviewed to determine;
  - All certified and military/joint aerodromes located within 30nm (55.6km) of the wind farm;
  - Any associated Instrument Departure and Approach Procedures (DAP);
  - The extent of the OLS and PANS-OPS surfaces for the identified DAP;
  - Published air routes located over or near the wind farm;
  - The classification of the airspace surrounding the wind farm;
- Ascertain the locations of CNS facilities that may be impacted and analyse the impact on;
  - Communications facilities;
  - Navigation facilities;
  - Surveillance facilities (in accordance with EUROCONTROL Guidelines); and
- Compile a report for review by Airservices Australia and the Department of Defence.

3.2 Qualitative Risk Assessment

A Qualitative Risk Assessment is the analysis for risks, through facilitated interviews or meetings with stakeholders and outside experts, as to their probability of occurrence and impact expressed using non-numerical terminology; for example, low, medium and high. The basis for the QRA is ASNZS ISO 31000-2018 *Risk Management –Guidelines.*

The methodology for the Qualitative Risk Assessment was as follows:

- The Australian AIP and CASA documents were reviewed to identify relevant physical and operational aviation issues that may impact on the requirement for lighting of the wind farm;
- Current topographical maps were studied to assess the local terrain and identify any local airstrips and any other relevant features;

- The nature of any impacts because of the operation of the wind farm was considered in regard to;
    - General Aviation training;
    - Recreational and sport aviation activities;
    - Approved low flying activities (including aerial agricultural applications)
    - Any known highly trafficked VFR routes; and
    - Emergency Services (air ambulance, police and fire service);
- In addition, further consideration was given to the consequences (for the above elements) of the potential influence of topography and poor weather; and
- Consideration of the NASF, Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* in relation to the QRA findings.

4. AVIATION IMPACT STATEMENT

The Aviation Impact Statement meets the requirements of Airservices Australia for their assessment of the MWF potential impact on the items listed in Section 3. The AIS is submitted to both Airservices Australia and the Department of Defence for assessment in relation to civil and military facilities.

4.1 Location

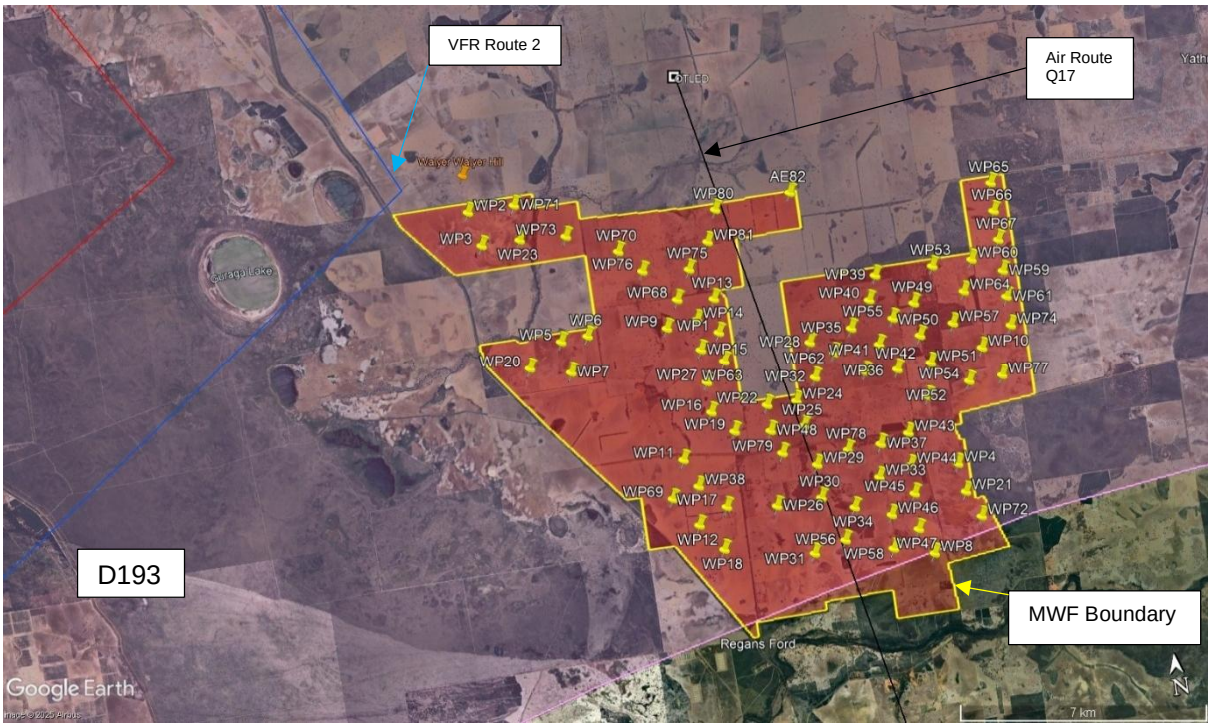

Figure 2 – MWF location – Light shaded area is D193

Figure 2 shows the MWF location within D193 and abutting the 60nm arc based on the Perth DME. The black line is air route Q17 (LSALT 2700ft). Air route Q17 passes overhead the MWF. The blue line is VFR Route 2 from Jurien Bay to Walyer Walyer Hill following the Brand Highway.

4.2 Obstacles

The MWF will utilise up to 82 turbines with a tip height up to 275m above ground level. The tallest turbine is WP64 at 515.12m (1689.99ft) AHD, giving a Lowest Safe Altitude of 2700ft over the MWF. The addition of an extra turbine within the already assessed volume of airspace does not change results of the assessment.

Turbine locations and elevations are shown at Appendix A.

4.3 Aerodromes within 30nm

The 30nm (56km) distance from a Certified or Military aerodrome is used to encompass the Procedures for Air Navigation Services ï Aircraft Operations (PANS-OPS) protected airspace associated with published Instrument Approach Procedures at the aerodrome. A Certified or Military aerodrome also has an Obstacle Limitation Surface (OLS) associated with each runway. The dimensions of the OLS depend on the category (length & width) of the runway. The OLS does not extend beyond 15km from the end of each runway.

The 16nm (30km) distance for an Uncertified aerodrome is specified in the National Airports Safeguarding Framework (NASAF) Guideline D *Managing the risk to aviation safety of wind turbine installations (wind farms)/ wind monitoring towers.* An Uncertified aerodrome does not have an OLS and cannot have a published Instrument Approach Procedure, therefore the 16nm distance is adequate to assess aircraft operations at the aerodrome.

4.3.1 Certified and Military Aerodromes

There are no Certified or Military aerodromes within 30nm of the MWF.

The Gin Gin (YGIG) Military aerodrome is 30.57nm (56.62km) SSE of turbine WP8. Its location is noted but not considered in the AIS as it does not have a published Instrument Approach Procedure and associated PANS-OPS protected airspace.

4.3.2 Known Uncertified Aerodromes within 16nm (30km)

There is an unverified ALA at Moora, 15.08nm (27.93km) NE of turbine WP65. There are no details of this ALA in the AIP ERSA[5] or DAH[6]. From Google Earth the runway is unrated gravel, with sealed threshold/touchdown areas, approximately 1400m long aligned RWY12/30 (ESE/WNW).

The MWF is sufficiently distant from the Moora ALA to have no impact on safe aircraft operations at the aerodrome.

4.4 Air Routes and Lowest Safe Altitudes

There is one published air route within the Required Navigation Performance (RNP2)[7] criteria; that is Q17, which passes overhead the MWF with an LSALT of 2700ft.

The GRID LSALT is 2700ft over the MWF

The MWF does not penetrate any published LSALT.

5 Aeronautical Information Publication - EnRoute Supplement Australia

6 Aeronautical Information Publication ï Designated Airspace Handbook

7 Required Navigation Performance, 2nm tolerance, is the lateral tolerance and accuracy of navigation for air route Q17

4.5 Airspace

The MWF is in Class G uncontrolled airspace.

The MWF is within the published Danger Area D193 *Pearce Military Flying,* which is active Monday to Friday from sunrise to sunset or as notified by NOTAM. D193 extends from the surface to 4000ft. There are two existing wind farms within D193, being the Yandin and Waddi wind farms located to the north of the proposed Marri wind farm.

There are published VFR Routes shown on the Perth Visual Terminal Chart that follow the Brand Highway immediately to the west of the MWF. These VFR Routes are designed to facilitate VFR aircraft tracking around active Military Special Use Areas from Jurien Bay/Cervantes and back to the coast at Lancelin.

Given that the VFR routes follow the Brand Highway, a significant visual refence with which to maintain track, the MWF is not considered to be a hazard to aircraft safety.

4.6 Communications, Navigation and Surveillance (CNS)

Wind turbines by their size and construction may cause interference to air traffic control communications, navigation and surveillance (CNS) facilities. Airservices Australia (AsA) recommends the use of the *EuroControl Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors*[8].

The CASR Part 139 Manual of Standards ï Aerodromes, Chapter 11, sets out the general requirements for navigation aid sites and air traffic control (ATC) facilities, including the clearance planes for planned and existing facilities.

The author is not aware of the detail of Military CNS associated with YPEA and YGIG RAAF bases or any other Military CNS in the area. The Department of Defence will analyse this report and advise accordingly.

4.6.1 Communications

There are Airservices Australia ATC communications facilities at Perth 60nm (110km) south of turbine WP08; Kalamunda 63nm (117km) south of turbine WP08; Mt Singleton 115nm (214km) northeast of turbine WP65.

There are Military ATC communications facilities at Pearce 44nm (82km) SSE of turbine WP08 and Gin Gin 30nm (56km) SSE of turbine WP08.

These communications systems operate in the VHF and UHF bands and should not experience any interference from the MWF due to the distances from the transmitters and the line of site nature of VHF and UHF communications.

8 Available at http://www.eurocontrol.int/sites/default/files/publication/files/20140909-impact-wind-turbines-sur-sensors-guid-v1.2.pdf

4.6.2 Navigation

There are Tactical Air Navigation Systems (TACAN) at Beermullah 18.92nm (35.05km) SSE of turbine WP08, and at Pearce 44.67nm (82.73km) SSE of turbine WP08.

A TACAN operates in the UHF frequency band. Neither TACAN should experience any interference from the MWF.

There are Non Directional Beacons (NDB) at Gin Gin 30.28nm (56km) S of turbine WP08 and Pearce 43.54nm (80.67km) SSE of turbine WP08. An NDB operates in the MF frequency band, with Gin Gin and Pearce having a range of 100nm. The nature of an NDB and the frequency band used is such that the MWF should not interfere with the operation of either navigation aid.

4.6.3 Surveillance

The applicable document is the Eurocontrol Guidelines *"How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors"* edition 1.2, September 2014 (EUROCONTROL-GUID-130).

This guideline nominates the following four zones (shown below) and the associated level of assessment for PSR installations.

Zone	Zone 1	Zone 2	Zone 3	Zone 4
Description	0 ï 500m	500m 0 15km and in radar line of sight	Further than 15km but within maximum instrumented range and in line of sight	Anywhere within maximum instrumented range but not in line of sight or outside the maximum instrumented range
Assessment Requirements	Safeguarding	Detailed assessment	Simple assessment	No assessment

The guideline nominates the following three zones (shown below) for the assessment of SSR.

Zone	Zone 1	Zone 2	Zone 4
Description	0 ï 500m	500m ï 16km but within maximum instrumented range and in radar line of sight	Further than 16km or not in radar line of sight
Assessment Requirements	Safeguarding	Detailed Assessment	No assessment

Note: There is no Zone 3 for SSR

The Eclipse Hill RAAF Radar is 27.34nm (50.63km) SSE of turbine WP08. Radar elevation is 213m (from Google Earth) with a tower height assumed to be 25m AGL. This gives an approximate antenna height of 238m AHD. Turbine WP08 is on an elevation of 184m AHD with a tip height of 459.24m AHD. The range of this radar is not

known but assumed to be 150 to 200nm. This Eclipse Hill radar is greater than 15km from the MWF and within line of site. The MWF is within Zone 3 of the Eurocontrol Guidelines and requires a simple assessment by the DoD.

The Perth Terminal Area Radar (TAR) is 108km SSE of turbine WP08. The MWF is within the rated coverage of the TAR, however it is not in line of site due to high ground between the radar site and the MWF. The MWF is within Zone 4 of the Eurocontrol Guidelines and no assessment is required.

4.7 AIS Conclusions

The MWF will: -

- Not impact on the OLS or PANS-OPS protected airspace of any Certified or Military aerodrome
- Not impact on the operation of known Uncertified aerodrome within 16nm (30km)
- Not impact on any Lowest Safe Altitudes
- Not impact on any Military Special Use or Restricted Areas
- Not impact on known Communications and Navigation facilities
- Impact on Military Danger Area D193
- Require a simple assessment of the Eclipse Hill Military Radar facility by the DoD.

4.8 Airservices Australia Response

Airservices Australia response WA-WF-067 P2 is at Appendix C. The assessment advises that there will be no impact to published Instrument Approach Procedures, LSALT or Civil ATC CNS facilities.

4.9 Department of Defence Response

At the date of this report the Department of Defence has not provided their assessment to the AIS.

5. Qualitative Risk Assessment

The expression ñin the vicinity of the aerodromeòis considered by CASA to mean within the boundaries of either the OLS or the PANS-OPS surfaces for a certified aerodrome. CASA Advisory Circular AC130.E-05 v1.0 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome,* refers to the *vicinity of an aerodrome* as being within the limits of the Obstacle Limitation Surface[9].

The NASF Guideline D considers 30km (16.2nm) from a certified aerodrome to be ñin the vicinity.ò

For an AIS and this assessment, the impact on any certified aerodrome within 56km (30nm) of a wind farm is considered. This ensures the 25nm (47km) Minimum Sector Altitude (MSA) and its 5nm (9km) safety buffer radius protected airspace associated with any published aerodrome instrument approach procedure is captured in the analysis.

5.1 Airspace and Aerodromes

The airspace, air routes and aerodromes associated with the Marri Wind Farm (MWF) are set out in Section 4 of this report.

As noted in Section 4.5 the MWF is in Class G uncontrolled airspace. It is also within Danger Area D193 *Pearce Military Flying* used for Military low flying training. D193 is active Monday to Friday from sunrise to sunset or as notified by NOTAM. D193 extends from the surface to 4000ft. There are two existing wind farms within D193, being the Yandin and Waddi wind farms located to the north of the proposed Marri wind farm.

Approval for flight within an active Danger Area outside controlled airspace is not required. However, it is the responsibility of the pilot in command to be aware of the dangerous activity and take appropriate precautions[10].

The published VFR routes follow the Brand Highway, a significant visual refence with which to maintain track, and therefore remain clear of the MWF. These published VFR routes are in place to provide a known, easy to follow, flight path that avoids the extensive Military Special Use Airspace and Restricted Areas extending from Perth to Jurien Bay. Military Operating Areas M147A, M147B, M147C extend to immediately west of the Brandt Highway, with a vertical extent from the surface to 70,000ft, and are used for flying and non-flying military activity.[11]

The LSALT over the MWF is 2700ft; the GRID LSALT for the area and the overlying published air route is 2700ft. The MWF does not impinge the LSALT

The MWF is not considered to be a hazard to aircraft safety.

[9] CASA AC139.E-05 v1.0 Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome, May 2021.

[10] AIP Enroute ENR 5.1ï 3, paragraph 2.5, September 2025

[11] AIP DAH, Section 13, SUA-48, Military Operating Areas, June 2025

5.2 Night Flying

Aircraft flying at night under either IFR or VFR are protected by published or calculated LSALT. Descent below the LSALT for a VFR at Night flight is restricted to within 3nm (5.4km) of the aerodrome and with it in sight. Where an IFR aircraft is using a published instrument approach at a Certified aerodrome it is protected by PANS-OPS surfaces. An IFR aircraft descending to land at aerodrome that does not have a published instrument approach will descend to the LSALT and then operate as a VFR at Night flight.

The Uncertified aerodrome at Jurien Bay (YJUR), 44.88nm (88.12km) northwest of MWF, is equipped with Pilot Activated Lighting facilitating night operations.

5.3 General, Recreational and Sport Aviation

Sky Dive Jurien Bay operates a parachuting school and jump zone at Jurien Bay aerodrome. The jump zone is within Danger Area D174 *Jurien Bay Parachuting*.

Light sport and general aviation aircraft operate at Jurien Bay and along the coast from Perth to Geraldton. The majority of this flying activity is VFR, conducted by day.

An RAAus ultra-light aircraft flying training school, *Top Fun,* operates from Moora ALA (YMRO) and Greenside/Muchea ALA (YGSD). Both ALA are considered sufficiently distant from the MWF for there to be no impact on these operations. RAAus ultra-light aircraft are restricted to VFR flight by day.

5.4 Known Highly Trafficked Areas

There are published VFR Routes through and around Military Special Use Airspace along the coast and inland to the Brandt Highway. These routes follow the Brandt Highway which keeps VFR aircraft clear of the MWF. There are existing wind farms in the area to the east of the Brandt Highway and north of the MWF. It is considered that the MWF will not limit the use of nor affect aircraft safety of these published VFR routes along the Brand Highway.

5.5 Approved Low Flying Activities

There are no published civil flying training areas in the vicinity of the MWF.

The MWF is within the Military Danger Area D193 used for Military flying training.

5.6 Aerial Applications Activity

There is some aerial applications activity in the general area, dependent on seasons,

crops and pests. It is understood that large scale aerial applications is not used on the predominantly cereal crop farming within the area of the MWF.

An aerial application operator made the comment that *"the decision to host wind turbines is one made by the landholder who must accept that there will most probably be limitations to any aerial applications on the property*[12]*."*

Aerial applications operators have become familiar with low level flying within and adjacent to wind turbines. The cut-in wind speeds for the turbines are, generally, at or above the wind speeds suitable for aerial applications.

Another operator made the comment that *"wind farms are becoming common, they're a fact of life, we know more about them and can operate safely in their vicinity."*[13]

Aerial applications operators all consider meteorological monitoring masts to be ñkillersò because they are very difficult to see from the air.

5.7 Fire Fighting

Firefighting is a multi-faceted operation utilising multiple resources and equipment appropriate to the circumstances. A fire ground is a dynamic place where resources are continually being reassigned to have the best effect. Aerial firefighting is just one of the resources available and its use may or may not be appropriate to the current fire ground situation.

Aircraft, both fixed and rotary wing (helicopters), are used by firefighting agencies as another firefighting asset, along with firefighting personnel on the fire ground, firefighting tankers, earthmoving equipment and multiple other assets. Multiple factors, including availability, weather, terrain and known obstacles are considered when assigning aerial assets to a fire ground.

5.7.1 Aerial Firefighting

Although aircraft are often the most visible part of the response to a fire, and therefore believed to be the most important, almost all fires are still extinguished by ground crews.[14]

Aerial firefighting flying is conducted at low level using specialist aircraft flown by appropriately rated pilots in accordance with the Visual Flight Rules. The pilot is required to maintain forward visibility with the ground, therefore they will remain clear of smoke

[12] Expert opinion obtained by the author during previous QRA work

[13] Stakeholder interview with aerial agricultural applications operator for Border Air.

[14] SA CFS Fact sheet 2024.

so that they can accurately and safely drop the fire retardant. Fixed wing single engine air tankers do not currently attack fires at night. Some large helicopter tankers are equipped and certified for night operations.

Other aircraft involved with aerial firefighting operate at altitudes above that used by those dropping retardant, such that they can guide the ñbomberò aircraft accurately to the required drop zone [Birddog]. Additional aircraft operate at high level to scan the fireground for ñhot spotsòand breakaway areas [Firescan].

At all times, the pilot in command has the ultimate responsibility for the safety of the aircraft.[15]

"It is important to remember that aircraft alone do not extinguish fires."[16]

There will be times when aerial firefighting is not possible due to turbulence, smoke, strong wind, or erratic fire behaviour. High atmospheric temperatures affect the performance of aircraft. High temperatures reduce the load carrying capacity and low relative humidity will reduce the overall effectiveness of firebombing due to the rapid evaporation of the water. This was graphically demonstrated in the 2019 - 2020 fire season where an intense fire created its own severe weather system with pyrocumulonimbus cloud and severe turbulence[17]. Such conditions are dangerous for both large and small aircraft[18] and preclude the use of aerial firefighting.

From previous work undertaken by the author regarding firefighting within wind farms it is noted that the rural firefighting agencies in Victoria, New South Wales, South Australia and Western Australia all view wind turbines and wind farms to be ójust another hazardô that has to be considered in the risk management process associated with aerial firefighting.

The pilot in command will consider the presence of the wind turbines and meteorological monitoring masts[19] when planning the firefighting task and assessing the risks to the operation. Aerial firefighting can and does occur within and around wind farms.

5.8 Advisory Circular AC139.E-05 v1.0

CASA Advisory Circular, AC139.E-05 v1.0 *Obstacles (including wind farms) outside the*

15 A point reiterated in an interview by the author with a Victorian Forest Fire Management Fire Ground Manager, 6 August 2019. This is part of the Civil Aviation Safety Regulations 1998.

16 NSW Rural Fire Service submission to the Senate Select Committee on Wind Turbines, 6 March 2015, page 2

17 Flight Safety Australia, Beware of bushfire clouds, 9 Jan 2020

18 Flight Safety Australia, Turbulence on day of tanker crash, 25 Sep 2020

19 CFA Design Guidelines and Model Requirements, paragraph 4.2.6.1 refer to ñweather monitoring stationsòinstead of meteorological monitoring masts

vicinity of a CASA certified aerodrome was published in May 2021 to provide advice to wind farm proponents and planning authorities.

This AC defines outside the vicinity of a certified aerodrome as *outside the limits of the obstacle limitation surface (OLS) of a CASA certified aerodrome.*

The MWF is beyond 30nm (56km) from the closest Certified Aerodrome or Military Aerodrome and is therefore outside the vicinity of any Obstacle Limitation Surface (OLS). It is also outside the PANS-OPS surfaces protecting the non-precision instrument approaches at these aerodromes.

CASA provides advice and recommendations to the Planning Authority; and it is the Planning Authority who make the final decision.

5.9 NASF Guidelines

The National Airports Safeguarding Framework (NASF) ï Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* provides guidance for the siting and marking of the turbines and meteorological monitoring towers associated with wind farms. This Guideline has not been updated since 15th July 2012.

5.9.1 Notification to Authorities

Paragraph 20 of Guideline D advises that:

> *When wind turbines over 150m above ground level are to be built within 30km (16.2nm) of a certified or registered aerodrome, the proponent should notify the Civil Aviation Safety Authority and Airservices. If the wind farm is within 30km of a military aerodrome, Defence should be notified.*

The turbines are greater than 150m and are within 30km of a certified or registered aerodrome.

The turbines and meteorological monitoring towers used in the MWF must be reported in accordance with AC 139.E-01 v1.0 *Reporting of Tall Structures* to ensure their position is marked on aeronautical charts.

5.9.2 Qualitative Risk Assessment

The NASF Guideline has the following requirements for a risk assessment.

> *26. Following preliminary assessment by an aviation consultant of potential issues, proponents should expect to commission a formal assessment of any risks to aviation safety posed by the proposed development. This assessment should address any issues identified during stakeholder consultation.*

The risk assessment for the MWF indicates that the overall risk to aviation is LOW. A risk assessment of LOW indicates that the wind farm is *'not a hazard to aircraft safety.'*

> *27. The risk assessment should address the merits of installing obstacle marking or lighting. The risk assessment should determine whether or not a proposed structure will be a hazardous object. CASA may determine, and subsequently advise a proponent and relevant planning authorities that the structures have been determined as:*
>
> *(a) Hazardous but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or*
>
> *(b) Hazardous and should not be built, either in the location and/or to the height proposed as an unacceptable risk to aircraft safety will be created; or*
>
> *(c) Not a hazard to aircraft safety.*

By day, the MWF turbines are conspicuous by their size and colour. The MWF does not impact on any LSALT in the area. Night operations for aircraft do not occur below the LSALT for IFR and VFR at Night. IFR aircraft are protected by the LSALT and PANS-OPS prescribed airspace at each Certified or Military aerodrome. Where an approach to land is undertaken operating to VFR at night, descent below the LSALT does not occur until within 3nm of the aerodrome, in VMC, and with the aerodrome in sight.

Given the above, the MWF does not require obstacle lighting as the risk to aviation is LOW and no additional mitigating strategies are required.

Overall, the risk assessment demonstrates that the MWF is a LOW risk to aviation and is therefore *not a hazard to aircraft safety.*

> *28 If CASA advice is that the proposal is hazardous and should not be built, planning authorities should not approve the proposal. If a wind turbine will penetrate a PANS-OPS surface, CASA will object to the proposal. Planning decision makers should not approve a wind turbine to which CASA has objected.*

The MWF does not penetrate any OLS or PANS-OPS surfaces either civil or military, therefore CASA has no reason to determine that it is hazardous.

> *29 In the case of military aerodromes, Defence will conduct a similar assessment to the process described above if required. Airservices, or in the case of a military aerodrome, Defence, may object to a proposal if it will adversely impact on Communications, Navigation or Surveillance (CNS) infrastructure. Airservices/ Defence will provide detailed advice to proponents on request regarding the requirements that a risk assessment process must meet from the CNS perspective.*

There is no civil CNS infrastructure that will be impacted by the MWF, however the DoD is yet to advise (as at report date) regarding Military CNS.

> *30 During the day, large wind turbines are sufficiently conspicuous due to their shape and size, provided the colour of the turbine is of a contrasting colour to the background. Rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study. Other colours are also acceptable unless the colour of the turbine is likely to blend in with the background.*

The MWF turbines will be appropriately coloured to ensure they are conspicuous by day.

5.9.3 Lighting of Wind Turbines

> *33 Where a wind turbine 150m or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment.*
>
> *34. The risk assessment, to be conducted by a suitably qualified person(s), should examine the effect of the proposed wind turbines on the operation of aircraft. The study must be submitted to CASA to enable an assessment of any potential risk to aviation safety. CASA may determine that the proposal is:*
>
> > *(a) hazardous, but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or*
> >
> > *(b) not a hazard to aircraft safety.*

As noted earlier, pilots flying IFR consider that obstacle lights on the MWF are not required because:

- In ñsolid IMCò they cannot be seen; and
- In light cloud or light fog, they ñflareò and distract the pilot.[20]

The MWF does not penetrate any OLS or PANS-OPS airspace, therefore, it is assessed as a LOW risk to aviation and therefore, *is not a hazard to aircraft safety.*

[20] Stakeholder interviews with experienced IFR pilots.

5.10 QRA Findings

Risk Element	Assessed Level of Risk	Comments
Airport Operations	LOW	Nil Certified/Military aerodromes within 30nm
Aircraft Landing Area Operations	LOW	Suitability for use is a pilot responsibility.
Known Highly Trafficked Routes	LOW	Published VFR routes clear of MWF
Published Air Routes	LOW	Nil impact
Military Special Use Airspace	LOW	Within D193 ï military flying
Promulgated Flying Training Areas	LOW	Nil exist in the area
GA Flying	LOW	Published VFR routes clear of MWF
Night Flying	LOW	
Emergency Services Flying	LOW	
Recreational and Sport Aviation	LOW	

Table 2 – Risk Assessment Summary

6. Wind Monitoring Towers

Meteorological Monitoring Masts are difficult to see due to their slender construction and thin guy wires. The masts are often a grey (galvanised steel) colour that readily blends with the background.

The photograph in Fig 7 shows a Meteorological Monitoring Mast as seen from the ground.

The aerial application operators and the emergency services pilots all note the danger of meteorological monitoring masts to low flying aircraft. All these pilots made comment that ñmet masts are extremely dangerous.ò Each of these stakeholders requested that the NASF Guidelines, except for the strobe light, be used to make the masts more visible and that the markings be maintained in a serviceable condition.

The aerial application pilots all requested that the outer guy wire ground anchor points be painted a contrasting colour to enhance their visibility. When low flying, particularly when spraying, the pilot is looking at the ground as their reference point. The contrasting ground anchor point is the most valuable visual cue in this situation.

It is generally considered by aerial agricultural pilots that a flashing strobe light is ineffective and as such should not be used.

Figure 7 – A Meteorological Monitoring Mast photographed from the ground

All the markings used to make the masts more visible must be maintained in a serviceable condition. This is particularly important for balls, flaps and sleeves that deteriorate due to wind and sun damage.

6.1 NASF Guidelines – Marking of Meteorological Monitoring Masts

The NASF guideline also refers to the marking and lighting of wind monitoring towers. The relevant points are summarised as:

> *Wind monitoring towers are very difficult to see from the air due to their slender construction and guy wires. This is a particular problem for low flying aircraft, particularly aerial agricultural and emergency services operations.*
>
> *Measures to be considered to improve visibility include:*
>
> - *The top one third of wind monitoring towers be painted in alternating contrasting bands of colour. Examples can be found in the CASA MOS 139 sections 8 and 9;*
> - *Marker balls, high visibility flags or high visibility sleeves*

placed on the outer guy wires;

- *Ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground and vegetation; or*
- *A flashing strobe light during daylight hours.*

The aerial applications and emergency services pilots interviewed by the author all make the point that the flashing strobe light does little to make the mast more visible and therefore is unnecessary.

6.2 Reporting Tall Structures

The turbines proposed for the MWF have a tip height of greater than 100m AGL; therefore, they must be reported as per CASR 175.480.

CASR Part 175E requires that obstacles having a height of 100m AGL (turbines and meteorological monitoring masts) be reported as tall structures for inclusion in the vertical obstacle database and on appropriate aeronautical charts.

The procedure for reporting tall structures is contained in Advisory Circular AC139.E-01 v1.0 *Reporting of Tall Structures*[21].

Meteorological Monitoring Masts for the MWF must also be reported as per AC139.E-01 *Reporting of Tall Structures* and to the Aerial Agricultural Association of Australia (admin@aaaa.org.au).

Consideration should be given to ensuring an AIP SUP that provides the height and location of the structure is issued. This is due to the current lead time between reporting tall structures and the information appearing on aeronautical charts.

[21] Advisory Circular AC 139.E-01 v1.0 December 2021

Figure 8 – An appropriately marked Meteorological Monitoring Mast[22]

[22] Met Mast at Delburn Wind Farm, Photo courtesy Osmi Australia

6.3 Recommendations

It is recommended that wind monitoring towers used in the MWF are:

- Appropriately marked as per guidelines above except for strobe light;
- Reported as tall structures in accordance with AC139.E-01;
- Notified to the Aerial Application Association of Australia;
- Subject to an AIP SUP specifying their location and height.

7. Conclusions – Aviation Impact Assessment

7.1 Aviation Impact Statement

The MWF will: -

- Not impact on the LSALT of any published air route
- Not impact on the GRID LSALT
- Not impact on any civil aviation CNS.
- Not impact on any PANS ï OPS airspace
- Not impact the OLS for any Certified or Military Aerodrome.

The MWF is situated in Class G Uncontrolled airspace and within Military airspace D193.

Airservices Australia advise that the MWF will not impact any LSALT, Instrument Approach Procedures or Civil CNS facilities.

At the date of this report the Department of Defence have assessed the AIS.

7.2 Risk Assessment

The Qualitative Risk Assessment finds that the MWF poses a low risk to aircraft safety.

7.3 Obstacle Lighting

The MWF does not require aviation obstacle lighting.

7.4 Met Masts

Meteorological monitoring masts are difficult to see and pose a hazard to authorised low flying aircraft. Therefore, they need to be appropriately marked as per the NASF Guideline D (except for the strobe light) and the markings need to be maintained in serviceable condition.

7.5 Reporting Tall Structures

Tall structures must be reported to the Vertical Obstacles Database in accordance with CASA AC139.E-01 *Reporting tall structures*.

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APPENDIX A

Turbine Locations and Heights
Layout WP 20250822

APPENDIX A

Turbine ID	Easting m	Northing m	Lat_WGS84	Long_WGS84	Elevation[m]	275m Tip Ht AHD [ft]	Add MOC	LSALT
WP54	382698.7758	6578510.353	30.920973	115.772334	211.276993	1594.988537	2594.988537	2600
WP65	384067.1599	6583945.917	30.872072	115.787271	202.397003	1565.86217	2565.86217	2600
WP53	382104.4919	6581860.536	30.890691	115.766503	218.384995	1618.302784	2618.302784	2700
WP55	380790.3587	6580552.195	30.902362	115.752604	232.854996	1665.764387	2665.764387	2700
WP5	371428.9267	6581176.774	30.895746	115.654748	154.966995	1410.291744	2410.291744	2500
WP69	373947.4154	6576338.933	30.93966	115.680494	126.120003	1315.67361	2315.67361	2400
WP38	374719.9061	6576594.356	30.937438	115.68861	148.039993	1387.571177	2387.571177	2400
WP56	378630.2674	6574525.876	30.956506	115.729287	141.393005	1365.769056	2365.769056	2400
WP46	380017.2404	6575059.304	30.951836	115.743868	179.330002	1490.202407	2490.202407	2500
WP72	382536.7334	6574670.25	30.955599	115.770195	159.977005	1426.724576	2426.724576	2500
WP21	382184.3101	6575423.757	30.948767	115.766593	187.033005	1515.468256	2515.468256	2600
WP79	377191.593	6577209.327	30.93215	115.714551	189.345001	1523.051603	2523.051603	2600
WP13	375871.5098	6581787.814	30.890709	115.701295	205.442993	1575.853017	2575.853017	2600
WP68	374843.712	6581908.741	30.88951	115.690559	186.162003	1512.61137	2512.61137	2600
WP73	371968.43	6584100.047	30.869434	115.660758	147.171997	1384.72415	2384.72415	2400
WP23	370657.3149	6584180.37	30.868567	115.647057	120.008003	1295.62625	2295.62625	2300
WP71	370629.2806	6585175.947	30.859583	115.64689	124.733002	1311.124247	2311.124247	2400
WP66	384036.1592	6583155.767	30.879197	115.786857	227.132996	1646.996227	2646.996227	2700
WP67	384050.3804	6582336.019	30.886594	115.786913	238.218994	1683.3583	2683.3583	2700
WP60	383225.4984	6581889.477	30.890541	115.778233	235.858002	1675.614247	2675.614247	2700
WP39	380471.1565	6581820.366	30.890889	115.749413	212.994003	1600.62033	2600.62033	2600
WP35	379596.7305	6580435.875	30.90329	115.740103	212.802002	1599.990567	2599.990567	2600

Turbine ID	Easting m	Northing m	Lat_WGS84	Long_WGS84	Elevation[m]	275m Tip Ht AHD [ft]	Add MOC	LSALT
WP40	380209.0183	6581155.806	30.896858	115.746593	206.647995	1579.805424	2579.805424	2600
WP49	381438.2391	6580898.635	30.899302	115.759422	231.625	1661.73	2661.73	2700
WP64	382885.8483	6581033.42	30.89823	115.774582	240.018997	1689.26231	2689.26231	2700
WP59	384063.0201	6581455.496	30.894539	115.786945	229.186005	1653.730096	2653.730096	2700
WP61	384070.5339	6580723.115	30.901147	115.78694	206.537003	1579.44137	2579.44137	2600
WP57	382459.4828	6580188.116	30.905814	115.770024	227.839996	1649.315187	2649.315187	2700
WP50	381490.7258	6579970.135	30.907683	115.759863	225.615005	1642.017216	2642.017216	2700
WP41	380313.9061	6579872.456	30.908446	115.747539	221.186996	1627.493347	2627.493347	2700
WP62	379031.3326	6579815.175	30.908832	115.734114	191.764999	1530.989197	2530.989197	2600
WP28	378384.5316	6580197.92	30.905313	115.727392	202.291	1565.51448	2565.51448	2600
WP32	378395.8747	6579203.938	30.914281	115.727392	215.223999	1607.934717	2607.934717	2700
WP36	379821.4067	6579172.918	30.914707	115.742304	203.626999	1569.896557	2569.896557	2600
WP42	380724.8777	6579114.507	30.915325	115.75175	231.983002	1662.904247	2662.904247	2700
WP51	381690.4796	6579166.925	30.914949	115.76186	213.115005	1601.017216	2601.017216	2700
WP10	383184.3686	6579391.683	30.913071	115.777517	213.953003	1603.76585	2603.76585	2700
WP74	384079.6738	6579907.08	30.908509	115.786943	204.085999	1571.402077	2571.402077	2600
WP77	383648.4795	6578547.203	30.920735	115.782276	206.429993	1579.090377	2579.090377	2600
WP52	381485.7973	6578240.292	30.923288	115.75961	201.912994	1564.27462	2564.27462	2600
WP43	380793.345	6577286.492	30.931823	115.752253	198.102997	1551.77783	2551.77783	2600
WP4	382070.606	6576236.18	30.941426	115.765498	188.800003	1521.26401	2521.26401	2600
WP44	380728.9579	6576377.966	30.940012	115.751472	211.858994	1596.8975	2596.8975	2600
WP45	380739.3234	6575570.614	-30.947297	115.751486	184.554993	1507.340377	2507.340377	2600
WP37	379971.0493	6577090.193	30.93351	115.743624	210.660004	1592.964813	2592.964813	2600

Turbine ID	Easting m	Northing m	Lat_WGS84	Long_WGS84	Elevation[m]	275m Tip Ht AHD [ft]	Add MOC	LSALT
WP78	379037.2676	6577046.525	30.933809	115.733847	199.212006	1555.41538	2555.41538	2600
WP33	379812.9676	6576162.795	30.941861	115.74186	188.781998	1521.204953	2521.204953	2600
WP8	381069.3646	6573822.452	30.9631	115.754736	184.292007	1506.477783	2506.477783	2600
WP47	380720.1962	6574559.555	30.956416	115.751167	180.475006	1493.95802	2493.95802	2500
WP58	379945.6547	6574110.651	30.960387	115.743007	160.813004	1429.466653	2429.466653	2500
WP31	377718.2826	6574271.311	30.958708	115.71971	134.697006	1343.80618	2343.80618	2400
WP34	379012.5207	6575409.818	30.948571	115.733393	167.994003	1453.02033	2453.02033	2500
WP30	378113.9237	6575812.214	30.944849	115.724036	172.660004	1468.324813	2468.324813	2500
WP26	376838.8823	6575745.398	30.945319	115.710683	180.716995	1494.751744	2494.751744	2500
WP29	378113.225	6576752.854	30.936363	115.724142	217.304001	1614.757123	2614.757123	2700
WP18	375197.4656	6574728.312	30.954322	115.693379	134.697006	1343.80618	2343.80618	2400
WP25	377895.8844	6577888.189	30.926099	115.722003	193.345993	1536.174857	2536.174857	2600
WP24	377778.5953	6578618.09	30.919502	115.720864	217.994003	1617.02033	2617.02033	2700
WP22	376942.3269	6578615.828	30.919436	115.712113	226.253998	1644.113113	2644.113113	2700
WP48	376944.1142	6577876.82	30.926103	115.712042	215.910004	1610.184813	2610.184813	2700
WP19	375937.9069	6577997.844	30.924906	115.701528	191.742996	1530.917027	2530.917027	2600
WP17	375426.362	6575919.654	30.943599	115.695921	184.529999	1507.258397	2507.258397	2600
WP12	374590.9722	6575504.654	30.947254	115.687126	151.537994	1399.04462	2399.04462	2400
WP11	374398.0508	6577394.546	30.930185	115.68534	138.278	1355.55184	2355.55184	2400
WP16	375360.4653	6578625.09	30.919186	115.695562	188.682999	1520.880237	2520.880237	2600
WP2	369318.2308	6585145.22	30.859716	115.633177	158.054993	1420.420377	2420.420377	2500
WP3	369571.4867	6584167.129	30.868567	115.6357	145.917007	1380.607783	2380.607783	2400
WP6	372190.312	6581235.4	30.8953	115.66272	159.755005	1425.996416	2425.996416	2500

Turbine ID	Easting m	Northing m	Lat_WGS84	Long_WGS84	Elevation[m]	275m Tip Ht AHD [ft]	Add MOC	LSALT
WP20	370444.5064	6580551.124	30.901283	115.64437	100.862	1232.82736	2232.82736	2300
WP7	371590.0624	6580276.596	30.903884	115.65632	127.990997	1321.81047	2321.81047	2400
WP63	375918.8109	6580006.918	30.90678	115.701573	219.121994	1620.72014	2620.72014	2700
WP27	375349.7746	6579488.251	30.911399	115.695556	218.988998	1620.283913	2620.283913	2700
WP15	375308.0066	6580410.92	30.903071	115.695232	218.789993	1619.631177	2619.631177	2700
WP1	375880.2913	6580830.423	30.899347	115.70127	192.046997	1531.91415	2531.91415	2600
WP81	375922.7657	6583406.065	30.876116	115.702028	148.442993	1388.893017	2388.893017	2400
WP14	375318.154	6581268.814	30.895333	115.695443	198.237	1552.21736	2552.21736	2600
WP9	374442.533	6581142.755	30.896377	115.686268	182.300003	1499.94401	2499.94401	2500
WP80	376260.2545	6584272.152	30.868338	115.705663	162.332001	1434.448963	2434.448963	2500
WP70	373378.9294	6583479.031	30.875188	115.675432	134.160004	1342.044813	2342.044813	2400
WP76	373980.5304	6582835.484	30.881058	115.681644	148.270004	1388.325613	2388.325613	2400
WP75	375292.6224	6582706.83	30.882358	115.695352	181.822006	1498.37618	2498.37618	2500
AE82	378403.975	6584448.199	30.866973	115.728103	209.748993	1589.976697	2589.976697	2600

Tallest Turbine is WP64 – at elevation 240.018997m and tip height 515.018997m

APPENDIX B

Turbine Locations and Heights
Layout WP 20250630
Superseded

APPENDIX B

no	Turbine ID	X_GDA2020z50	Y_GDA2020z50	Long_WGS84	Lat_WGS84	Tip Height (m) AGL	Elevation (m) AHD	Tip Height (m) AHD	Tip Height (ft) AHD	Plus MOC	LSALT
1	WP8	381067.1	6573820	115.754712	-30.963118	275	184.248001	459.248001	1506.700842	2506.700842	2600
2	WP58	379872.3	6574172	115.742246	-30.959829	275	161.360992	436.360992	1431.613143	2431.613143	2500
3	WP31	377716	6574269	115.719686	-30.958726	275	134.738998	409.738998	1344.271705	2344.271705	2400
4	WP56	378628	6574524	115.729263	-30.956524	275	141.373001	416.373001	1366.036542	2366.036542	2400
5	WP47	380730.7	6574560	115.751277	-30.956413	275	180.348007	455.348007	1493.905741	2493.905741	2500
6	WP72	382534.5	6574668	115.770171	-30.955617	275	160.139008	435.139008	1427.604057	2427.604057	2500
7	WP18	375195.2	6574726	115.693355	-30.95434	275	134.74	409.74	1344.274992	2344.274992	2400
8	WP46	380015	6575057	115.743844	-30.951854	275	179.205994	454.205994	1490.159025	2490.159025	2500
9	WP21	382182.1	6575422	115.76657	-30.948785	275	187.011002	462.011002	1515.765695	2515.765695	2600
10	WP34	379010.3	6575408	115.733369	-30.948589	275	167.873993	442.873993	1452.980996	2452.980996	2500
11	WP45	380649.9	6575570	115.75055	-30.94729	275	189.414001	464.414001	1523.649454	2523.649454	2600
12	WP12	374588.7	6575503	115.687102	-30.947272	275	151.328003	426.328003	1398.696912	2398.696912	2400
13	WP26	376836	6575692	115.710646	-30.945801	275	179.248993	454.248993	1490.300096	2490.300096	2500
14	WP30	378111.5	6575858	115.724016	-30.944439	275	174.561996	449.561996	1474.922996	2474.922996	2500
15	WP17	375424.1	6575918	115.695897	-30.943617	275	184.488007	459.488007	1507.488253	2507.488253	2600
16	WP33	379810.7	6576161	115.741837	-30.941878	275	188.660995	463.660995	1521.178992	2521.178992	2600
17	WP4	382068.4	6576234	115.765474	-30.941444	275	189.003998	464.003998	1522.304317	2522.304317	2600
18	WP44	380797.7	6576378	115.752192	-30.940017	275	205.834	480.834	1577.520187	2577.520187	2600
19	WP69	373945.2	6576337	115.68047	-30.939677	275	125.984001	400.984001	1315.54831	2315.54831	2400
20	WP38	374749.5	6576599	115.68892	-30.9374	275	149.020996	424.020996	1391.128084	2391.128084	2400
21	WP29	378111	6576751	115.724118	-30.936381	275	217.136002	492.136002	1614.599795	2614.599795	2700
22	WP37	379968.8	6577052	115.743596	-30.933859	275	210.067993	485.067993	1591.411071	2591.411071	2600

no	Turbine ID	X_GDA2020z50	Y_GDA2020z50	Long_WGS84	Lat_WGS84	Tip Height (m) AGL	Elevation (m) AHD	Tip Height (m) AHD	Tip Height (ft) AHD	Plus MOC	LSALT
23	WP78	379035	6577045	115.733823	-30.933827	275	199.078003	474.078003	1555.355112	2555.355112	2600
24	WP43	380805.2	6577226	115.75237	-30.932371	275	199.809006	474.809006	1557.753387	2557.753387	2600
25	WP79	377189.3	6577207	115.714528	-30.932168	275	189.414993	464.414993	1523.652709	2523.652709	2600
26	WP11	374457.5	6577393	115.685963	-30.930203	275	138.332993	413.332993	1356.062883	2356.062883	2400
27	WP48	376906.2	6577875	115.711645	-30.926117	275	216.992996	491.992996	1614.130621	2614.130621	2700
28	WP25	377893.6	6577886	115.721979	-30.926117	275	193.317993	468.317993	1536.457671	2536.457671	2600
29	WP19	375935.7	6577996	115.701504	-30.924923	275	191.529999	466.529999	1530.591621	2530.591621	2600
30	WP52	381483.5	6578238	115.759586	-30.923306	275	201.998001	476.998001	1564.935042	2564.935042	2600
31	WP54	382640.9	6578417	115.771718	-30.921808	275	211.485001	486.485001	1596.059991	2596.059991	2600
32	WP77	383643.5	6578619	115.782232	-30.920089	275	208.341995	483.341995	1585.748417	2585.748417	2600
33	WP24	377776.3	6578616	115.72084	-30.91952	275	217.975006	492.975006	1617.3524	2617.3524	2700
34	WP22	376940.1	6578614	115.712089	-30.919454	275	226.203995	501.203995	1644.350067	2644.350067	2700
35	WP16	375352.4	6578623	115.695477	-30.919205	275	188.748993	463.748993	1521.467696	2521.467696	2600
36	WP42	380722.6	6579113	115.751727	-30.915343	275	231.906006	506.906006	1663.057224	2663.057224	2700
37	WP51	381688.2	6579165	115.761836	-30.914967	275	213.253998	488.253998	1601.863717	2601.863717	700
38	WP36	379819.2	6579176	115.742281	-30.91468	275	203.565002	478.565002	1570.076059	2570.076059	2600
39	WP32	378393.6	6579202	115.727369	-30.914299	275	215.276001	490.276001	1608.497504	2608.497504	2700
40	WP10	383182.1	6579390	115.777493	-30.913088	275	213.770996	488.770996	1603.559884	2603.559884	2700
41	WP27	375246.2	6579487	115.694473	-30.911398	275	220.059998	495.059998	1624.192841	2624.192841	2700
42	WP62	379029.1	6579813	115.73409	-30.90885	275	191.824005	466.824005	1531.556196	2531.556196	2600
43	WP74	383916.1	6579903	115.785231	-30.908533	275	211.776001	486.776001	1597.014704	2597.014704	2600
44	WP41	380311.7	6579870	115.747516	-30.908464	275	221.186996	496.186996	1627.890296	2627.890296	2700
45	WP50	381488.5	6579968	115.759839	-30.907701	275	225.591003	500.591003	1642.338963	2642.338963	2700

no	Turbine ID	X_GDA2020z50	Y_GDA2020z50	Long_WGS84	Lat_WGS84	Tip Height (m) AGL	Elevation (m) AHD	Tip Height (m) AHD	Tip Height (ft) AHD	Plus MOC	LSALT
46	WP63	375954.7	6580006	115.701948	-30.90679	275	219.160004	494.160004	1621.240141	2621.240141	2700
47	WP57	382457.2	6580186	115.77	-30.905832	275	227.662003	502.662003	1649.133499	2649.133499	2700
48	WP28	378382.3	6580196	115.727369	-30.905331	275	202.414001	477.414001	1566.299854	2566.299854	2600
49	WP7	371582.6	6580245	115.656238	-30.904171	275	126.589996	401.589996	1317.536459	2317.536459	2400
50	WP35	379594.5	6580434	115.740079	-30.903308	275	212.639999	487.639999	1599.849309	2599.849309	2600
51	WP15	375215.3	6580396	115.69426	-30.903192	275	220.593002	495.593002	1625.941521	2625.941521	2700
52	WP55	380788.1	6580550	115.75258	-30.90238	275	232.854996	507.854996	1666.170671	2666.170671	2700
53	WP20	370442.3	6580549	115.644347	-30.901301	275	100.768997	375.768997	1232.822925	2232.822925	2300
54	WP61	383775.5	6580715	115.783853	-30.901189	275	222.580002	497.580002	1632.460471	2632.460471	2700
55	WP1	375924.8	6580833	115.701736	-30.89933	275	191.511993	466.511993	1530.532547	2530.532547	2600
56	WP49	381466.8	6580923	115.759724	-30.899081	275	230.600006	505.600006	1658.7725	2658.7725	2700
57	WP64	382883.6	6581031	115.774558	-30.898248	275	240.115005	515.115005	1689.989308	2689.989308	2700
58	WP40	380206.8	6581154	115.746569	-30.896876	275	206.582001	481.582001	1579.974229	2579.974229	2600
59	WP9	374440.3	6581141	115.686244	-30.896395	275	182.300995	457.300995	1500.313104	2500.313104	2500
60	WP5	371426.7	6581175	115.654724	-30.895764	275	154.826996	429.826996	1410.176408	2410.176408	2500
61	WP14	375315.9	6581267	115.695419	-30.895351	275	198.235001	473.235001	1552.589391	2552.589391	2600
62	WP6	372186.7	6581234	115.662681	-30.895312	275	159.854004	434.854004	1426.669016	2426.669016	2500
63	WP59	384068.1	6581454	115.786998	-30.894555	275	229.244003	504.244003	1654.323725	2654.323725	2700
64	WP39	380468.9	6581818	115.749389	-30.890907	275	212.884003	487.884003	1600.649837	2600.649837	2600
65	WP60	383223.2	6581887	115.778209	-30.890559	275	235.779999	510.779999	1675.767021	2675.767021	2700
66	WP53	382102.2	6581899	115.766484	-30.890348	275	217.746002	492.746002	1616.601083	2616.601083	2700
67	WP13	375918.4	6581860	115.701794	-30.890062	275	204.688004	479.688004	1573.760404	2573.760404	2600
68	WP68	374841.5	6581886	115.690532	-30.889714	275	186.397003	461.397003	1513.751287	2513.751287	2600

no	Turbine ID	X_GDA2020z50	Y_GDA2020z50	Long_WGS84	Lat_WGS84	Tip Height (m) AGL	Elevation (m) AHD	Tip Height (m) AHD	Tip Height (ft) AHD	Plus MOC	LSALT
69	WP67	384075.2	6582334	115.787172	-30.886613	275	237.785995	512.785995	1682.348292	2682.348292	2700
70	WP75	375290.4	6582705	115.695328	-30.882376	275	181.906998	456.906998	1499.020479	2499.020479	2500
71	WP76	374124.2	6582942	115.68316	-30.88011	275	154.240997	429.240997	1408.253863	2408.253863	2500
72	WP66	384058.9	6583154	115.787095	-30.879218	275	227.281006	502.281006	1647.883524	2647.883524	2700
73	WP81	376022	6583353	115.703059	-30.876606	275	148.660995	423.660995	1389.946992	2389.946992	2400
74	WP70	373389.4	6583432	115.675535	-30.875615	275	134.296997	409.296997	1342.821588	2342.821588	2400
75	WP65	384035.5	6583944	115.78694	-30.872087	275	201.764999	476.764999	1564.170609	2564.170609	2600
76	WP73	371950.9	6584139	115.66058	-30.869083	275	146.621002	421.621002	1383.254183	2383.254183	2400
77	WP23	370639	6584143	115.646861	-30.868899	275	120.690002	395.690002	1298.179759	2298.179759	2300
78	WP3	369572.8	6584183	115.635716	-30.868427	275	146.315994	421.315994	1382.253513	2382.253513	2400
79	WP80	376258	6584270	115.705639	-30.868356	275	162.304001	437.304001	1434.706966	2434.706966	2500
80	WP2	369311.8	6585159	115.633111	-30.859591	275	157.822006	432.822006	1420.002437	2420.002437	2500
81	WP71	370703.8	6585211	115.647674	-30.859277	275	124.194	399.194	1309.675675	2309.675675	2400

Tallest turbine is WP64 at elevation 240.115005m and tip height 515.115005m.

APPENDIX C

Turbine Locations and Heights Superseded

Appendix C

No.	Name	X	Y	Latitude S WGS84	Longitude E WGS84	Hub Height	Tip Height	Rotor Diam	Elevation	Tip Height	Tip Height	Add MOC	LSALT
				dd mm ss	dd mm ss	m AGL	m AGL	m	m AHD	m AHD	ft AHD	1000ft	
1	T04	368386.3777	6585068.338	30 51 37.10	115 37 24.32	155	247	246.7	135.1610	382.1610	1253.7938	2253.7938	2300
2	T08	369342.0699	6585053.264	30 51 37.97	115 38 00.29	155	247	246.7	160.5780	407.5780	1337.1819	2337.1819	2400
3	T09	369878.1207	6584101.1	30 52 09.11	115 38 20.03	155	247	246.7	134.5130	381.5130	1251.6679	2251.6679	2300
4	T10	370166.2551	6581613.588	30 53 30.00	115 38 29.74	155	247	246.7	101.6940	348.6940	1143.9953	2143.9953	2200
5	T24	371547.7952	6581003.744	30 53 50.35	115 39 21.49	155	247	246.7	158.3930	405.3930	1330.0134	2330.0134	2400
6	T26	372356.7478	6581419	30 53 37.18	115 39 52.14	155	247	246.7	153.5410	400.5410	1314.0949	2314.0949	2400
7	T27	372260.8196	6580198.344	30 54 16.79	115 39 47.98	155	247	246.7	140.9670	387.9670	1272.8421	2272.8421	2300
8	T29	373412.0451	6581372.781	30 53 39.09	115 40 31.86	155	247	246.7	167.3850	414.3850	1359.5143	2359.5143	2400
9	T31	374495.9542	6581118.765	30 53 47.76	115 41 12.57	155	247	246.7	185.6640	432.6640	1419.4841	2419.4841	2500
10	T32	374573.0908	6579143.684	30 54 51.93	115 41 14.60	155	247	246.7	198.1970	445.1970	1460.6023	2460.6023	2500
11	T34	374563.4276	6577338.456	30 55 50.55	115 41 13.43	155	247	246.7	136.6650	383.6650	1258.7281	2258.7281	2300
12	T35	374441.712	6575577.987	30 56 47.68	115 41 08.06	155	247	246.7	144.2990	391.2990	1283.7737	2283.7737	2300
13	T36	375396.6296	6581338.583	30 53 40.96	115 41 46.58	155	247	246.7	197.0730	444.0730	1456.9147	2456.9147	2500
14	T37	375366.9459	6580369.689	30 54 12.42	115 41 45.04	155	247	246.7	217.9570	464.9570	1525.4309	2525.4309	2600
15	T38	375379.9954	6579493.66	30 54 40.87	115 41 45.14	155	247	246.7	218.6380	465.6380	1527.6652	2527.6652	2600
16	T39	375338.1204	6578623.75	30 55 09.11	115 41 43.18	155	247	246.7	189.3970	436.3970	1431.7313	2431.7313	2500
17	T40	375827.0459	6577858.529	30 55 34.14	115 42 01.26	155	247	246.7	181.4160	428.4160	1405.5472	2405.5472	2500
18	T41	375346.0888	6576046.656	30 56 32.80	115 41 42.35	155	247	246.7	181.5990	428.5990	1406.1476	2406.1476	2500
19	T42	375201.5675	6575076.736	30 57 04.24	115 41 36.47	155	247	246.7	145.0000	392.0000	1286.0736	2286.0736	2300
20	T43	375842.9409	6574298.313	30 57 29.77	115 42 00.30	155	247	246.7	135.0000	382.0000	1253.2656	2253.2656	2300
21	T44	376144.9381	6580824.356	30 53 57.95	115 42 14.54	155	247	246.7	192.6220	439.6220	1442.3118	2442.3118	2500

No.	Name	X	Y	Latitude S WGS84	Longitude E WGS84	Hub Height	Tip Height	Rotor Diam	Elevation	Tip Height	Tip Height	Add MOC	LSALT
				dd mm ss	dd mm ss	m AGL	m AGL	m	m AHD	m AHD	ft AHD	1000ft	
22	T45	376157.455	6579947.92	30 54 26.41	115 42 14.62	155	247	246.7	219.2680	466.2680	1529.7321	2529.7321	2600
23	T46	376188.2079	6579048.383	30 54 55.64	115 42 15.39	155	247	246.7	192.1370	439.1370	1440.7206	2440.7206	2500
24	T47	376998.5127	6578697.541	30 55 07.34	115 42 45.76	155	247	246.7	227.0800	474.0800	1555.3617	2555.3617	2600
25	T48	376687.679	6577789.06	30 55 36.72	115 42 33.65	155	247	246.7	216.7690	463.7690	1521.5333	2521.5333	2600
26	T49	377859.6578	6578671.926	30 55 08.49	115 43 18.19	155	247	246.7	219.4260	466.4260	1530.2504	2530.2504	2600
27	T50	377563.3232	6577858.67	30 55 34.79	115 43 06.27	155	247	246.7	190.4860	437.4860	1435.3040	2435.3040	2500
28	T51	377199.2152	6575774.897	30 56 42.33	115 42 52.05	155	247	246.7	157.1200	404.1200	1325.8369	2325.8369	2400
29	T52	377368.9587	6574461.55	30 57 25.04	115 42 57.87	155	247	246.7	143.0380	390.0380	1279.6367	2279.6367	2300
30	T53	378127.1686	6579892.563	30 54 28.95	115 43 28.79	155	247	246.7	198.0060	445.0060	1459.9757	2459.9757	2500
31	T54	378160.2171	6577227.114	30 55 55.52	115 43 28.88	155	247	246.7	224.4600	471.4600	1546.7660	2546.7660	2600
32	T55	378134.9077	6576303.072	30 56 25.52	115 43 27.53	155	247	246.7	189.6890	436.6890	1432.6893	2432.6893	2500
33	T56	378598.5653	6580644.615	30 54 04.70	115 43 46.87	155	247	246.7	176.2910	423.2910	1388.7331	2388.7331	2400
34	T57	378636.9231	6579059.704	30 54 56.18	115 43 47.63	155	247	246.7	217.7060	464.7060	1524.6074	2524.6074	2600
35	T58	378948.3691	6576857.034	30 56 07.83	115 43 56.42	155	247	246.7	193.2890	440.2890	1444.5002	2444.5002	2500
36	T59	378618.4788	6575459.9	30 56 53.08	115 43 45.39	155	247	246.7	166.2910	413.2910	1355.9251	2355.9251	2400
37	T60	379375.4556	6581041.82	30 53 52.09	115 44 16.29	155	247	246.7	199.2160	446.2160	1463.9455	2463.9455	2500
38	T61	379085.3962	6579896.648	30 54 29.17	115 44 04.88	155	247	246.7	189.1650	436.1650	1430.9701	2430.9701	2500
39	T62	379672.8538	6579219.729	30 54 51.37	115 44 26.72	155	247	246.7	204.7440	451.7440	1482.0817	2482.0817	2500
40	T63	379842.4696	6576955.404	30 56 04.97	115 44 32.15	155	247	246.7	204.9290	451.9290	1482.6887	2482.6887	2500
41	T64	379283.8844	6576024.935	30 56 34.98	115 44 10.70	155	247	246.7	172.4940	419.4940	1376.2759	2376.2759	2400
42	T65	380166.2	6581725.9	30 53 30.16	115 44 46.36	155	247	246.7	201.6850	448.6850	1472.0457	2472.0457	2500
43	T66	380233.6181	6580762.924	30 54 01.46	115 44 48.49	155	247	246.7	222.7610	469.7610	1541.1919	2541.1919	2600

No.	Name	X	Y	Latitude S WGS84	Longitude E WGS84	Hub Height	Tip Height	Rotor Diam	Elevation	Tip Height	Tip Height	Add MOC	LSALT
				dd mm ss	dd mm ss	m AGL	m AGL	m	m AHD	m AHD	ft AHD	1000ft	
44	T67	380303.7056	6579874.881	30 54 30.32	115 45 50.76	155	247	246.7	220.8140	467.8140	1534.8042	2534.8042	2600
45	T68	380703.3828	6579094.369	30 54 55.82	115 45 05.48	155	247	246.7	231.4660	478.4660	1569.7513	2569.7513	2600
46	T69	380606.3546	6577404.583	30 55 50.66	115 45 01.12	155	247	246.7	204.3600	451.3600	1480.8219	2480.8219	2500
47	T70	380629.8711	6576494.417	30 56 20.23	115 45 01.62	155	247	246.7	216.7220	463.7220	1521.3791	2521.3791	2600
48	T71	380548.8391	6575623.703	30 56 48.47	115 44 58.20	155	247	246.7	195.7550	442.7550	1452.5906	2452.5906	2500
49	T72	380233.7947	6574782.547	30 57 15.68	115 44 45.97	155	247	246.7	193.7540	440.7540	1446.0257	2446.0257	2500
50	T73	380919.4365	6574186.279	30 57 35.29	115 45 11.55	155	247	246.7	181.9270	428.9270	1407.2237	2407.2237	2500
51	T74	381317.2029	6573387.62	30 58 01.37	115 45 26.21	155	247	246.7	171.1120	418.1120	1371.7418	2371.7418	2400
52	T75	381337.7694	6580914.207	30 53 56.95	115 45 30.14	155	247	246.7	233.1140	480.1140	1575.1580	2575.1580	2600
53	T76	381326.3956	6579985.322	30 54 27.11	115 45 29.32	155	247	246.7	228.9060	475.9060	1561.3524	2561.3524	2600
54	T77	381588.1705	6579123.825	30 54 55.18	115 45 38.82	155	247	246.7	219.4770	466.4770	1530.4178	2530.4178	2600
55	T78	381349.5151	6578278.177	30 55 22.56	115 45 29.48	155	247	246.7	210.6960	457.6960	1501.6090	2501.6090	2600
56	T79	382102.6387	6581313.322	30 53 44.26	115 45 59.11	155	247	246.7	221.4700	468.4700	1536.9564	2536.9564	2600
57	T80	382186.3882	6578028.747	30 55 30.96	115 46 00.90	155	247	246.7	200.3730	447.3730	1467.7413	2467.7413	2500
58	T81	382193.5187	6575638.441	30 56 48.59	115 46 00.17	155	247	246.7	186.1490	433.1490	1421.0752	2421.0752	2500
59	T82	382555.5246	6582176.439	30 53 16.39	115 46 16.53	155	247	246.7	211.5810	458.5810	1504.5125	2504.5125	2600
60	T83	382606.323	6580175.14	30 54 21.40	115 46 17.61	155	247	246.7	230.2550	477.2550	1565.7782	2565.7782	2600
61	T84	382687.4227	6579291.596	30 54 50.13	115 46 20.30	155	247	246.7	211.9100	458.9100	1505.5919	2505.5919	2600
62	T86	383462.2545	6582137.805	30 53 17.97	115 46 50.66	155	247	246.7	237.9360	484.9360	1590.9780	2590.9780	2600
63	T87	382991.0428	6581404.302	30 53 41.62	115 46 32.61	155	247	246.7	235.3880	482.3880	1582.6186	2582.6186	2600
64	T88	383649.5089	6580798.255	30 54 01.54	115 46 57.16	155	247	246.7	230.9820	477.9820	1568.1633	2568.1633	2600
65	T89	383509.596	6579948.388	30 54 29.09	115 46 51.54	155	247	246.7	230.6420	477.6420	1567.0479	2567.0479	2600

No.	Name	X	Y	Latitude S WGS84	Longitude E WGS84	Hub Height	Tip Height	Rotor Diam	Elevation	Tip Height	Tip Height	Add MOC	LSALT
				dd mm ss	dd mm ss	m AGL	m AGL	m	m AHD	m AHD	ft AHD	1000ft	
66	T90	383527.3719	6579023.509	30 54 59.13	115 46 51.83	155	247	246.7	214.0700	461.0700	1512.6785	2512.6785	2600
67	T91	383061.67	6578222.252	30 55 24.99	115 46 33.95	155	247	246.7	204.3720	451.3720	1480.8612	2480.8612	2500
68	T92	384058.0178	6583308.475	30 52 40.16	115 47 13.57	155	247	246.7	223.6450	470.6450	1544.0921	2544.0921	2600
69	T93	384426.3626	6582475.809	30 53 07.33	115 47 27.10	155	247	246.7	238.8700	485.8700	1594.0423	2594.0423	2600
70	T94	384206.2945	6581586.76	30 53 36.13	115 47 18.45	155	247	246.7	225.6660	472.6660	1550.7226	2550.7226	2600
71	T95	384513.5	6580368.4	30 54 15.80	115 47 29.52	155	247	246.7	205.2830	452.2830	1483.8501	2483.8501	2500
72	T96	384408.4886	6579487.909	30 54 44.36	115 47 25.21	155	247	246.7	191.0180	438.0180	1437.0495	2437.0495	2500
73	TN01	372730.5037	6583497.852	30 52 29.92	115 40 07.15	155	247	246.7	166.5560	413.5560	1356.7945	2356.7945	2400
74	TN02	373515.2	6583811.2	30 52 19.94	115 40 36.83	155	247	246.7	130.1340	377.1340	1237.3012	2237.3012	2300
75	TN03	376481.4208	6584552.692	30 51 56.99	115 42 28.83	155	247	246.7	168.4250	415.4250	1362.9264	2362.9264	2400
76	TN04	377543.6	6584509.6	30 51 58.79	115 43 08.80	155	247	246.7	197.1930	444.1930	1457.3084	2457.3084	2500
77	TN05	378440.2	6584511.8	30 51 59.05	115 43 42.56	155	247	246.7	209.6380	456.6380	1498.1380	2498.1380	2500
78	TN06	376006.1	6582497.5	30 53 03.56	115 42 10.04	155	247	246.7	177.2920	424.2920	1392.0172	2392.0172	2400
79	TN07	374892.7	6582502.7	30 53 02.96	115 41 28.12	155	247	246.7	178.7370	425.7370	1396.7579	2396.7579	2400
80	TN08	374124.4	6582942.6	30 52 48.39	115 40 59.38	155	247	246.7	154.2250	401.2250	1316.3390	2316.3390	2400
81	TN09	373253.7322	6582767.123	30 52 53.75	115 40 26.52	155	247	246.7	142.1580	389.1580	1276.7496	2276.7496	2300

T93 is tallest turbine at 485.8700m (1594.0423ft) AHD to give an LSALT of 2600ft.

APPENDIX D

Airservices Australia Response
WA-WF-067 P2
For tip height 275m AGL

Airservices Australia

ian_jennings@netspace.net.au

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Tuesday, 19 August 2025 12:56 PM
To: ian_jennings@netspace.net.au
Cc: Airspace Protection
Subject: Airservices response: WA-WF-067 P2 Marri Wind Farm - Revised AIA

OFFICIAL

Good afternoon,

I refer to your request for an Airservices assessment of the proposed activity at Marri, WA.

Airspace Procedures

With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Doc 9905, at a height of 515.12m (1690ft) AHD the wind turbines will not affect any sector or circling altitude, nor any instrument approach or departure procedure at any aerodrome or any air routes.

Note: Procedures not designed by Airservices at any aerodrome were not considered in this assessment.

Communications/Navigation/Surveillance (CNS) Facilities

We have assessed the proposed activity to the above specified height for any impacts to Airservices Precision/Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections to it proceeding.

Note: Meteorological instruments not owned by Airservices were not considered in this assessment. In accordance with Part 139 (Aerodromes) Manual of Standards, Chapter 19, we recommend consulting with the Bureau of Meteorology (the Bureau) to ensure that the proposed activity does not adversely affect their equipment. The Bureau can be contacted at airport.developments@bom.gov.au

Air Traffic Control (ATC) Operations

There are no additional instructions/concerns from ATC.

Summary

The proposed activity does not impact Airservices operations or facilities at any aerodrome or any air routes.

Vertical Obstacle Notification

As this proposed activity is more than 30m (99ft) AGL, please follow the below notification process:

1. Complete the Vertical Obstacle Notification Form: ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf (airservicesaustralia.com)

1

2. Submit completed form to: VOD@airservicesaustralia.com as soon as the development reaches the maximum height.

For further information regarding the reporting of tall structures, please contact the VOD team:

- Email - VOD@airservicesaustralia.com
- Or refer to: Civil Aviation Safety Regulation Part 175 — Airservices and You - Airservices (airservicesaustralia.com)

If you have any queries, please let our team know.

Thanks, and regards,
AIS Data & Airspace Development Protection
Email: airport.developments@airservicesaustralia.com
Phone: 0436 325 205

airservices

I acknowledge Aboriginal and Torres Strait Islander peoples as the traditional custodians of country throughout Australia where we live, learn and work.

OFFICIAL

From: ian_jennings@netspace.net.au <ian_jennings@netspace.net.au>
Sent: Friday, 11 July 2025 4:28 PM
To: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Subject: WA-WF-067 Marri Wind Farm - Revised Aviation Impact Statement

CAUTION: This email was sent from an external email address. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Team
Please find attached a Revised AIS for WA-WF-067 Marri Wind Farm.
The turbine tip height is now "up to 275m AGL" and some turbine locations have shifted.
This layout uses turbine ID of WP##.
At 275m AGL the tallest turbine has a LSALT of 2700ft.
Regards
Ian

Ian Jennings
Chiron Aviation Consultants
27 Hilda Street
Essendon Vic 3040
Australia
Mob +61 (0)402 025 223

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APPENDIX E

Superseded
Airservices Australia Response
WA-WF-067
For tip height 247m AGL

Airservices Australia

ian_jennings@netspace.net.au

From: Airport Developments <Airport.Developments@AirservicesAustralia.com>
Sent: Friday, 11 April 2025 2:14 PM
To: ian_jennings@netspace.net.au; DSRGIDEP.ExecutiveSupport@defence.gov.au
Cc: Airspace Protection; airport.developments@bom.gov.au
Subject: Airservices response: WA-WF-067 - Marri Wind Farm

Flag Status: Flagged

OFFICIAL

Good morning,

I refer to your request for an Airservices assessment of the proposed activity at Marri, WA.

Airspace Procedures

With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Doc 9905, at a height of 485.87m (1595ft) AHD the wind farm will not affect any sector or circling altitude, nor any instrument approach or departure procedure at any aerodrome or any air routes.

Note: Procedures not designed by Airservices at any aerodrome were not considered in this assessment.

Communications/Navigation/Surveillance (CNS) Facilities

We have assessed the proposed activity to the above specified height for any impacts to Airservices Precision/Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections to it proceeding.

Note: Meteorological instruments not owned by Airservices were not considered in this assessment. In accordance with Part 139 (Aerodromes) Manual of Standards, Chapter 19, we recommend consulting with the Bureau of Meteorology (the Bureau) to ensure that the proposed activity does not adversely affect their equipment. The Bureau can be contacted at airport.developments@bom.gov.au

Air Traffic Control (ATC) Operations

There are no additional instructions or concerns from ATC.

Summary

The proposed activity does not impact Airservices operations or facilities at any aerodrome or any air routes.

Vertical Obstacle Notification

As this proposed activity is more than 30m (99ft) AGL, please follow the below notification process:

1. Complete the Vertical Obstacle Notification Form: ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf (airservicesaustralia.com)
2. Submit completed form to: VOD@airservicesaustralia.com as soon as the development reaches the maximum height.

For further information regarding the reporting of tall structures, please contact the VOD team:

1

- Phone - (02) 6268 5622
- Email - VOD@airservicesaustralia.com
- Or refer to: Civil Aviation Safety Regulation Part 175 — Airservices and You - Airservices (airservicesaustralia.com)

If you have any queries, please let our team know.

Thanks and Regards,
Airport Development & Protection
Email: airport.developments@airservicesaustralia.com
Phone: 0436 325 205

airservices

I acknowledge Aboriginal and Torres Strait Islander peoples as the traditional custodians of country throughout Australia where we live, learn and work.

OFFICIAL

From: ian_jennings@netspace.net.au <ian_jennings@netspace.net.au>
Sent: Wednesday, 26 February 2025 2:27 PM
To: Airport Developments <Airport.Developments@AirservicesAustralia.com>; DSRGIDEP.ExecutiveSupport@defence.gov.au
Subject: Marri Wind Farm Aviation Impact Statement

CAUTION: This email was sent from an external email address. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Team,
Attached is the Aviation Impact Statement for the Marri Wind Farm, inland from Lancelin Western Australia. The proposed wind farm is within Danger Area D193 – Low Flying and close to the turning point for VFR Route 2.
Any questions please contact me.
Regards
Ian

Ian Jennings
Chiron Aviation Consultants
27 Hilda Street
Essendon Vic 3040
Australia
Mob +61 (0)402 025 223
E-mail ian_jennings@netspace.net.au
URL www.chironaviationconsultants.com.au

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APPENDIX F

Glossary of Terms and Abbreviations

APPENDIX E

Glossary of Terms and Abbreviations

AERONAUTICAL STUDY GLOSSARY

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. A full list of terms and abbreviations used in this report is included as an Appendix.

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.

AHD (Australian Height Datum) is the datum to which all vertical control for mapping is to be referred. The datum surface is that which passes through mean sea level at the 30 tide gauges and through points at zero AHD height vertically below the other basic junction points.

AIP (Aeronautical Information Publication) is a publication promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. It contains details of regulations, procedures and other information pertinent to flying and operation of aircraft. In Australia, the AIP may be issued by CASA or Airservices Australia.

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

AMSL (Above Mean Sea Level) is the elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level datum. In aviation, the ellipsoid known as World Geodetic System 84 (WGS 84) is the datum used to define 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, vehicles 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, ña term used by pilots and controllers to indicate the type of flight plan an aircraft is flying,ò such as an IFR or VFR flight plan.

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.

NASAG (National Airports Safeguarding Advisory Group) set up in May 2010 to implement the Australian Governmentôs National Aviation Policy White Paper, *Flight Path to the Future* initiatives relating to safeguarding airports and surrounding communities from inappropriate development. NASAG comprises representatives from state and territory planning and transport departments, the Civil Aviation Safety Authority (CASA), Airservices Australia, the Department of Defence and the Australian Local Government Association (ALGA) and is chaired by the Department of Infrastructure and Transport (DoIT).

NASF (National Airports Safeguarding Framework) is the published guidelines from the NASAG.

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 penetrate the OLS, they cannot be permitted to penetrate 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.

Protected 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 protected 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.

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.

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 CASR 1998)
ACFT	Aircraft
AD	Aerodrome
AHD	Australian Height Datum
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALA	Aircraft Landing Area
Alt	Altitude
AMSL	Above Minimum Sea Level
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
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
ELEV	Elevation (above mean sea level)
ENE	East Northeast
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
ft	feet
GA	General Aviation
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres

Abbreviation	Meaning
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LSALT	Lowest Safe Altitude
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
SSR	Monopulse Secondary Surveillance Radar
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NDB	Non Directional Beacon
NE	Northeast
NM or nm	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	North Northeast
NOTAM	NOtice To AirMen
OHS	Outer Horizontal Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services ï Aircraft Operations, ICAO Doc 8168
PSR	Primary Surveillance Radar
QNH	An altimeter setting relative to height above mean sea level
Rnnn	Restricted Airspace ï promulgated in AIP as R with 3 numbers
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPT	Regular Public Transport
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
SSR	Secondary Surveillance Radar
STAR	Standard ARrival
TAR	Terminal Area Radar
TAS	True Air Speed
TACAN	Tactical Air Navigation Systems
THR	Threshold (Runway)
TODA	Take-Off Distance Available
VFR	Visual Flight Rules
VOR	Very high frequency Omni directional Range

Abbreviation	Meaning
WAC	World Aeronautical Chart
YGIG	Gin Gin RAAF Base
YPEA	Pearce RAAF Base