

AVIATION IMPACT ASSESSMENT

KOJONUP WIND FARM

Prepared for Kojonup Wind Farm Pty Ltd



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TABLE OF CONTENTS

EXECUTIVE SUMMARY	IX
Introduction	ix
Aviation Impact Statement (AIS)	x
Obstacle lighting risk assessment	xi
Consultation	xi
Summary of key recommendations	xi
1. INTRODUCTION	1
1.1. Situation	1
1.2. Purpose and Scope	1
1.3. Methodology	1
1.4. Aviation Impact Statement (AIS)	2
1.5. Material reviewed	2
2. BACKGROUND	3
2.1. Site Overview	3
2.2. Project Description	3
3. EXTERNAL CONTEXT	4
3.1. National Airports Safeguarding Framework	4
3.2. Western Australia Government, Department of Planning, Lands and Heritage	4
3.3. Shire of Kojonup	5
3.4. Civil Aviation Safety Authority (CASA)	5
3.5. Rules of flight	8
3.6. Aircraft operator characteristics	8
3.7. Passenger transport operations	9
3.8. Private operations	9
3.9. Military operations	9
3.10. Aerial application operations	9
3.11. Emergency services	10
4. INTERNAL CONTEXT	12
4.1. Wind turbine generator (WTG) description	12
5. CONSULTATION	13
6. AVIATION IMPACT STATEMENT	24
6.1. Overview	24
6.2. Nearby certified aerodromes	24
6.3. Katanning Airport (YKNG)	25
6.4. Grid and Air routes LSALT	28
6.5. Airspace Protection	30
6.6. Aviation facilities	30
6.7. ATC Surveillance Radar installations	30
6.8. AIS Summary	31
7. UNCERTIFIED AERODROMES / HELIPAD	32
7.1. Kitto Aerodrome	33
7.2. Heggaton Aerodrome	34
7.3. Fares Aerodrome	36
7.4. Klopper Helipad	37
7.5. Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service	38

8. POTENTIAL WAKE TURBULENCE IMPACTS	40
8.1. Kitto Aerodrome	43
8.2. Heggaton Aerodrome	44
8.3. Fares Aerodrome	45
8.4. Klopper Helipad	46
9. HAZARD LIGHTING AND MARKING	47
10. ACCIDENT STATISTICS	48
10.1. General aviation operations	48
10.2. ATSB occurrence taxonomy	48
10.3. National aviation occurrence statistics 2010-2019	49
10.4. Worldwide accidents involving wind farms	51
11. RISK ASSESSMENT	53
11.1. Risk Identification	53
11.2. Risk Analysis, Evaluation and Treatment	53
12. CONCLUSIONS	64
12.1. Planning considerations	64
12.2. Aviation Impact Statement	64
12.3. Aircraft operator characteristics	64
12.4. Hazard marking and lighting	65
12.5. Summary of risks	65
13. RECOMMENDATIONS	67
ANNEXURES	69
ANNEXURE 1 – REFERENCES	70
ANNEXURE 2 – DEFINITIONS	71
ANNEXURE 3 – CASA REGULATORY REQUIREMENTS – LIGHTING AND MARKING	73
ANNEXURE 4 – RISK FRAMEWORK	80
ANNEXURE 5 – PROJECT TURBINE COORDINATES AND HEIGHTS	83

LIST OF FIGURES

Figure 1 Project site overview.....	3
Figure 2 Aerodrome standard traffic circuit, showing arrival and joining procedures.....	7
Figure 3 Lateral and vertical separation in the standard aerodrome traffic circuit.....	7
Figure 4 Project layout and highest WTG location.....	12
Figure 5 Location of certified airport in relation to the Project Site	25
Figure 6 MSA at Katanning Airport.....	26
Figure 7 Katanning Airport MSA.....	27
Figure 8 Grid LSALTs in proximity to the project site.	29
Figure 9 Uncertified aerodromes in the vicinity of the Project Site	32
Figure 10 Close-up satellite image of Kitto Aerodrome’s runway.....	33
Figure 11 Kitto Aerodrome in relation to the Project Site	34
Figure 12 Close-up satellite image of Heggaton Aerodrome’s runway	35
Figure 13 Heggaton Aerodrome in relation to the Project Site	35
Figure 14 Close-up satellite image of Fares Aerodrome’s runway	36
Figure 15 Fares Aerodrome in relation to the Project Site	36
Figure 16 Close-up satellite image of Klopper Helipad	37
Figure 17 Klopper Helipad in relation to the Project Site.....	38
Figure 18 National Park boundary related to WTGs.....	38
Figure 19 Turbulence intensities	43
Figure 20 Wake turbulence of closer WTGs in relation to the Kitto Aerodrome	43
Figure 21 Wake turbulence of closer WTGs in relation to the Heggaton Aerodrome	44
Figure 22 Wake turbulence of closer WTGs in relation to the Fares Aerodrome.....	45
Figure 23 Wake turbulence of closer WTGs in relation to the helipad.....	46
Figure 24 Fatal Accident Rate (per million departures) by Operation Type	50

LIST OF TABLES

Table 1 Stakeholder consultation details.....	14
Table 2 Katanning Airport (YKNG) aerodrome and procedure charts.....	26
Table 3 Katanning Airport MSA Impact Analysis	27
Table 4 Katanning Airport PANS-OPS Assessment.....	28
Table 5 Air route impact analysis	30
Table 6 Wake Turbulence Distances	42
Table 7 Number of fatalities by General Aviation sub-category – 2010 to 2019.....	49
Table 8 Fatal accidents by GA sub-category – 2010 -2019.....	50
Table 9 Aircraft collision with wind turbine generator (WTG)	54
Table 10 Harsh manoeuvring leading to controlled flight into terrain	57
Table 11 Effect of the Project on operating crew	60
Table 12 Effect of obstacle lighting on neighbours.....	62
Table 13 Summary of Residual Risks.....	65

ACRONYMS

AAAA	Aerial Application Association Australia
AC	Advisory Circular
AFAC	Australasian Fire and Emergency Services Council
AGL	above ground level
AHD	Australian Height Datum
AIA	aviation impact assessment
AIP	Aeronautical Information Package
AIS	aviation impact statement
ALARP	as low as reasonably practicable
AMSL	above mean sea level
ARP	Aerodrome Reference Point
AS	Australian Standards
ATSB	Australian Transport Safety Bureau
BoM	Bureau of Meteorology
CAO	Civil Aviation Orders
CAR	Civil Aviation Regulation (1988)
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation (1998)
CFIT	controlled flight into terrain
CNS	communications, navigation and surveillance
DAH	Designated Airspace Handbook
EIS	environmental impact statement
ERC-H	en-route chart high
ERC-L	en-route chart low
ERSA	En Route Supplement Australia
GA	general aviation
ICAO	International Civil Aviation Organization
IFR	instrument flight rules
IMC	instrument meteorological conditions
LGA	local government area

LSALT	lowest safe altitude
MOC	minimum obstacle clearance
MOS	Manual of Standards
MSA	minimum sector altitude
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NDB	non-directional (radio) beacon
OLS	obstacle limitation surface
PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
PSR	primary surveillance radar
RAAF	Royal Australian Air Force
RFDS	Royal Flying Doctor Service
RPT	regular public transport
RSR	route surveillance radar
SSR	secondary surveillance radar
VFR	visual flight rules
VMC	visual meteorological conditions
WMT	wind monitoring tower
WTG	wind turbine generator

UNITS OF MEASUREMENT

ft	feet	(1 ft = 0.3048 m)
km	kilometres	(1 km = 0.5399 nm)
m	metres	(1 m = 3.281 ft)
nm	nautical miles	(1 nm = 1.852 km)

DEFINITIONS

Definitions of key aviation terms are included in **Annexure 2**

NOTES

Nil

EXECUTIVE SUMMARY

Introduction

Kojonup Wind Farm Pty Ltd is preparing a new wind farm development in Kojonup, Western Australia, for development approval.

Kojonup Wind Farm Pty Ltd has requested that Aviation Projects prepare an aviation impact assessment (AIA) for the proposed Kojonup Wind Farm project.

The Project requires an AIA to be undertaken in accordance with the:

- Civil Aviation Regulations 1988 (CAR)
- Civil Aviation Safety Regulations 1998 (CASR)
- National Airspace Safeguarding Framework (NASF) Guideline D: *Managing the Risk to aviation safety of wind turbine installations (wind farms)/Wind Monitoring Towers* effective July 2012
- Western Australia Planning Commission, *Position Statement: Renewable energy facilities*, March 2020
- Specific requirements as advised by Airservices Australia

This AIA assesses the potential aviation impacts, provides aviation safety advice in respect of relevant requirements of air safety regulations and procedures and informs and documents consultation with relevant aviation agencies.

This AIA report includes an Aviation Impact Statement (AIS) for Airservices Australia and a qualitative risk assessment to determine the need for obstacle lighting.

Project description

The Wind Farm includes the following:

- Up to 33 wind turbine generators (WTGs) with a maximum tip height of 206 m above ground level (AGL)
- The ground elevation for the highest WTG location (WTG T11) is 381 m Australian height datum (AHD), which, with a 206 m WTG height, results in a maximum overall height of 587 m AHD (1925.9 ft above mean sea level (AMSL)).

Conclusions

Based on a comprehensive analysis and assessment detailed in this report, the following conclusions were made:

Planning considerations

1. The Project, as proposed, satisfies the planning provisions in relation to aviation safety matters and will not create incompatible intrusions or compromise the safety of existing airports and associated navigation and communication facilities.

Certified aerodromes

2. There is one certified aerodrome located within 30 nm (56 km) of the Project – Katanning Airport (YKNG).
 - a. The WTGs would not impact the IFR circling areas.
 - b. The 25 nm MSA would need to be increased by 100 ft to 3000 ft or sectorised to exclude the wind farm area.
 - c. The WTGs would not impact the PANS-OPS surfaces of the RNP RWY 25 instrument approach procedures. However, if the 25 nm MSA is not sectorised for the wind farm and increased to 3000 ft, the minimum altitudes in the initial approach segments would need to be increased to be consistent with the 25 nm MSA minimum altitude

Obstacle Limitation Surfaces (OLS)

3. The Project is located outside the horizontal extent of OLS of any airport.

Uncertified Aerodromes

4. There are four uncertified aerodromes identified within 3 nm of the Project site – Fares aerodrome, Kitto aerodrome, Heggaton aerodrome, Klopper Helipad:
 - a. The WTGs might have some impact on the operation of the aerodromes.
 - b. Downstream wake turbulence from the closer WTGs might extend into the circuit area of the aerodrome and may create an impact on aircraft operations of the Unknown Aerodrome.
 - c. Consultation with the aerodrome owners commenced and recommended continuing.

Air Routes and Lowest Safe Altitude (LSALT)

5. The WTGs would not impact any Grid LSALT and air route LSALT.

Airspace

6. The project area is located within Class G airspace and outside all controlled airspace, Prohibited, Restricted and Danger areas.

Aviation Facilities

7. The WTGs would not infringe any protection areas associated with aviation facilities.

Radar

8. The project site is located outside of the Area of Interest for assessment of potential impact from the development on surveillance radar. The Project will not impact the Kalamunda surveillance radar (RSR) and Perth Primary surveillance radar (PSR) and Perth Secondary surveillance radar (SSR).

Aviation Impact Statement (AIS)

Based on the WTG layout and maximum blade tip height of up to 206 m AGL, the blade tip elevation of the highest WTG, which is WTG T11, will not exceed 587 m AHD (1925.9 ft AMSL) and;

- There is one certified aerodrome located within 30 nm (56 km) of the Project - Katanning Airport (YKNG)
 - The WTGs would not impact the OLS surfaces.

- The WTGs would not impact the IFR circling areas.
 - The 25 nm MSA would need to be increased by 100 ft to 3000 ft or sectorised to exclude the wind farm area.
 - The WTGs would not impact the PANS-OPS surfaces of the RNP RWY 25 instrument approach procedures. However, if the 25 nm MSA is not sectorised for the wind farm and increased to 3000 ft, the minimum altitudes in the initial approach segments would need to be increased to be consistent with the 25 nm MSA minimum altitude
- The WTGs would not impact any Grid LSALT and air route LSALT
 - The Project area is located within Class G airspace and outside of controlled airspace, Prohibited, Restricted and Danger areas.
 - The WTGs would not impact the aviation navigation facilities.
 - The WTGs would not impact the closest ATC surveillance radar installations

Obstacle lighting risk assessment

Aviation Projects has undertaken a safety risk assessment of the Project and concludes that the proposed WTGs would not require obstacle lighting to maintain an acceptable level of safety to aircraft.

Consultation

Refer to **Section 5** for detailed responses from relevant aviation stakeholders received.

The risk assessment has been updated, and this report finalised based on the feedback received during the consultation process. Feedback is documented in this report.

Summary of key recommendations

Recommended actions resulting from the conduct of this assessment are provided below:

Notification and reporting

1. Details of WTGs 100 m or more AGL must be reported to CASA as soon as practicable after forming the intention to construct or erect the proposed object or structure, in accordance with CASR Part 139.165(1)(2).
2. Final layout details of WTG coordinates and elevation should be provided to Airservices Australia at least two weeks prior to construction commencing, by submitting the form at this webpage: https://www.airservicesaustralia.com/wp-content/uploads/ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf to the following email address: vod@airservicesaustralia.com
3. Any obstacles 100 m or above AGL (including temporary construction equipment) should be reported to Airservices Australia NOTAM office until they are incorporated in published operational documents. With respect to crane operations during the construction of the Project, a notification to the NOTAM office may include, for example, the following details:
 - a. The planned operational timeframe and maximum height of the crane; and

- b. Either the general area within which the crane will operate and/or the planned route with timelines that crane operations will follow.
4. Details of the Project should be provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the Project on their operations.
5. To facilitate the flight planning of aerial application operators, details of the Project, including the 'as constructed' location and height information of WTGs and overhead transmission lines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.
6. Jingalup Nature Reserve is 4.8 km from the project's boundary. Some low-level flight operations might occur in Jingalup Nature Reserve which would require a safe flight corridor without turbines along the park's boundaries. Liaison with Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service will be required regarding the buffer area of the boundary.

Marking of WTGs

7. The rotor blades, nacelle and supporting mast of the WTGs should be painted in a low reflective off-white or white, typical of most WTGs operational in Australia. No additional marking measures are required for WTGs.

Lighting of WTGs

8. CASA will consider whether obstacle lighting is recommended for the WTGs. Lighting the WTGs is not a formal requirement. Based on the risk assessment set out in Section 9 It is concluded that aviation lighting is not likely to be required.

Micrositing

9. Providing the micrositing is within 100 m of the WTGs, it will not likely result in a change in the maximum overall blade tip height of the Project. No further assessment is likely to be required from micrositing and the conclusions of this AIA would remain the same.

Aerial firefighting

10. The developer or operator should consider the guidance contained in the National Council for Fire and Emergency Services, Wind Farms and Bushfire Operations to ensure:
 - a. Liaison with the relevant fire and land management agencies is ongoing and effective
 - b. Access is available to the wind farm site by emergency services for on-ground firefighting operations
 - c. Wind turbines are shut down immediately during emergency operations
 - d. Where possible, blades should be stopped in the 'Y' or 'rabbit ear' position, as this positioning allows for the maximum airspace for aircraft to manoeuvre underneath the blades and removes one of the blades as a potential obstacle. Note: This may not always be possible due to the risk to equipment and personnel as a fire approaches or exists in or near to the WTGs.

Aviation Projects considers that it may be impractical to stop and lock the turbine blades in a Y configuration due to the time needed to stop and lock the turbine and the risk to personnel having to climb into the WTG tower as a bush fire approaches. WTG blades can be feathered to effectively stop or reduce the rotation rate of the turbine to a very slow speed.

Triggers for review

11. Triggers for review of this risk assessment are provided for consideration:
 - a. Prior to construction to ensure the regulatory framework has not changed
 - b. Following any significant changes to the context in which the assessment was prepared
 - c. Following any near miss, incident or accident associated with operations considered in this risk assessment.

1. INTRODUCTION

1.1. Situation

Kojonup Wind Farm Pty Ltd is preparing a new wind farm development in Kojonup, Western Australia, for development approval.

Kojonup Wind Farm Pty Ltd has requested that Aviation Projects provide a proposal to prepare an aviation impact assessment (AIA) for the proposed Kojonup Wind Farm project.

1.2. Purpose and Scope

The purpose and scope of the work are to prepare an AIA for consideration by Airservices Australia, CASA, and the Department of Defence and support the development application.

The AIA specifically responds to the following key legislation, approvals, and guidance material:

- Civil Aviation Regulations 1988 (CAR)
- Civil Aviation Safety Regulations 1998 (CASR)
- National Airspace Safeguarding Framework (NASF) Guideline D: *Managing the Risk to aviation safety of wind turbine installations (wind farms)/Wind Monitoring Towers* effective July 2012
- Western Australia Planning Commission, *Position Statement: Renewable energy facilities*, March 2020
- Specific requirements as advised by Airservices Australia.

1.3. Methodology

Aviation Projects conducted the task in accordance with the following methodology:

- Confirmed the scope and deliverables
- Reviewed client material
- Conducted a site visit to properly investigate aviation safety aspects of the proposed site
- Identified and assess any likely impacts to:
 - Certified aerodromes within 30 nm (55.5 km) of the Project
 - Uncertified aerodromes within 3 nm (5.56 km) of the Project
 - Military aerodromes and associated Special Use Airspace (SUA)
 - Other SUA in the vicinity of the Project
 - Aviation radio telecommunications services.
- Prepared a draft aviation impact assessment and supporting technical data that provides evidence and analysis for the planning application to demonstrate that appropriate risk mitigation strategies have been identified. The draft aviation impact assessment report will include an Aviation Impact Statement (AIS) and a qualitative risk assessment to determine the need for obstacle lighting and of applicable aspects for client review and acceptance before submission to external aviation regulators

- Identified risk mitigation strategies that provide an acceptable alternative to night lighting. The risk assessment will be completed following the guidelines in *ISO 31000:2018 Risk Management – Guidelines*
- Consulted with aviation regulators, Airservices Australia (and other Part 173 procedure designers if applicable), and the Department of Defence
- Consulted with relevant Council (s), and aerodrome operators of the nearby aerodrome/s to seek endorsement of the proposal to change instrument procedures (if applicable)
- Consulted/engaged with stakeholders (including RFDS, Western Australia Department of Fire and Emergency Services) to negotiate acceptable outcomes (if required)
- Finalised the aviation impact assessment report when responses received from stakeholders for client review and acceptance.

1.4. Aviation Impact Statement (AIS)

The AIS included in this report includes the following specific requirements as advised by Airservices Australia:

Aerodromes:

- Specify all certified aerodromes that are located within 30 nm (55.6 km) of the project site
- Nominate all instrument approach and landing procedures at these aerodromes
- Review the potential effect of project operations on the operational airspace of the aerodrome(s).

Air Routes:

- Nominate air routes published in en-route chart low (ERC-L) & en-route chart high (ERC-H) which are located near/over the project site and review potential impacts of project operations on aircraft using those air routes.

Airspace:

- Nominate the airspace classification – A, C, D, E, G etc where the project site is located
- Any Special Use Airspace (SUA) in relation to the project site.

Navigation/Radar:

- Nominate air traffic control radar with coverage overlapping the project site
- Nominate aviation navigation systems in proximity to the project site.

1.5. Material reviewed

The material provided by the Proponent for the preparation of this assessment includes:

- GIS Data of the Wind Farm
 - Information for Aviation Projects.kmz
- WTG and WMT coordinates and ground elevation data
 - 20250502 Information for Aviation Projects WTG & WMT.xlsx

2. BACKGROUND

2.1. Site Overview

Kojonup Wind Farm Pty Ltd is preparing a new wind farm development in Kojonup, Western Australia, for development approval.

An overview of the site is provided in Figure 1 (source: Kojonup Wind Farm Pty Ltd, Google Earth).

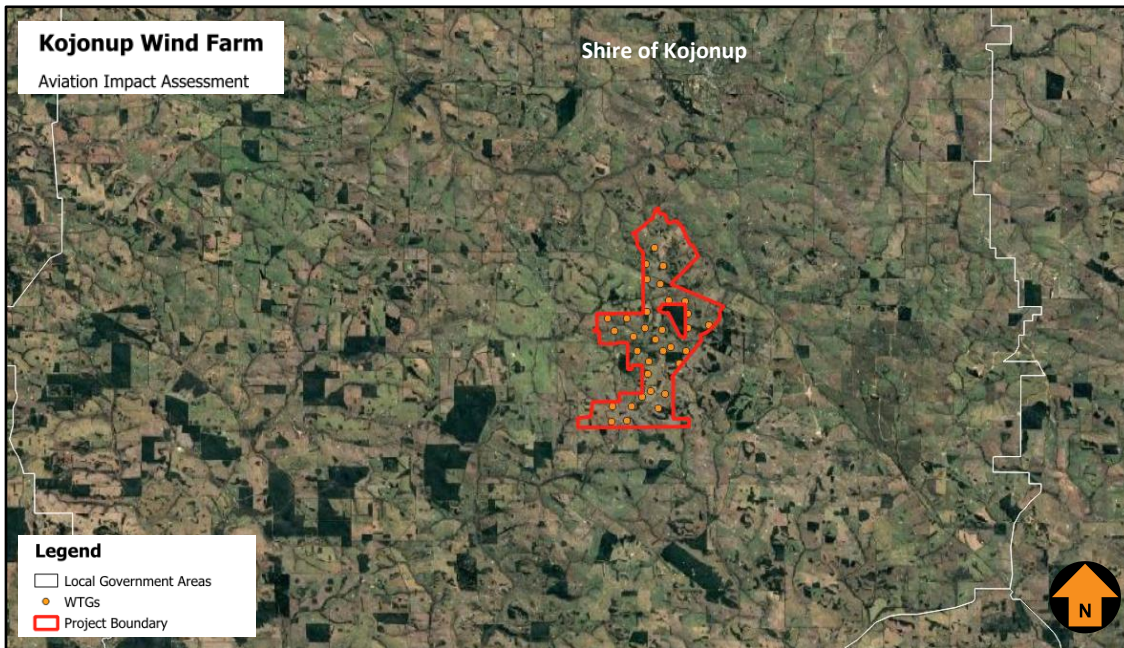


Figure 1 Project site overview

2.2. Project Description

The Project involves constructing, operating, maintaining and decommissioning the Kojonup Wind Farm, including a layout of up to 33 WTGs.

The WTGs will have a rotor diameter of approximately 162 m, with a maximum tip height of 206 m AGL.

The ground elevation for the highest WTG location (WTG T11) is 381 m AHD, which, with a 206 m WTG height, results in a maximum overall height of 587 m AHD (1925.9 ft AMSL).

3. EXTERNAL CONTEXT

3.1. National Airports Safeguarding Framework

The National Airports Safeguarding Advisory Group (NASAG) was established by Commonwealth Department of Infrastructure, Transport, Regional Development, Communications and the Arts to develop a national land use planning framework called the National Airports Safeguarding Framework (NASF). The purpose of the NASF is to enhance the current and future safety, viability, and growth of aviation operations at Australian airports through:

- The implementation of best practice in relation to land use assessment and decision making in the vicinity of airports
- Assurance of community safety and amenity near airports
- Better understanding and recognition of aviation safety requirements and aircraft noise impacts in land use and related planning decisions
- The provision of greater certainty and clarity for developers and landowners
- Improvements to regulatory certainty and efficiency
- The publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports.

NASF Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers*, provides guidance to State/Territory and local government decision makers, airport operators and developers of wind farms to jointly address the risk to civil aviation arising from the development, presence and use of wind farms and WMTs.

The methodology for preparing the risk assessment is contained in the NASF Guideline D.

The risk assessment will have regard to all potential aviation activities within the vicinity of the project site including recreation, commercial, civil (including for agricultural purposes) and military operations.

NASF Guideline D strongly encourages consultation with aviation stakeholders in the early stages of wind farm development planning, including with aerodrome owners and operators, regional aircraft operators and CASA and Airservices.

3.2. Western Australia Government, Department of Planning, Lands and Heritage

The Western Australian Planning Commission administers responsibility for approving renewable energy facilities through local councils. The Department of Planning, Lands and Heritage has published *Position Statement: Renewable energy facilities* (March 2020) on behalf the Western Australia Planning Commission. These guidelines provide advice to inform planning decisions about a wind energy facility proposal.

The intent of this position statement is to:

- Outline the Western Australian Planning Commission (WAPC) requirements to support the consistent consideration and provision of renewable energy facilities within Western Australia
- Identify assessment measures to facilitate appropriate development of renewable energy facilities.

The position statement applies to the preparation and assessment of planning instruments including regional and local planning schemes and strategies.

The position statement supersedes Planning Bulletin 67 Guidelines for Wind Farm Development (2004).

Section 5.3.1 *Community Consultation* and Section 5.3.5 *Public and Aviation safety* are relevant to this assessment and are extracted below:

Section 5.3.1 Community Consultation

Early consultation with the community and stakeholders by the proponents is encouraged to ensure that the proposal is compatible with existing land uses on and near the site. The local government should be consulted with respect to the community consultation program. Relevant stakeholders may include:

- *Air Services Australia*
- *Australian Wind Alliance*
- *Civil Aviation Safety Authority*

5.3.5 Public and aviation safety

Proponents of wind turbine proposals should refer to the National Airports Safeguarding Framework (NASF) Guideline D: Managing the Risk to Aviation Safety of Wind Turbine Installation (Wind Farms) / Wind Monitoring Towers to determine any potential aviation safety risks and possible mitigation measures.

Any potential aviation safety risks identified require consultation with Civil Aviation Safety Authority (CASA), Air Services Australia and/or the Commonwealth Department of Defence.

The position paper defines Renewable energy facility as premises used to generate energy from a renewable energy source and includes any building or other structure used in, or relating to, the generation of energy by a renewable resource. It does not include renewable energy electricity generation where the energy produced principally supplies a domestic and/or business premises and any on selling to the grid is secondary.

An AIA would include consultation with relevant aviation stakeholders and address aviation-related matters included in the Position Statement

3.3. Shire of Kojonup

There is no aviation-related information in the Shire of Kojonup town planning scheme No 3.

3.4. Civil Aviation Safety Authority (CASA)

CASA provides the following guidance to inform pilots of their obligations at non-certified aerodromes.

3.4.1. AC 91-02 V1.2, Guidelines for aeroplanes with MTOW not exceeding 5700 kg – suitable places to take off and land, dated November 2022

This AC provides guidance for pilots of:

- Aeroplanes with maximum take-off weight (MTOW) not exceeding 5700 kg that are operated under Part 91 of CASR, including experimental aircraft, and
- Light sport aircraft (LSA) under Part 103 of CASR.

Purpose

This AC provides guidance to assist aeroplane pilots when determining the suitability of a place to safely take off and land. It provides an overview of pilot responsibilities, discusses the relevant circumstances recommended to be considered and includes general information and advice to enhance the safety of taking off and landing at any place.

2 Introduction

2.2 Use of Aerodromes

2.2.1 Regulation 91.410 authorises a place for use as an aerodrome if: (i) it is suitable for the landing and taking-off of aircraft; and (ii) an aircraft can land at or take off from the place safely, having regard to all the circumstances of the proposed landing or take-off (including the prevailing weather conditions).

4.2.4 The examples below are two of many possible considerations:

- the obstacles surrounding the aerodrome have been accurately described and are still current (e.g. have the trees on final grown taller since last reported), and*
- the information provided enables the pilot to judge whether or not a landing approach can be made from both runway directions.*

3.4.2. AC 91-10 v1.6, Operations in the vicinity of non-controlled aerodromes, dated September 2025

This AC provides guidance on procedures that, when followed, will improve situational awareness and safety for all pilots when flying at, or in the vicinity of, non-controlled aerodromes.

7.2 Traffic circuit direction

7.2.1 The standard aerodrome traffic circuit facilitates the orderly flow. Unless an alternative requirement for an aerodrome is stated in the ERSA or NOTAMs, all turns must be made to the left (regulation 91.385).

7.2.2 When arriving at an aerodrome to land, the pilot will normally join the circuit on upwind, crosswind (midfield), or at or before mid-downwind. Landings and take-offs should be made on the preferred runway.

7.3.2 During initial climb-out, the turn onto crosswind should be appropriate to the performance of the aircraft but, in any case, not less than 500 ft above terrain so as to be at circuit height when turning downwind (regulation 91.390). Pilots may vary the size of the circuit depending on:

- the performance of the aircraft*
- AFM/Pilot's Operating Handbook requirements*
- company standard operating procedures*
- other safety reasons.*

7.8 Final approach

7.8.1 The turn onto final approach should be:

- completed by a distance and height that is common to all operations at the aerodrome*
- commensurate with the speed flown in the circuit for all aircraft of the same type.*

Illustrations of the standard aerodrome traffic circuit procedures provided in AC 91-10 v164. are shown in Figure 2 and Figure 3.

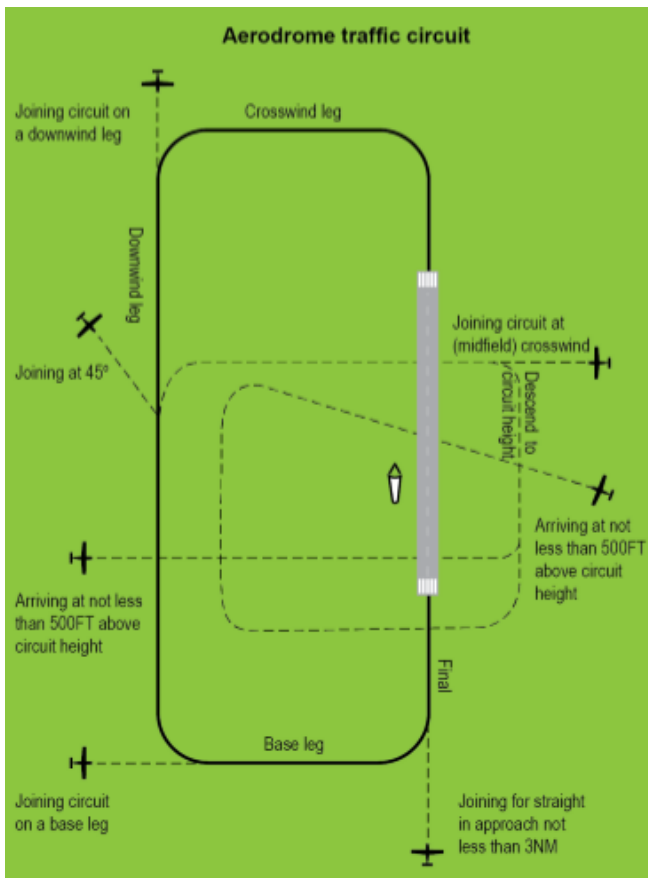


Figure 2 Aerodrome standard traffic circuit, showing arrival and joining procedures

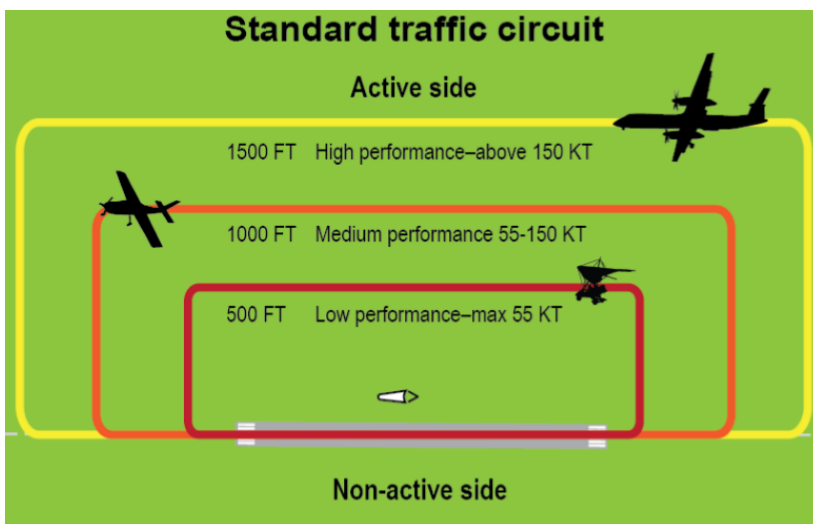


Figure 3 Lateral and vertical separation in the standard aerodrome traffic circuit

Paragraph 7.11 refers to a distance that is “normally” well outside the circuit area and where no traffic conflict exists, which is at least 3 nm. The paragraph is copied below:

7.11 Departing the circuit area

7.11.1 Aircraft should depart the aerodrome circuit area by extending one of the standard circuit legs or climbing to depart overhead. However, the aircraft should not execute a turn to fly against the circuit direction unless the aircraft is well outside the circuit area and no traffic conflict exists. This should be 500 ft or more above the circuit height and at least 3 NM from the departure end of the runway but may be less for aircraft with high climb performance. In all cases, the distance should be based on the pilot's awareness of traffic and the ability of the aircraft to climb above and clear of the circuit area.

3.5. Rules of flight

3.5.1. Flight under Day Visual Flight Rules (Day VFR)

According to Australia's Aeronautical Information Package (AIP) the meteorological conditions required for visual flight in the applicable (class G) airspace at or below 3,000 ft AMSL or 1,000 ft AGL (whichever is the higher) are: 5,000 m visibility, clear of clouds and in sight of ground or water.

CASR 91.267 (Minimum height rules—other areas) prescribes the minimum height for flight. Generally speaking, and unless otherwise approved, aircraft are restricted to a minimum height of 500 ft AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas, and 1000 ft AGL over built up areas (within a horizontal radius of 600 m of the point on the ground or water immediately below the aeroplane).

Flight below these height restrictions is also permitted in certain other circumstances.

3.5.2. Flight under Night Visual Flight Rules (Night VFR)

With respect to flight under the VFR at night CASR 91.277 requires that the pilot in command of an aircraft flying VFR at night must not fly below the appropriate lowest safe altitude (unless during take-off and landing operations, within 3 nm of an aerodrome).

3.5.3. Flight under Instrument Flight Rules (Day or Night) (IFR)

According to CASR Part 91, flight under the IFR requires an aircraft to be operated at a height clear of obstacles that is calculated according to an approved method.

Obstacle lights on structures not within the vicinity of an aerodrome are effectively redundant to an aircraft being operated under the IFR.

3.6. Aircraft operator characteristics

Flying training may be conducted under either the IFR or VFR. Other general aviation operations under either IFR or VFR are also likely to be conducted at various aerodromes in the area.

Flight under day VFR is conducted above 500 ft above the highest point of the terrain within a 300 m radius unless the operation is approved to operate below 500 ft above the highest point of the terrain.

It is expected that the proposed WTGs will be sufficiently visually conspicuous to pilots conducting VFR operations within the vicinity of the project area to enable appropriate obstacle avoidance manoeuvring.

IFR and Night VFR (which are required to conform to IFR applicable altitude requirements) aircraft operations are addressed in **Section 6**.

3.7. Passenger transport operations

Scheduled and non-scheduled passenger transport operations are generally operated under the IFR.

3.8. Private operations

Private operations are generally conducted under day or night VFR, with some IFR. Flight under day VFR is conducted above 500 ft AGL in areas outside city and township built-up areas.

3.9. Military operations

There may be some high-speed low-level military jet aircraft and helicopter operations conducted in the area. Military operations are conducted under separate but compatible regulations and standards, including obstacle separation requirements.

Refer to **Section 5** for a detailed response from the Department of Defence.

3.10. Aerial application operations

Aerial application operations including such activities as fertiliser, pest and crop spraying are generally conducted under day VFR below 500 ft AGL: usually between 6.5 ft and 100 ft AGL.

Due to the nature of the operations conducted, aerial agriculture pilots are subject to rigorous training and assessment requirements to obtain and maintain their licence to operate under these conditions.

3.10.1. Aerial Agricultural Association of Australia (AAAA)

The Aerial Application Association of Australia (AAAA) has a formal risk management program (which is recommended for use by its members) to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained.

In previous consultation with the AAAA, Aviation Projects has been directed to the AAAA Windfarm Policy (dated March 2011), now superseded by the AAAA Tall Structures Policy dated March 2024 which states in part:

The development of tall structures in agricultural and bush fire prone areas can pose a direct threat to aviation safety, particularly where fixed and rotary aircraft may be requested to operate for agricultural or bush/grass fire control.

The absence of historical aircraft use in an area is considered an insufficient reason to discount the threat to Aviation Operations.

The AAAA will oppose any development application or similar process unless the proponent has:

- o Identified the structure as posing a low-level flying risk that needs to be managed on an ongoing basis,*
- o Consulted honestly and in detail with local aerial application operators or the AAAA where a local operator cannot be identified,*
- o Consulted with adjoining landowners regarding the impact on adjacent properties,*
- o Included appropriate lighting and marking in the development proposal, consistent with providing a warning to low level flying,*
- o Identified the process for advising of the location height and presence of the structure to the relevant authorities, and*
- o Ensure that the proposal is in keeping with CASA requirements for structures near aerodromes, including temporary landing areas.*

3.10.2. Aerial application operators

Local aerial application operators consulted in previous studies undertaken by Aviation Projects have stated that a wind farm would, in all likelihood, prevent aerial agricultural operations in that particular area, but that properties adjacent to the wind farm would have to be assessed on an individual basis.

Aerial application operators generally align their positions with the AAAA policies, and they utilise the AAAA formal risk management programme.

Based on previous studies for other wind farm projects undertaken by Aviation Projects, and the results of consultation with AAAA and local aerial application operators, it is reasonable to conclude that safe aerial application operations would be possible on properties within the Project site and on neighbouring properties, subject to final WTG locations and by implementing recommendations provided in this report at Section 12.

To facilitate the flight planning of aerial application operators, details of the Project, including location and height information of WTGs, WMTs and overhead powerlines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.

The use of helicopters and drones enables aerial application operations to be conducted in closer proximity to obstacles than would be possible with fixed wing aircraft due to their greater manoeuvrability.

3.11. Emergency services

3.11.1. Royal Flying Doctor Service

Royal Flying Doctor Service (RFDS) and other emergency services operations are generally conducted under the IFR, except when arriving/departing a destination that is not serviced by instrument approach aids or procedures, in which case they would be operating day or night VFR.

Most emergency aviation services organisations have formal risk management programs to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained.

For example, pilots and crew require specific training and approvals, additional equipment is installed in the aircraft, and special procedures are developed.

3.11.2. Aerial firefighting

Aerial firefighting operations (firebombing in particular) are conducted under Day VFR, sometimes below 500 ft AGL. Under certain conditions visibility may be reduced/limited by smoke/haze.

Most aerial firefighting organisations have formal risk management programs to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained. For example, pilots require specific training and approvals, additional equipment is installed in the aircraft, and special procedures are developed.

The Australasian Fire and Emergency Services Council (AFAC) has developed a national position on wind farms, their development and operations in relation to bushfire prevention, preparedness, response and recovery, set out in the document titled *Wind Farms and Bushfire Operations*, version 3.0, dated 25 October 2018.

Of specific interest in this document is the section extracted from under the 'Response' heading, copied below:

Wind farm operators should be responsible for ensuring that the relevant emergency protocols and plans are properly executed in an emergency event. During an emergency, operators need to react quickly to ensure they can assist and intervene in accordance with their planned procedures.

The developer or operator should ensure that:

- o liaison with the relevant fire and land management agencies is ongoing and effective*
- o access is available to the wind farm site by emergency services response for on-ground firefighting operations*
- o wind turbines are shut down immediately during emergency operations – where possible, blades should be stopped in the ‘Y’ or ‘rabbit ear’ position, as this positioning allows for the maximum airspace for aircraft to manoeuvre underneath the blades and removes one of the blades as a potential obstacle.*

Aerial personnel should assess risks posed by aerial obstacles, wake turbulence and moving blades in accordance with routine procedures.

Aviation Projects considers that it may be impractical to stop and lock the turbine blades in a Y configuration due to the time needed to stop and lock the turbine and the risk to personnel having to climb into the WTG tower as a bush fire approaches. WTG blades can be feathered to effectively stop or reduce the rotation rate of the turbine to a very slow speed.

4. INTERNAL CONTEXT

4.1. Wind turbine generator (WTG) description

The Project site will comprise up to 33 WTGs, the maximum blade tip height of which will be 206 m AGL

Figure 4 Illustrates the project layout identifying the highest WTG location - WTG T11 (source: Google Earth, Kojonup Wind Farm Pty Ltd).

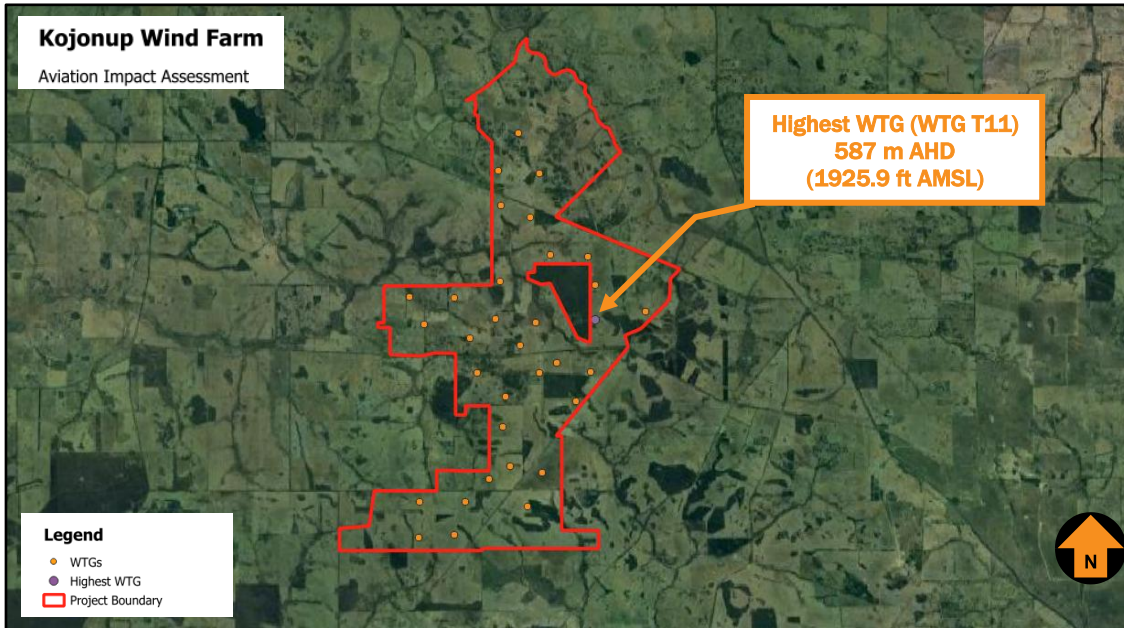


Figure 4 Project layout and highest WTG location

‘Micrositing’ of WTGs means an alteration to the siting of a WTG by not more than 100 m and any consequential changes to access tracks and internal power cable routes. The potential micrositing of the WTGs has been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level is within 100 m of the nominal WTG position. The micrositing of the WTGs is not likely to result in a change in the maximum overall blade tip height of the Project. This AIA assumes that a maximum blade tip height of 206 m AGL is implemented at all WTG locations.

5. CONSULTATION

The following list of stakeholders were identified as requiring consultation:

1. Airservices Australia
2. Department of Defence
3. Shire of Kojonup
4. Shire of Katanning
5. Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service
6. St John WA
7. Western Australia Department of Fire and Emergency Services
8. Royal Flying Doctor Services
9. Bureau of Meteorology
10. Klopper Helipad Owner and Operator

Details and results of the consultation activities are provided in Table 1.

Table 1 Stakeholder consultation details

<i>Agency/Contact</i>	<i>Activity/Date</i>	<i>Response/ Date</i>	<i>Issues Raised During Consultation</i>	<i>Action Proposed / Aviation Project's Reply</i>
Airservices Australia	Email sent on 25 June 2025	Response received on 06 August 2025 from AIS Data & Airspace Development Protection	<p>I refer to your request for an Airservices assessment of the proposed activity at Kojonup Wind Farm, WA.</p> <p>Airspace Procedures</p> <p>With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905 the wind farm turbine number 11, at 587m/1926ft AHD will affect the 25NM minimum sector altitude at Katanning Aerodrome. The remaining turbines, based on the heights and positions supplied, will not affect any instrument flight procedures.</p> <p>To accommodate turbine number 11 the 25NM minimum sector altitude is required to be increased from 2900ft to 3000ft. This is not expected to adversely affect the instrument procedures.</p> <p>The maximum height of turbine number 11 without affecting any procedures at Katanning Aerodrome is 584m/1916ft AHD.</p> <p>Note: Procedures not designed by Airservices at Katanning Aerodrome were not considered in this assessment.</p> <p>Communications/Navigation/Surveillance (CNS) Facilities</p>	<p>Consult with the aerodrome and aviation operators to ensure that they accept the proposed changes. Airservices Australia need confirmation from the aerodrome operator before they will make any changes.</p> <p>All amendments to airspace procedures are made on a commercial basis.</p> <p>As this proposed activity is more than 30m (99ft) AGL, please follow the below notification process:</p> <ol style="list-style-type: none"> 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. <p>For further information regarding the reporting of tall structures, please contact the VOD team:</p> <ul style="list-style-type: none"> • Email - VOD@airservicesaustralia.com • Or refer to: Civil Aviation Safety Regulation Part 175 – Airservices and You - Airservices (airservicesaustralia.com)

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed / Aviation Project's Reply
			<p>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.</p> <p>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</p> <p>Air Traffic Control (ATC) Operations</p> <p>There are no additional instructions/concerns from ATC.</p> <p>Summary</p> <p>The proposed activity will penetrate the current Airservices-designed airspace procedures and/or impact CNS facilities or ATC operations at Katanning aerodrome.</p> <p>Please consult with the aerodrome and aviation operators to ensure that they accept the proposed changes. We need confirmation from the aerodrome operator before we will make any changes.</p>	

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed / Aviation Project's Reply
			<p>All amendments to airspace procedures are made on a commercial basis.</p> <p>Vertical Obstacle Notification</p> <p>As this proposed activity is more than 30m (99ft) AGL, please follow the below notification process:</p> <ol style="list-style-type: none"> 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. <p>For further information regarding the reporting of tall structures, please contact the VOD team:</p> <ul style="list-style-type: none"> • Email - VOD@airservicesaustralia.com • Or refer to: Civil Aviation Safety Regulation Part 175 – Airservices and You - Airservices (airservicesaustralia.com) <p>If you have any queries, please let our team know.</p>	
Department of Defence	Email sent on 25 June 2025	Response received on 05 September 2025 from Matthew Williams (Estate Strategic Planner)	The Department of Defence's (Defence's) major planning consideration in relation to the abovementioned significant development proposal is the potential hazard to Defence aircraft and aviation related communications, navigation or surveillance.	Notify Airservices Australia to update the database regarding the Wind Farm project.

<i>Agency/Contact</i>	<i>Activity/Date</i>	<i>Response/ Date</i>	<i>Issues Raised During Consultation</i>	<i>Action Proposed / Aviation Project's Reply</i>
			<p>In this regard Defence has conducted an assessment of the proposed wind farm projects for potential impacts on the safety of military low flying operations as well as possible interference to Defence communications and radar. In doing this it has also reviewed the draft Aviation Impact Assessment – Kojonup Wind Farm (Aviation Projects)</p> <p>Defence advises that as the proposed wind farm meets the requirement for reporting tall structures, the proponent should provide Air Services Australia (AsA) with vertical obstacle notification.</p> <p>Marking tall structures on aeronautical charts assists pilot navigation and enhances flight safety. Airservices Australia (ASA) is responsible for recording the location and height of tall structures. The information is held in a central database managed by ASA and relates to the erection, extension, or dismantling of tall structures, the top of which is above:</p> <ul style="list-style-type: none"> a. 30 metres AGL, that are within 30 kilometres of an aerodrome; and b. 45 metres AGL elsewhere for RAAF. 	
Shire of Kojonup	Email sent on 25 June 2025		On going	

<i>Agency/Contact</i>	<i>Activity/Date</i>	<i>Response/ Date</i>	<i>Issues Raised During Consultation</i>	<i>Action Proposed / Aviation Project's Reply</i>
Shire of Katanning	Email sent on 25 June 2025	Response received on 17 July 2025 from Muhamad Taylor (Jeddy) (Technical Officer)	AMS are conducting their annual inspection early August and when they come down, we will get them to review the report that you sent us ,which they would have more knowledge about this kind of info .	Will communicate directly with AMS
Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service	Email sent on 25 June 2025	Response received on 11 July 2025 from Maria Lee (Acting Regional Manager)	<p>On behalf of Mitch Davies, A/Regional Manager for DBCA Wheatbelt please find response to your email dated 25/6/2025.</p> <p>From an aerial fire fighting perspective, the following comments on the Aerial Impact Assessment:</p> <ul style="list-style-type: none"> • More large structures in the landscape. Given we operate under VFR guidelines, all pilots will (should) be aware of these types of obstacles and able to take appropriate avoidance action. • The proposed windfarm is situated well away from any of our Water Bomber bases, with Kojonup 9nm to the North and Ferngrove 21nm to the SSW. No issues here if we were to be using either of these bases. • The report does not recommend any lighting be installed on the turbines, even though CASA regs appear to promote some form of lighting. I'm not sure what the standard is across other windfarm submissions, but a turbine 206m (675 ft) 	<ul style="list-style-type: none"> • Inform DBCA of the WF detail prior construction • DBCA recommended lighting for the WTGs

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed / Aviation Project's Reply
			<p>in the air under smoky low light conditions would benefit from some form of lighting, especially given that's the height that some of the rotary and SEAT aircraft may be working in at a fire.</p> <ul style="list-style-type: none"> • The report does not mention Kojonup Airfield as it is a non-certified aerodrome, but given it's distance away from the windfarm not an issue. • Reference to the AFAC Bushfires and Windfarms Guidelines is made in the report. • Although guidelines refer to the Wind Turbine being shut down in the event of a fire, the report authors have noted that they consider it may be impractical to stop and lock turbine blades due to time and safety considerations. Is this a one off response or standard answer? • Closest DBCA asset is the Jingalup Nature Reserve, app 5kms to the West. No aerial baiting occurs in the reserve. <p>Overall, they are getting bigger, are going to be all over the place and will undoubtedly limit our aerial fire suppression capability if a fire was to be fought in or in the vicinity of a windfarm.</p>	

<i>Agency/Contact</i>	<i>Activity/Date</i>	<i>Response/ Date</i>	<i>Issues Raised During Consultation</i>	<i>Action Proposed / Aviation Project's Reply</i>
St John WA	Email sent on 25 June 2025		No response received by 23 September 2025	
Western Australia Department of Fire and Emergency Services.	Email sent on 25 June 2025	Response received on 13 August 2025 from Steve Sartain (Manager Emergency Rescue Helicopter Service)	<p>In line with previous advice provided with other Wind Farm projects in WA, and understanding there is no CASA legislative mandatory requirement to provide obstacle lighting / markings on the towers at wind farms, DFES Aviation Services recommends aviation obstacle lighting and markings be placed on these wind farms to protect emergency services aviation aircraft (as well as all general aviation), and to work with Airservices Australia to have these farms identified on Aviation navigation charts. These include the recommendation for additional marker balls on guide wires for masts at 50ft AGL, 100ft AGL, 150ft AGL and 200ft AGL to assist pilots to identify aviation risks with guide wires during day or night low-level flying operations.</p> <p>To assist the whole Aviation community with safety risk mitigation and lowering risks to ALARP, and in accordance with risk mitigation options as listed in the CASA Advisory Circular, paragraph 2.4.4.3(a); para 2.5; and para 2.6 – AC139.E-05 v1.1 – Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome, the addition of obstacle lighting / markings would be at minimal cost, which would have a significant positive impact to reduce Aviation risk to ALARP.</p>	DFES Aviation Services recommends aviation obstacle lighting and markings be placed on these wind farms to protect emergency services aviation aircraft.

AVIATION PROJECTS

<i>Agency/Contact</i>	<i>Activity/Date</i>	<i>Response/ Date</i>	<i>Issues Raised During Consultation</i>	<i>Action Proposed / Aviation Project's Reply</i>
			<p>The above recommendations for the obstacle lighting / markings and updates to Aviation navigation charts would be instrumental to maintaining safe aviation for emergency services and general aviation operations near any proposed wind farm locations. Understanding that the inclusion of obstacle lighting and markings is not yet a regulatory requirement, these are:</p> <ul style="list-style-type: none"> • Already addressed by CASA through the Advisory Circular • Already best practice as implemented in the Eastern States • Provide significant aviation safety benefits • Mitigates aviation risks to ALARP, and • Are a minor costs to include these during the installation process, verses retrofitting afterward. 	
Royal Flying Doctor Services	Email sent on 30 June 2025	Response received on 01 September 2025 from Finley Garside (Deputy Head of Flying Operations)	No issues from the RFDS.	No action required
Bureau of Meteorology	Email sent on 30 June 2025	Response received on 10 July 2025 from Pierre	Thank you for enquiring with the Bureau of Meteorology.	the developer of the wind farm to engage with the Bureau of Meteorology through the windfarmenquiries@bom.gov.au mailbox

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed / Aviation Project's Reply
		<p>Kemmers (Senior Aerodrome Engagement Lead) and 20 August 2025 from Stephanie Osborne (Customer Specialist – Energy & Resources)</p>	<p>I can confirm this development has no impact on the Bureau's aviation meteorological services. For this assessment, I make reference to clauses 19.17 and 19.18 of the CASR P139 Manual of Standards, articulating an obstacle free zone of 4 or 10 times the height of an obstacle from our aerodrome automatic weather stations.</p> <p>The closest observation site (automatic weather station) the Bureau owns is at Tunney (not an aviation site), at about 20km to the SE of the proposed wind farm.</p> <p>This site has not yet been assessed by our Bureau's Energy and Resources team for impacts on our weather radar network; the onus for this to occur is not on Aviation Projects, but may we kindly ask you to inform the developer of the wind farm to engage with the Bureau of Meteorology through the windfarmenquiries@bom.gov.au mailbox?</p> <p>Our assessment of the current Kojonup wind farm proposal has determined that, under normal atmospheric conditions, it poses a manageable risk to Bureau radar and radiocommunication assets.</p> <p>As a result, the Bureau has no objections to the proposed development proceeding, as detailed in the documentation provided for assessment.</p>	

AVIATION PROJECTS

<i>Agency/Contact</i>	<i>Activity/Date</i>	<i>Response/ Date</i>	<i>Issues Raised During Consultation</i>	<i>Action Proposed / Aviation Project's Reply</i>
			Modifications to the wind farms parameters, including layout designs, turbine locations, or heights, will require a new assessment.	
Klopper Helipad owner and operator		24 July 2025	I can't think of any other issues at this point.	No action required

6. AVIATION IMPACT STATEMENT

6.1. Overview

Potential safety risks include (but are not limited to) impacts on flight procedures and aviation communications, navigation, and surveillance (CNS) facilities, which require assessment by Airservices Australia.

To facilitate these assessments, all wind farm proposals submitted to Airservices Australia must include an AIS.

This analysis considers the aeronautical impact of the WTGs on the following:

- The operation of certified aerodromes within 30 nm of the wind farm
- The operation of nearby uncertified aerodromes within 3 nm of the wind farm
- Grid and air route LSALTs
- Airspace protection
- Aviation navigation facilities
- ATC surveillance radar installations
- Local aircraft operations.

6.2. Nearby certified aerodromes

A certified aerodrome is an aerodrome regulated by the Civil Aviation Safety Authority (CASA) under CASR Part 139 with defined standards established in CASR Part 139 MOS.

One certified aerodrome is located within 30 nm of the proposed site - Katanning Airport (YKNG).

The 30 nm radius represents the 25 nm minimum sector altitude (MSA) for aerodromes with terminal instrument flight procedures. The 25 nm MSA is determined by assessing obstacles within 30 nm (25 nm plus 5 nm buffer) of the aerodrome reference point or navigational aid on which the MSA is based.

The location of the Project site relative to Katanning Airport (YKNG) and Gnowangerup Airport (YGNW) is shown in Figure 5 (Source: Kojonup Wind Farm Pty Ltd, Google Earth). The orange circle represents a 30 nm radius from the airport's aerodrome reference point (ARP).

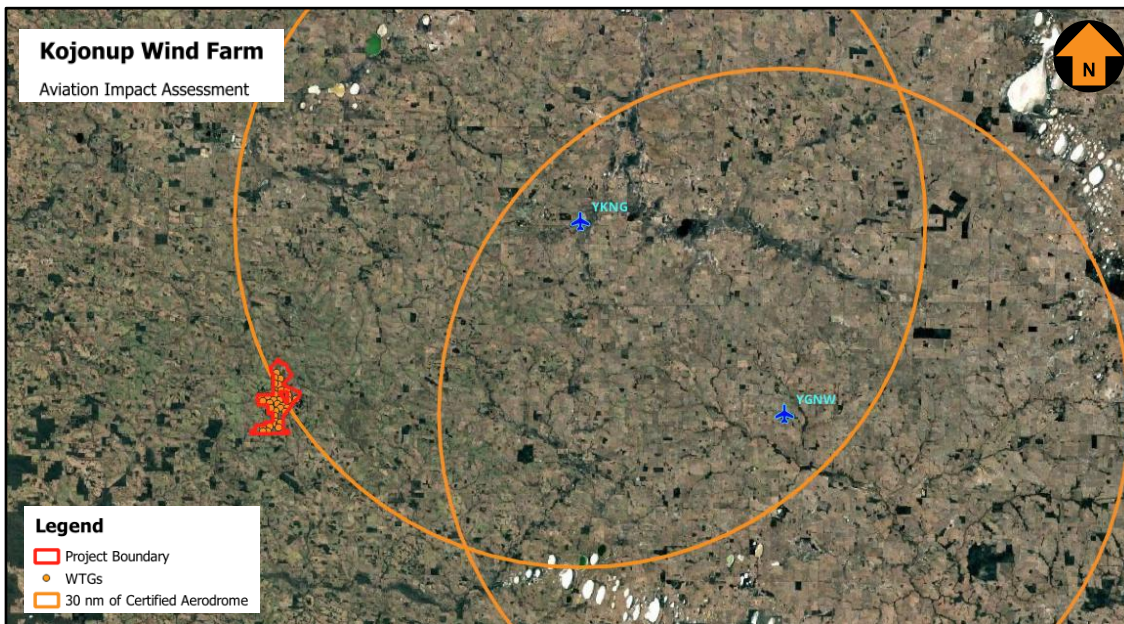


Figure 5 Location of certified airport in relation to the Project Site

6.3. Katanning Airport (YKNG)

Katanning Airport (YKNG) is a certified aerodrome operated by Shire of Katanning. Its published aerodrome elevation is 285 m AHD (936 ft AMSL) (source: AIP, effective 12 June 2025).

Katanning Airport's aerodrome reference point (ARP) coordinates published in Airservices Australia's Designated Airspace Handbook (DAH) are Latitude 33° 42' 01" S and Longitude 117° 39' 12" E (Source: DAH, effective 12 June 2025).

6.3.1. Obstacle Limitation Surfaces

OLS are established for each certified aerodrome runway. For the Code 1 non-precision runway at Katanning Airport, the maximum lateral extent of the OLS is up to 4.7 km for the conical surface and 1.6 km for the take-off and 2.5 km for the approach surfaces.

The closest WTG is approximately 55 km southwest of Katanning Airport's ARP, which is beyond the horizontal extent of the obstacle limitation surfaces.

6.3.2. Instrument approach procedures

A check of the AIP via the Airservices Australia website showed that Katanning Airport is served by one non-precision instrument flight procedure for the runway (source: AIP, effective 12 June 2025).

Table 2 Identifies the aerodrome and procedure charts for Katanning Airport, which were designed by Airservices Australia as indicated.

Table 2 Katanning Airport (YKNG) aerodrome and procedure charts

Chart name	Effective date (amendment number)
AERODROME CHART	13 June 2024 (Am 179)
RNP RWY 25	13 June 2024 (Am 179)

6.3.3. PANS-OPS Surfaces

A detailed assessment of the PANS-OPS surfaces associated with the published instrument approach procedures was undertaken:

- Minimum Sector Altitude
- IFR Circling Areas
- PANS-OPS approach procedure.

Minimum Sector Altitude (MSA)

The MSA applies to each instrument approach procedure at Katanning Airport. An Image of the MSA published for Katanning Airport is shown in Figure 6 (source: AIP, effective 12 June 2025).

CASR Part 173 Manual of Standards requires a minimum obstacle clearance (MOC) of 984 ft to be applied above the highest terrain or obstacle within the applicable segment. A 5 nm buffer is applied to both the 10 nm and 25 nm MSA circles and to the higher edge of each sector within the MSA.

Obstacles within the 10 nm and 25 nm MSA of Katanning Airport’s ARP define the minimum height at which an IFR aircraft can fly when within 10 nm and 25 nm of the airport when not in visual flight conditions.

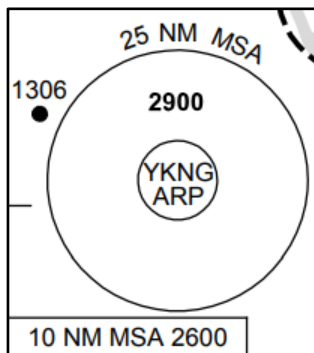


Figure 6 MSA at Katanning Airport

Part of the Project Site is within the Katanning Airport's 25 nm MSA. Figure 7 (Source: Kojonup Wind Farm Pty Ltd, Google Earth) shows Katanning Airport's 10 nm (10 nm + 5 nm buffer area) and 25 nm MSA (25 nm MSA + 5 nm buffer area) from ARP, and related PANS-OPS surface height (AMSL).

The 25 nm MSA minimum altitude is 884 m AHD (2900 ft AMSL), with a PANS-OPS surface elevation of 584 m AHD (1916 ft AMSL).

The highest WTG (WTG T11) will be within the 25 nm MSA, which is 587 m AHD (1925.9 ft AMSL) and will be higher than Katanning Airport's 25 nm MSA by 9.8 ft. An impact analysis of Katanning Airport’s MSA is provided in Table 3.

The Project will impact Katanning Airport's 25 nm MSA surface, which will need to be increased by 100 ft to 3000 ft or sectorised to exclude the wind farm.

If the 25 nm MSA is not sectorised for the wind farm, the increase to the 25 nm MSA will require a proportional increase in the commencement altitude and the minimum holding altitude for Arrival approach procedures. There is sufficient distance between the procedures' initial approach fixes to accommodate the minimum altitude increase without affecting aircraft operations or efficiency.

Table 3 Katanning Airport MSA Impact Analysis

MSA	Minimum altitude (ft AMSL)	PANS-OPS surface (ft AMSL)	Impact on airspace design	Potential solution	Impact on aircraft ops
10 nm MSA	2600	1616	Nil – outside the protection surface	N/A	N/A
25 nm MSA	2900	1916	The highest WTG is higher than the PANS-OPS surface by 9.8 ft	Increase minimum altitude by 100 ft or sectorize to exclude the WF	Minor. No change to flight paths.

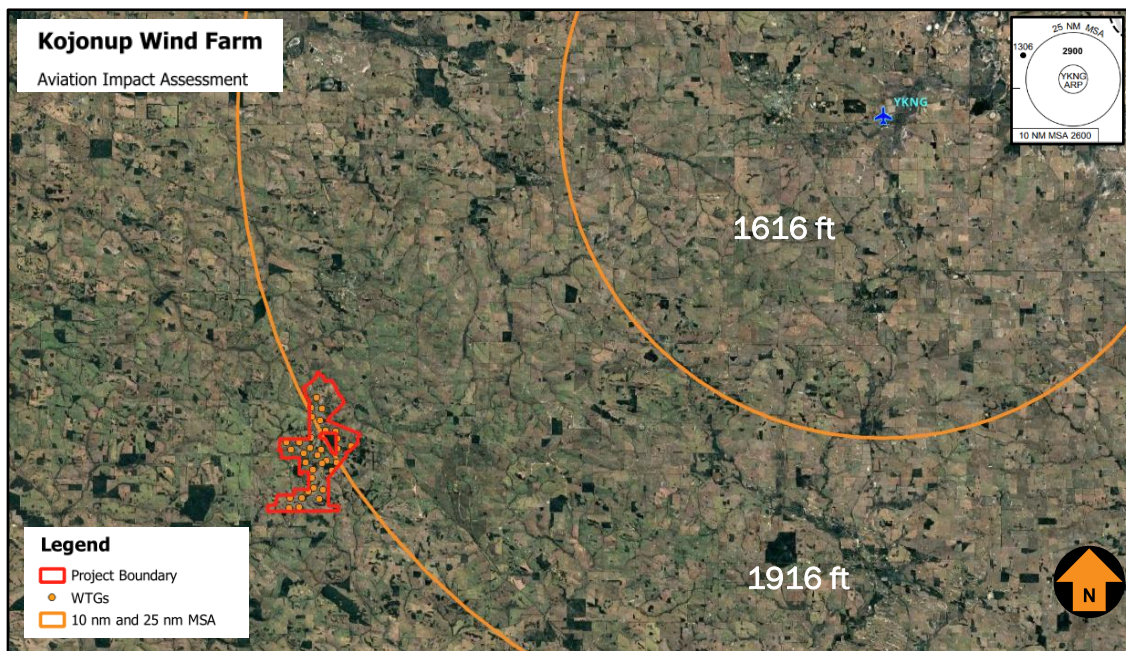


Figure 7 Katanning Airport MSA

IFR Circling areas.

A circling approach is an extension of an instrument approach to the specified circling minima (lowest altitude permitted without visual reference to the ground) at which point the pilot will visually manoeuvre the aircraft to

align with the runway for landing. Typically, a circling approach is only conducted where there is no runway-aligned instrument procedure or if the runway used for the approach procedure is not suitable for landing.

Circling areas are established by the instrument flight procedure designer based on International Civil Aviation Organization (ICAO) specifications related to the performance category of the designed aircraft. The circling area is determined by drawing an arc centred on the threshold of each usable runway and joining these arcs by tangents. Category C is the most demanding aircraft category provided for in Katanning Airport’s instrument flight procedures.

The radii for each relevant category of aircraft are provided below:

- Category A – 1.68 nm / 3.11 km
- Category B – 2.66 nm / 4.93 km
- Category C – 4.20 nm / 7.78 km

The closest WTG is located approximately 53 km / 29 nm from the threshold of Runway 07 and is beyond the circling area for all runway ends at Katanning Airport.

The Project will not impact circling areas established for instrument flight procedures.

PANS-OPS Approach Procedure Surfaces

A detailed assessment of the PANS-OPS surfaces associated with the published instrument approach procedures was undertaken. Table 4 Details the assessment for each instrument approach procedure.

Table 4 Katanning Airport PANS-OPS Assessment

<i>Airport Instrument Approach Title</i>	<i>Minimum Altitude over Project (ft AMSL)</i>	<i>PANS- OPS Surface (ft AMSL)</i>	<i>Impact on the procedure by WTGs</i>	<i>Potential solution</i>	<i>Impact on aircraft ops</i>
RNP RWY 25	2900 (MSA)	1916	Nil – outside protection surface	N/A	N/A

The Project Site will be outside RNP RWY 25 procedures’ protection surfaces. Therefore, the Project Site will not impact the PANS-OPS procedures at Katanning Airport.

If the 25 nm MSA is not sectorised for the WF, the increase to the 25 nm MSA will require a proportional increase in the commencement altitude and the minimum holding altitude for the RNP RWY 25 approach procedure. There is sufficient distance between the procedures’ initial approach fixes to accommodate the minimum altitude increase without affecting aircraft operations or efficiency.

6.4. Grid and Air routes LSALT

CASR Part 173 MOS requires the published LSALT for a particular airspace grid or air route to provide a minimum of 1000 ft clearance above the controlling (highest) obstacle within the relevant airspace grid or air route tolerances.

6.4.1. Grid LSALT

The project site is located within two (2) airspace Grid LSALT:

- Grid LSALT of 3000 ft AMSL, which provide clearance above obstacles with heights up to 2000 ft AMSL.
- Grid LSALT of 4200 ft AMSL, which provide clearance above obstacles with heights up to 3200 ft AMSL.

Figure 8 shows the grid LSALTs in proximity to the project site (source: ERC Low National, OzRunways, June 2025, Google Earth).

The highest WTG is 587 m AHD (1925.9 ft AMSL), which is below both the 2000 ft and 3200 ft protection surface.

Therefore, the WTGs would not impact both the 3000 ft and 4200 ft Grid LSALT.

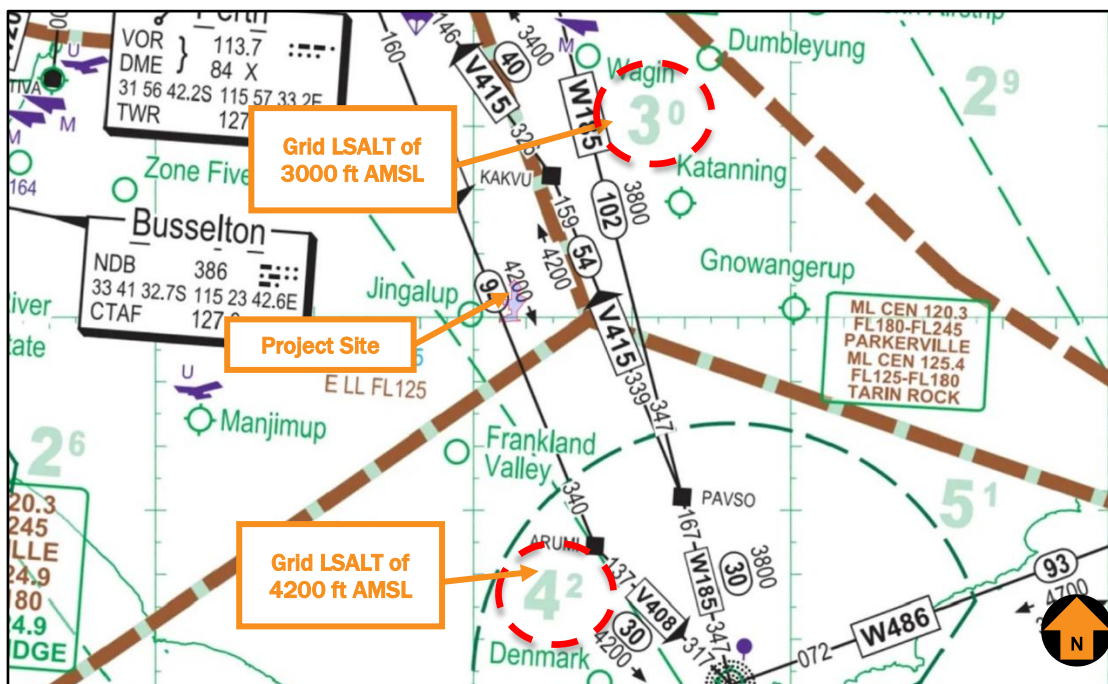


Figure 8 Grid LSALTs in proximity to the project site.

6.4.2. Air Route LSALTs

A protection area of 7 nm laterally on either side of an air route is used to assess the LSALT for the air route.

There is one (1) air route within the protection area of the Project Site. An impact analysis of the air routes is provided in Table 5.

The highest WTG (WTG T11) is 587 m AHD (1925.9 ft AMSL) in height, would be below the air routes protection surface.

Therefore, the Project will not impact any Air Route LSALT.

Table 5 Air route impact analysis

<i>Air route</i>	<i>Waypoint pair</i>	<i>Route LSALT</i>	<i>Protection Surface</i>	<i>Impact on airspace design</i>	<i>Potential solution</i>	<i>Impact on aircraft ops</i>
V408	JOSBU to ARMUI	4200	3200	Nil	Nil	N/A

6.5. Airspace Protection

The project site is located outside of controlled airspace (wholly within Class G airspace) and is not located in any Prohibited, Restricted and Danger areas.

The Project will not have an impact on controlled or designated airspace.

6.6. Aviation facilities

NASF Guideline G, *Protection of Aviation Facilities - Communication, Navigation and Surveillance (CNS)* and CASR Part 139 MOS specify the area where development of buildings and structures has the potential to cause unacceptable interference to CNS facilities.

The Project Site is located at a sufficient distance away from nearby certified aerodromes and aviation facilities and will not have an impact.

6.7. ATC Surveillance Radar installations

Airservices Australia requires an assessment of the potential for the WTGs that may affect radar line of sight. The three closest radar facilities to the project site are:

- Kalamunda RSR, which is located approximately 236 km northwest of the project site
- Perth PSR/SSR, which is located approximately 247 km northwest of the project site.

EUROCONTROL guidelines for assessing the potential impact on wind turbines on radar surveillance sensors stipulate the following assessment requirements:

Primary Surveillance Radar (PSR)

- Zone 1 0-500 m: Not permitted
- Zone 2 500 m – 15 km: Detailed assessment
- Zone 3: Further than 15 km but within maximum instrumented range and in radar line of sight: Simple assessment
- Zone 4: Anywhere within maximum instrumented range but not in radar line of sight or outside the maximum instrumented range: No assessment.

Secondary Surveillance Radar (SSR)

- Zone 1: 0 - 500 m: Not permitted
- Zone 2: 500 m - 16 km but within maximum instrumented range and in radar line of sight: Detailed assessment

- Zone 4: Further than 16 km or not in radar line of sight: No assessment

(Zone 3 is not established for secondary surveillance radar)

The project site is outside the line-of-sight range of Kalamunda RSR and Perth PSR/SSR and will not impact these facilities.

6.8. AIS Summary

Based on the WTG layout and maximum blade tip height of up to 206 m AGL, the blade tip elevation of the highest WTG, which is WTG T11, will not exceed 587 m AHD (1925.9 ft AMSL) and;

- There is one certified aerodrome located within 30 nm (56 km) of the Project - Katanning Airport (YKNG)
 - The WTGs would not impact the OLS surfaces.
 - The WTGs would not impact the IFR circling areas.
 - The 25 nm MSA would need to be increased by 100 ft to 3000 ft or sectorised to exclude the wind farm area.
 - The WTGs would not impact the PANS-OPS surfaces of the RNP RWY 25 instrument approach procedures. However, if the 25 nm MSA is not sectorised for the wind farm, increasing the 25 nm MSA to 3000 ft would require the minimum altitudes in the initial approach segments to be increased to be consistent with the 25 nm MSA minimum altitude
- The WTGs would not impact any Grid LSALT and air route LSALT
- The Project area is located within Class G airspace and outside of controlled airspace, Prohibited, Restricted and Danger areas.
- The WTGs would not impact the aviation navigation facilities.
- The WTGs would not impact the closest ATC surveillance radar installations

7. UNCERTIFIED AERODROMES / HELIPAD

Uncertified aerodromes can take the form of a fully serviceable aerodrome with sealed runways and comprehensive facilities, or they can be a paddock on private property used by the landholder or for aerial agricultural operations. They are not subject to CASR Part 139 regulations.

The aviation datasets used for the search are:

- AIP aeronautical charts, effective 12 June 2025
- OzRunways - which sources its data from AIP. The aeronautical data provided by OzRunways is approved under CASR Part 175
- Australian Government National Map website (www.nationalmap.com.au).

As a guide, an area of interest within a 3 nm radius of an uncertified aerodrome is used to assess the potential impacts of proposed developments on aircraft operations at or within the vicinity of the uncertified aerodrome. The 3 nm radius is considered to be the area in which aircraft are making preparations to join the circuit prior to landing and within which to manoeuvre after take-off to depart from the aerodrome.

Figure 9 Shows the location of the nearby aerodrome relative to the Project Site and a nominal 3 nm buffer from the closer aerodromes (source: Google Earth, Kojonup Wind Farm Pty Ltd).

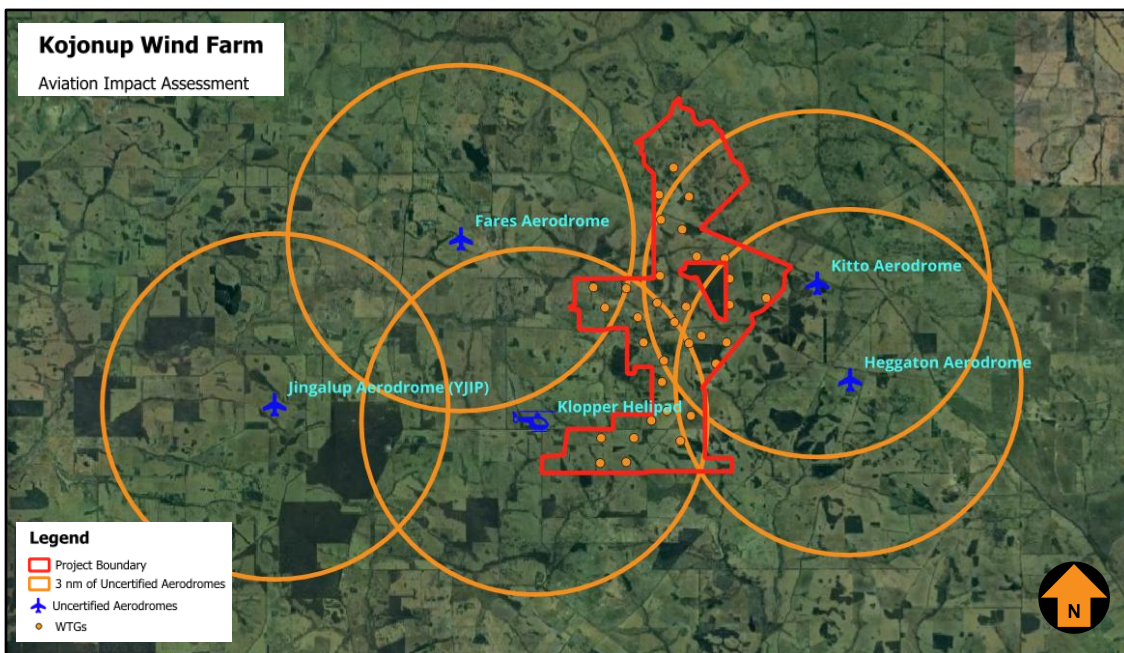


Figure 9 Uncertified aerodromes in the vicinity of the Project Site

Fares Aerodrome, Kitto Aerodrome, Heggaton Aerodrome, Jingalup Aerodrome (YJIP) and Klopper Helipad are the closest to the Project. The Project is located outside the radius of 3 nm of the YJIP and won't have an impact on it.

The Project Site will be within 3 nm of the Fares Aerodrome, Kitto Aerodrome, Heggaton Aerodrome and Klopper Helipad.

7.1. Kitto Aerodrome

The Kitto aerodrome is located east of the Project boundary. There is no information published about the uncertified aerodrome in aeronautical publications or publicly available information sources. Satellite imaging doesn't show a clear runway in the location, as shown in Figure 10 (Source: Google Earth). Aviation Project has been advised that the aerodrome is a paddock strip.



Figure 10 Close-up satellite image of Kitto Aerodrome's runway

Seventeen (17) WTGs are proposed to be located within 3 nm of this aerodrome and would be considered potentially hazardous obstacles, as shown in Figure 11 (Source: Kojonup Wind Farm Pty Ltd, Google Earth). Consultation with the landowner would be required to determine the type of flight operations normally conducted there.

Aircraft typically operate in circuit patterns when arriving and departing from an aerodrome. CASA AC 91-10 'Operations in the vicinity of non-controlled aerodromes' describes the standard traffic circuit and the heights at which aircraft should fly. This is shown in Figure 3 (Section 3.4.2).

In addition, various entry and departure procedures are described for aircraft joining and departing a standard traffic circuit. Figure 2 in Section 3.4.2 shows the standard arrival and joining procedures for a standard traffic circuit.

The standard circuit described in AC-91-10 normally consists of 5 'legs; upwind, crosswind, downwind, base and final.

The upwind leg is maintained after take-off until the aircraft reaches at least 500 ft above the runway before turning left and continuing to climb to circuit altitude. It normally takes 1 nm to climb to 500 ft and in any case a pilot can turn prior to 500 ft to avoid obstacles or high terrain.

The aircraft continues climbing to circuit altitude and this is usually reached during the crosswind leg or early in the downwind leg.

The pilot selects a point on the downwind where they turn onto the base leg, commence descent to position the aircraft on a slope that ensures they can reach the runway on a slope that allows them to land in the initial part of the runway and to avoid any obstacles such as trees and fences in close proximity to the runway end.

The downwind leg spacing is usually within 1 nm of the runway or closer, to allow the aircraft to reach the runway in the event of an engine failure.

Pilots need to be aware of the wind strength and direction prior to making a decision about which runway to land on so they would normally overfly the aerodrome to observe a wind sock or other features that would indicate wind speed and direction to enable to aircraft to land as close to into-wind as possible.

One (1) WTG would be within the 1 nm circuit operation area of the aerodrome, as shown in Figure 11.

Uncertified aerodromes do not have the same regulatory status and protections as certified aerodromes. Potential impacts upon an uncertified aerodrome caused by a wind farm would not preclude the regulatory approval of the wind farm under the Position Statement. However, it is highly recommended that any wind farm be designed to avoid, minimise, and/or mitigate impact(s) on private aerodromes.

Aerial application pilot do not need to conduct the standard circuit during their operations at uncertified aerodromes. They may conduct abbreviated circuits, and lower circuit altitudes than other aircraft operations that must comply with CASR Part 91.

Therefore, consultation with the landowner would be recommended for the Project.

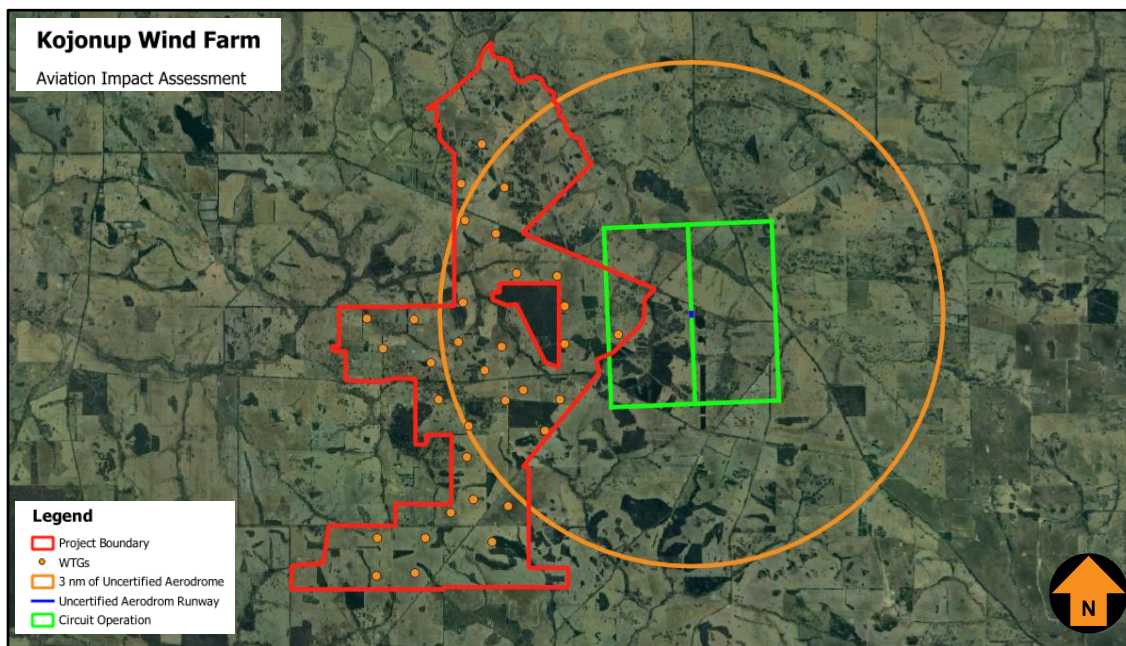


Figure 11 Kitto Aerodrome in relation to the Project Site

7.2. Heggaton Aerodrome

The Heggaton aerodrome is located east of the Project boundary. There is no information published about the uncertified aerodrome in aeronautical publications or publicly available information sources. Satellite imaging shows a prepared grass runway, as shown in Figure 12 (Source: Google Earth). Aviation Project has been advised that the aerodrome is not used very often.



Figure 12 Close-up satellite image of Heggaton Aerodrome's runway

WTGs within 3 nm of the Heggaton aerodrome that would be considered potentially hazardous obstacles are shown in Figure 13 (Source: Kojonup Wind Farm Pty Ltd, Google Earth). The closest WTG to the northern runway end is located 3.6 km/1.9 nm from it. A standard circuit would be contained within 1 nm of the runway end and comfortably avoid this WTG.

Consultation with the landowner would be recommended to determine the type of flight operations normally conducted there.

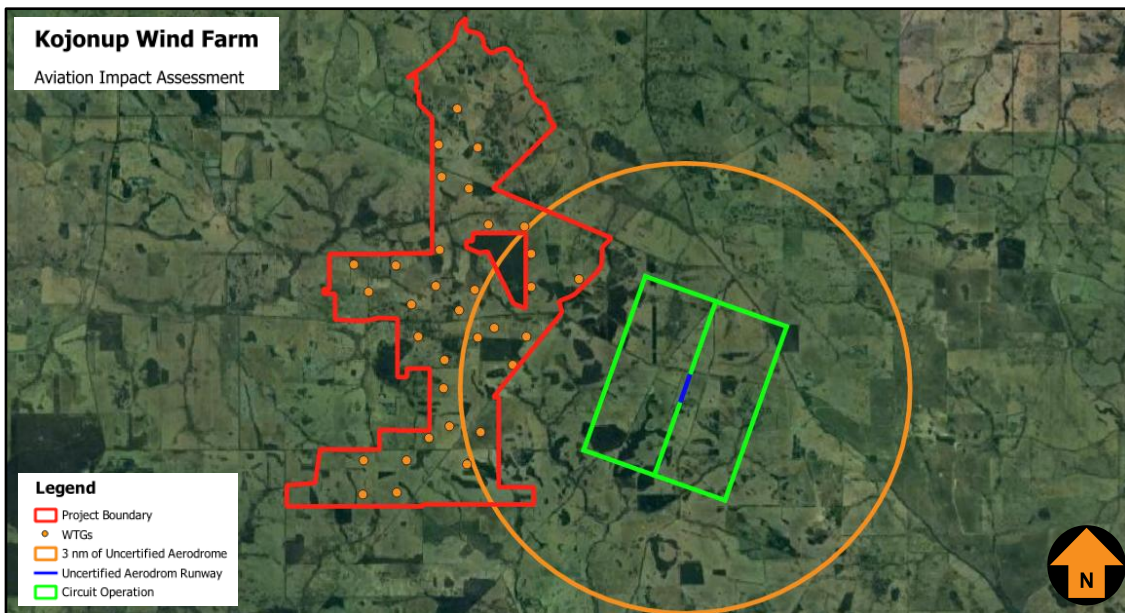


Figure 13 Heggaton Aerodrome in relation to the Project Site

7.3. Fares Aerodrome

The Fares aerodrome is located west of the Project boundary. There is no information published about the uncertified aerodrome in aeronautical publications or publicly available information sources. Satellite imaging shows a prepared grass runway, as shown in Figure 14 (Source: Google Earth). Aviation Projects has been advised that the aerodrome is not used very often since the land has changed ownership.



Figure 14 Close-up satellite image of Fares Aerodrome's runway

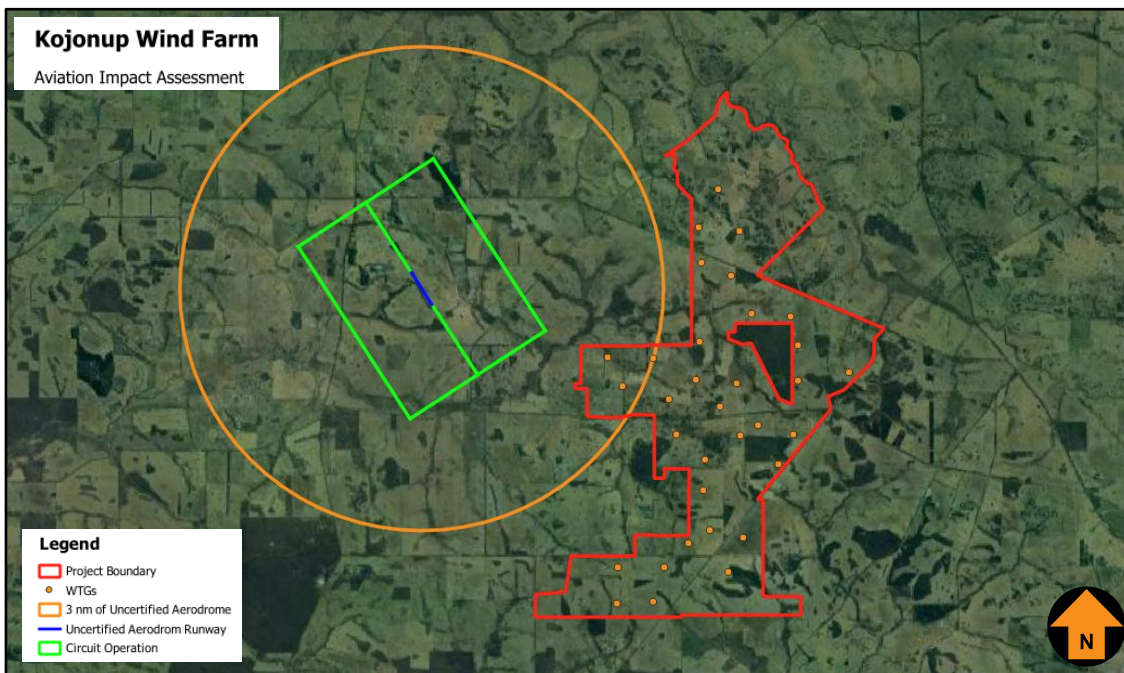


Figure 15 Fares Aerodrome in relation to the Project Site

WTGs within 3 nm of the Fares aerodrome that would be considered potentially hazardous obstacles are shown in Figure 15 (Source: Kojonup Wind Farm Pty Ltd, Google Earth). The closest WTG to the southern runway end

is located 4.2 km/2.3 nm from it. A standard circuit would be contained within 1 nm of the runway end and comfortably avoid this WTG.

Consultation with the landowner would be recommended to determine the type of flight operations normally conducted there.

7.4. Klopper Helipad

The Klopper Helipad is located west of the Project boundary. Satellite imaging as shown in Figure 16 (Source: Google Earth). Aviation Project has been advised that Klopper is an active helicopter pilot who uses his helicopter to fly to jobs as a civil contractor, and he is aware of the Wind Farm Project.

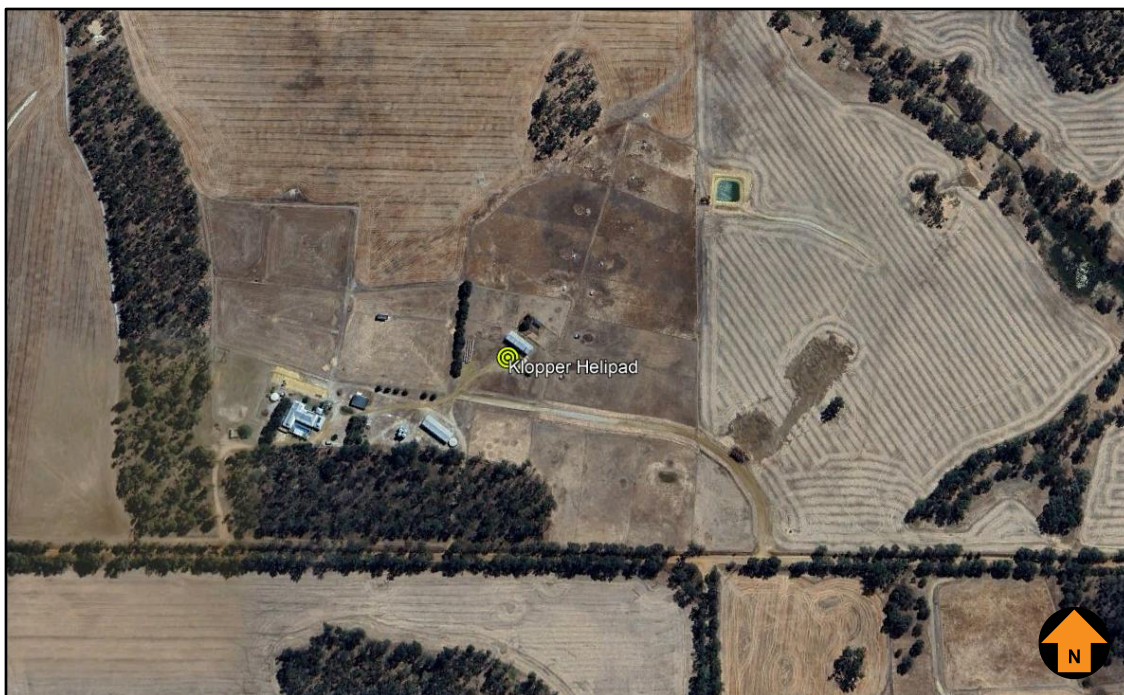


Figure 16 Close-up satellite image of Klopper Helipad

The closest WTG is located 2.2 km/1.8 nm from the helipad, as shown in Figure 17 (Source: Kojonup Wind Farm Pty Ltd, Google Earth). Initial consultation with the owner has already started. And the owner don't think the Project wont be a issue for its helipad operation. The ongoing consultation with the helipad owner regarding the Project is encouraged.

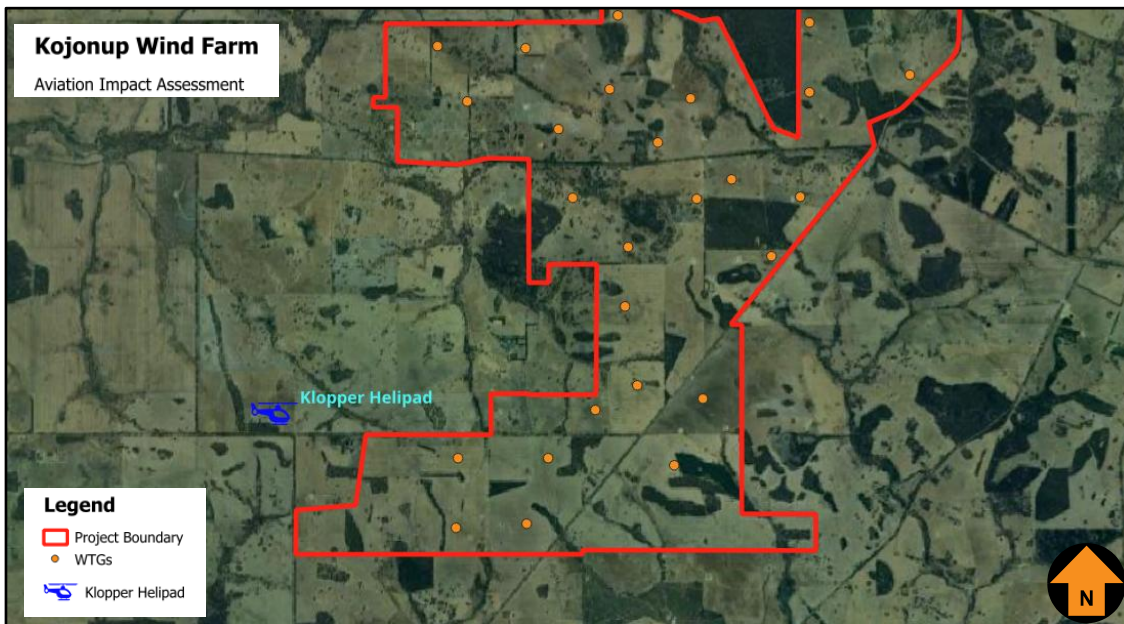


Figure 17 Kloppe Helipad in relation to the Project Site

7.5. Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service

Jingalup Nature Reserve is approximately 4.8 km from the Project's boundary. Some low-level flight operations might occur in Jingalup Nature Reserve, which will require a safe flight corridor without turbines along the park's boundaries.

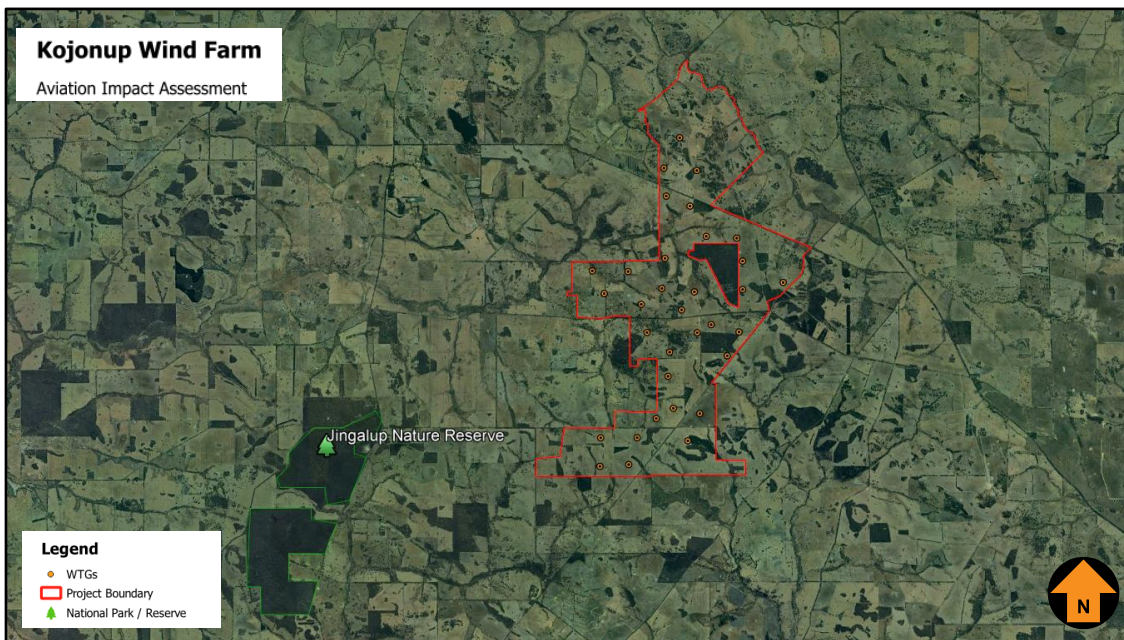


Figure 18 National Park boundary related to WTGs

Figure 18 (Source: Google Earth, Kojonup Wind Farm Pty Ltd) shows the park boundary in relation to the Project. The closest WTG is approximately 6.5 km away from the boundary of the Jingalup Nature Reserve. Consultation with Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service will be required regarding the buffer area of the reserve boundary.

8. POTENTIAL WAKE TURBULENCE IMPACTS

NASF Guideline D – *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* provides guidance to State/Territory and local government decision makers, airport operators and developers of wind farms to jointly address the risk to civil aviation arising from the development, presence and use of wind farms and WMTs.

NASF Guideline D provides guidance regarding WTG wake turbulence which states:

Wind farm operators should be aware that wind turbines may create turbulence which noticeable up to 16 rotor diameters from the turbine. In the case of one of the larger wind turbines with a diameter of 150 metres, turbulence may be present two kilometres downstream. At this time, the effect of this level of turbulence on aircraft in the vicinity is not known with certainty. However, wind farm operators should be conscious of their duty of care to communicate this risk to aviation operators in the vicinity of the wind farm...

The key wording in the NASF guidance is “noticeable” and that “the level of turbulence in the vicinity is not known with certainty.”

There are many situations in aviation where pilots “notice” their aircraft moving away from the desired flight path or altitude and take appropriate action to maintain control of the aircraft with minimal input.

Pilot training standards are regulated by CASA to ensure that all qualified pilots have demonstrated to a suitably qualified and authorised check pilot that they can maintain control of their aircraft along the chosen flight path, across a significant range of atmospheric conditions that cause the aircraft to deviate from the pilot’s chosen flight path.

Aircraft are designed to withstand a significant variation in atmospheric disturbances to ensure airframe integrity is maintained. The limits of the airframe’s integrity are known by the pilot and considered in every flight activity. Significant weather events such as thunderstorms are avoided because of the likelihood of airframe limits being exceeded by the strong wind shear type conditions within, beneath and surrounding thunderstorm cells.

Wind turbines have been assessed in a limited number of studies, in which the highest classification of hazard is considered to be medium only within approximately 7 rotor diameters (RD) downwind of the wind turbine. There are no assessments that consider that the downwind turbulence is significant and outside the ability of the aircraft to endure the impacts and for the pilot to be able to control the aircraft using normal control inputs.

There also have been no reported aircraft accidents or incidents involving an aircraft encounter with the turbulence downwind of a wind turbine.

Assessment

A 162 m rotor diameter has been used for the wake turbulence analysis. Based on this scenario, NASF Guideline D suggests the effects of wake turbulence could be noticeable from the WTGs within 16 rotor diameters (2592 m) of any WTG..

Based on the results of published scientific studies which indicate that any medium level of turbulence would in most circumstances be confined to within 7 rotor diameters of a WTG, Aviation Projects considers that a conservative area of 10 rotor diameters is likely to be the maximum area where wake turbulence from WTGs would be noticed by pilots of light aircraft operating downstream of a WTG.

These studies also indicated that where any such turbulence is experienced, the pilot would be able to control the aircraft using normal control inputs.

Two of those studies are referred to below.

The European Academy of Wind Energy published an open access report titled “Do wind turbines pose roll hazards to light aircraft?” dated 2 November 2018. This study concluded:

In neutral conditions, the largest of these hazards are classified as medium hazards and exist 6.5 D downwind of the turbine in the bottom-left portion of the rotor disk. The highest hazards in the stable case also remained within the medium threshold and are located in two separate regions of the wake: approximately 4 D downwind in the bottom-right quadrant of the rotor and 6 D downwind in the top-left quadrant of the rotor.

The United Kingdom (UK) Civil Aviation Authority commissioned the University of Liverpool to conduct a *Wind Turbine Wake Encounter Study*, the results of which were published in March 2015.

At University of Liverpool, a full CFD method [4] was used with the HMB solver to study wind turbine wakes. The CFD results showed good agreement for the blade surface pressure distributions and flow field velocities with the wind tunnel measurements. The wake was then solved on a very fine mesh able to capture the wake vortices up to 8 radii downstream of the blades on the MEXICO wind turbine rotor.

In general, the LIDAR measurements captured the regular wake mean velocity patterns. Statistic LIDAR data indicate that the effects of wind turbine rotor wake, in term of velocity deficit, are limited within a downwind distance of 5D. This is generally in agreement with the results of the full CFD method and the velocity deficit models.

For a wind turbine with size similar to the WTN250, and using the Beddoes circulation formula, the off-line simulation results indicate that the wind turbine wake did not pose any hazards to the encountering aircraft 5 diameters further from the wind turbine. The dominant upset that the wake generated is a yawing moment on the aircraft. The wake generated crosswind, is smaller than the maximum crosswind of 17.75 ft/s for an airport (codes A-I or B-I) that is expected to accommodate single engine aircraft. These conclusions are in line with that found in the piloted flight simulation.

These two studies are the only major studies of their kind.

Wind farm designers and developers recognise the impact of downwind changes in wind strength and direction when designing the overall wind farm to ensure that the turbines are located at minimum distances from each other in order to prevent turbulence from one or more turbines affecting the operational efficiency of a downwind turbine or causing damage to the downwind turbine blades. The minimum distance between turbines typical wind farms is approximately 800 m, a significantly shorter distance than either 16 RD or 10 RD presents.

The turbulence from a wind turbine could be described as a shear type turbulence which is caused by the difference of the free flow wind speed at the edge of the turbine rotor (the blade tip) being disrupted by the turbine blade being rotated by the wind and altering the wind speed within the rotor diameter moving downwind from the turbine. This shear type turbulence descends and weakens as it gets further away from the turbine. It is not a stream of turbulence being generated by the blades being turned by a mechanical force such as occurs with an aircraft propeller or ceiling fan in a house or factory.

The WTG blades change pitch, dependent on the wind strength, to maintain a constant rotor speed. They interfere with the natural wind flow and cause some degree of turbulence downwind of the WTG. A consistent theme among the studies was that the higher turbulence exists very close to the WTG and rapidly dissipates due to the effect of convection, mechanical turbulence from other sources such as the wind flowing over trees, buildings and terrain undulations.

The studies indicate that turbulence is likely to dissipate below a level that could be felt by pilots within 7 RD from the WTG. Aviation Projects considers that a more conservative value of 10 RD is best used to assess areas where the likely turbulence created downwind of a WTG will not be felt by or impact pilots of light aircraft.

The studies referenced above also indicate that aircraft controllability is maintained when experiencing the likely turbulence when the aircraft is approximately 6 RD from a WTG.

Table 6 Wake Turbulence Distances

1 RD (m)	7 RD (m)	10 RD (m)	16 RD (m)
162	1134	1660	2592

In conditions of high wind speed the WTGs are “parked” with the blades in a “feathered” condition to reduce the wind impact upon them. Turbulence from the “feathered” blades still exists but would be less than when the turbine is rotating. Other mechanical turbulence generated by trees, hills and other objects during high winds would significantly exceed and break up any minor turbulence from a stationary WTG.

Aircraft are designed to withstand significant turbulence according to aviation meteorological standards that are recognised and accepted worldwide. Even in recent circumstances with an airliner experiencing severe turbulence which injured passengers, the aircraft was controllable (except for the first part of the event where it descended rapidly) and has not suffered any significant damage (although it will undergo a major inspection). It was an encounter with severe turbulence far greater than normally experienced and is avoided wherever areas of severe turbulence is forecast or known to exist.

The downwind turbulence from WTGs beyond 7 RD may be felt by the pilot of a light aircraft but the pilot will only need to make minor control adjustments to maintain control of the aircraft’s attitude, altitude and heading. Such turbulence is likely to be classified as Light on an intensity scale published by the Australian Bureau of Meteorology shown in Figure 19.

Within the 7 RD boundary the turbulence is considered to create a medium hazard which is likely to equate to pilots experiencing “Moderate” turbulence in which the *“Pilot remains in control at all times.”* (Figure 19)

Light and moderate turbulence can be generated by lines of trees near runways.

Turbulence may disturb an aircraft’s attitude about its major axis, and cause rapid bumps or jolts to be experienced, but in most cases it does not significantly alter the aircraft’s flight path. ¹

Adverse turbulence from any source is most critical during initial climb after take-off until the aircraft is established in a climb and at the appropriate speed, and during final approach where the aircraft is configured for landing and operating at a slow speed prior to landing. The research studies indicate that adverse or severe turbulence is not created by wind turbines outside the 5 RD distance.

¹ Bureau of Meteorology – Hazardous Weather Phenomena – Turbulence

Intensity	Airspeed Fluctuations (kt/s)	Vertical Gust (ft/s)	G Load	Aircraft Reaction	Reaction Inside Aircraft
Light	5 – 14	5 - 19	0.15 – 0.49	Momentary slight and erratic changes in attitude and/or altitude. Rhythmic bumpiness.	Little effect on loose objects.
Moderate	15 – 24	20 - 35	0.50 – 0.99	Appreciable changes in attitude and/or altitude. Pilot remains in control at all times. Rapid bumps or jolts.	Unsecured objects move. Appreciable strain on seatbelts.
Severe	≥ 25	36 -49	1.0 – 1.99	Large abrupt changes in attitude and/or altitude. Momentary loss of control.	Unsecured objects are tossed about.
Extreme	≥ 25	≥ 50	> 2.0	Very difficult to control aircraft. May cause structural damage.	Occupants violently forced against seatbelts.

Figure 19 Turbulence intensities²

8.1. Kitto Aerodrome

As shown in Figure 20 (Source Google Earth, Kojonup Wind Farm Pty Ltd). The magenta circles indicates the 10 RD (1660 m) wake turbulence of the WTGs.

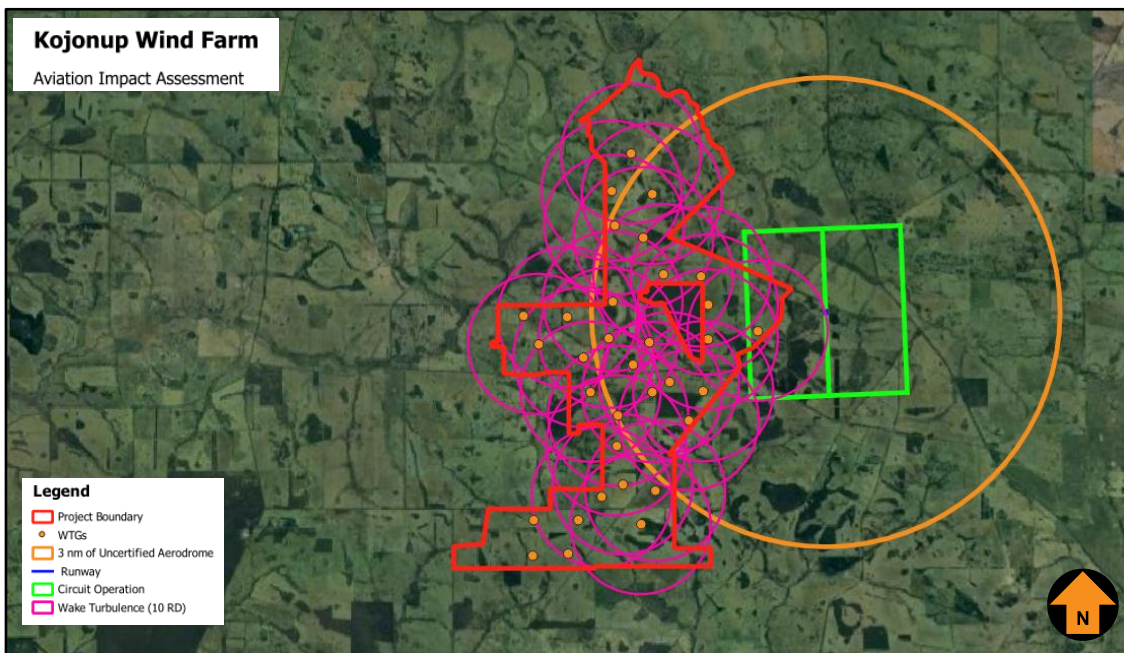


Figure 20 Wake turbulence of closer WTGs in relation to the Kitto Aerodrome

² Bureau of Meteorology – Hazardous Weather Phenomena – Turbulence

Whilst there is one (1) WTG infringing the standard 1 nm circuit, when the wind blows from the west, northwest or southwest, downwind wake turbulence from the nearest WTGs would be experienced by aircraft operating within the standard circuit area.

With a north-westerly wind, it would be usual for aircraft to land from the south to the north, and departing aircraft would take off in the same direction and would experience some degree of turbulence prior to reaching an altitude above the WTGs. This turbulence is likely to be similar to turbulence already existing at the aerodrome due to the undulating nature of the terrain, which causes turbulence in similar winds over the aerodrome. The turbulence would not be considered to cause a pilot serious problems in controlling the aircraft, nor would it compromise the aircraft's structure.

With a southeasterly wind, it would be usual for aircraft to land and take off from the north to the south. There is no downwind wake turbulence from the southeast for this aerodrome.

Consultation with the landowner is recommended to determine the landowners use of the aerodrome.

8.2. Heggaton Aerodrome

As shown in Figure 21 (Source Google Earth, Kojonup Wind Farm Pty Ltd). The magenta line indicates a 10 RD (1660 m) wake turbulence of the WTGs.

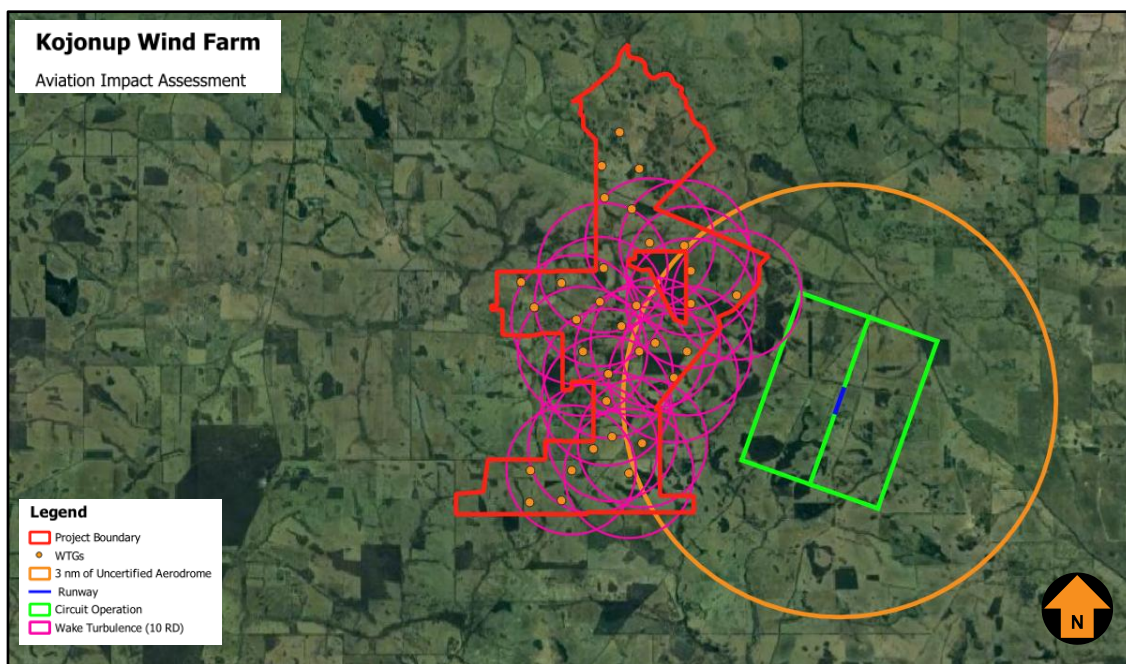


Figure 21 Wake turbulence of closer WTGs in relation to the Heggaton Aerodrome

When the wind blows from the west or northwest, downwind wake turbulence from the nearest WTGs would be potentially experienced by aircraft operating within the western circuit area at Heggaton aerodrome.

With a north-westerly wind, it would be usual for aircraft to land from the south to the north, and departing aircraft would take off in the same direction and would experience some degree of turbulence prior to reaching an altitude above the WTGs. This turbulence is likely to be similar to turbulence already existing at the aerodrome due to the undulating nature of the terrain, which causes turbulence in similar winds over the aerodrome. The turbulence would not be considered to cause a pilot serious problems in controlling the aircraft, nor would it compromise the aircraft's structure.

With a southeasterly wind, it would be usual for aircraft to land and take off from the north to the south. There is no downwind wake turbulence from the southeast for this aerodrome.

Confining circuit operations to the east of the aerodrome would effectively eliminate any turbulence.

Consultation with the landowner is recommended to determine the use of the aerodrome.

8.3. Fares Aerodrome

As shown in Figure 22 (Source Google Earth, Kojonup Wind Farm Pty Ltd). The magenta line indicates a 10 RD (1660 m) wake turbulence from the WTGs.

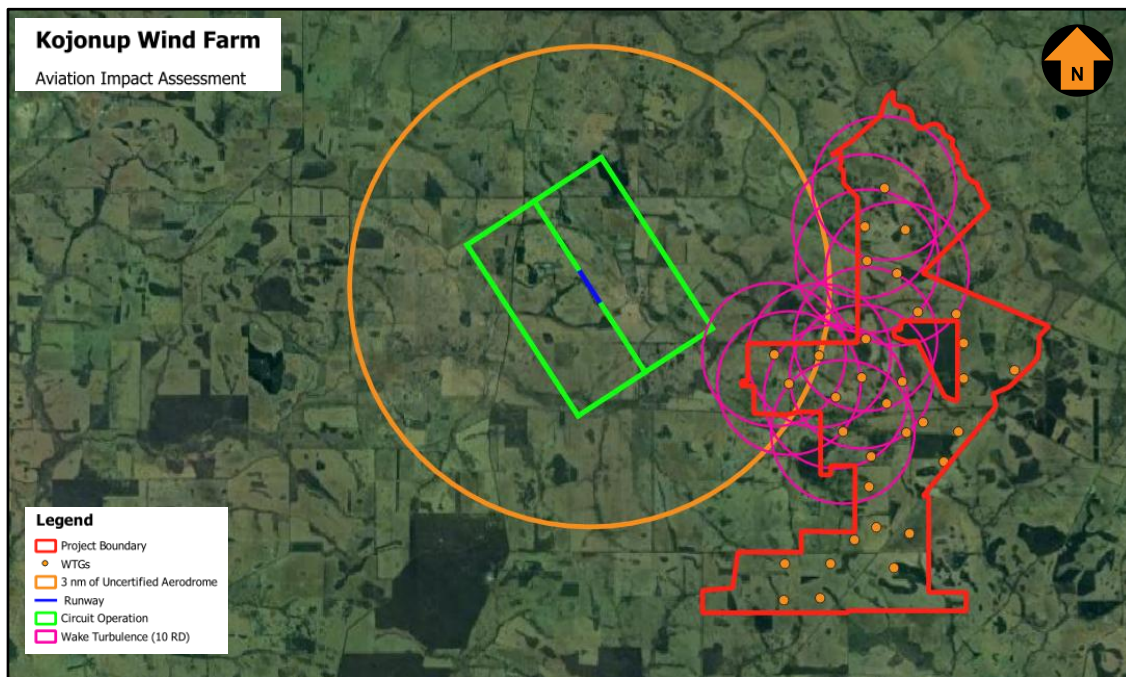


Figure 22 Wake turbulence of closer WTGs in relation to the Fares Aerodrome

When the wind blows from the east or southeast, downwind wake turbulence from the nearest WTGs would be experienced by aircraft.

With a south-easterly wind, it would be usual for aircraft to land from the north to the south, and departing aircraft would take off in the same direction and would experience some degree of turbulence prior to reaching an altitude above the WTGs. This turbulence is likely to be similar to turbulence already existing at the aerodrome due to the undulating nature of the terrain, which causes turbulence in similar winds over the aerodrome. The turbulence would not be considered to cause a pilot serious problems in controlling the aircraft, nor would it compromise the aircraft's structure.

With a north-westerly wind, it would be usual for aircraft to land and take off from the south to the north. There is no downwind wake turbulence from the northwest for this aerodrome.

Confining circuit operations to the east of the aerodrome would effectively eliminate any turbulence.

Consultation with the landowner is recommended to determine the use of the aerodrome.

8.4. Klopper Helipad

As shown in Figure 23 (Source Google Earth, Kojonup Wind Farm Pty Ltd). The magenta line indicates a 10 RD (1660 m) wake turbulence of the WTGs.

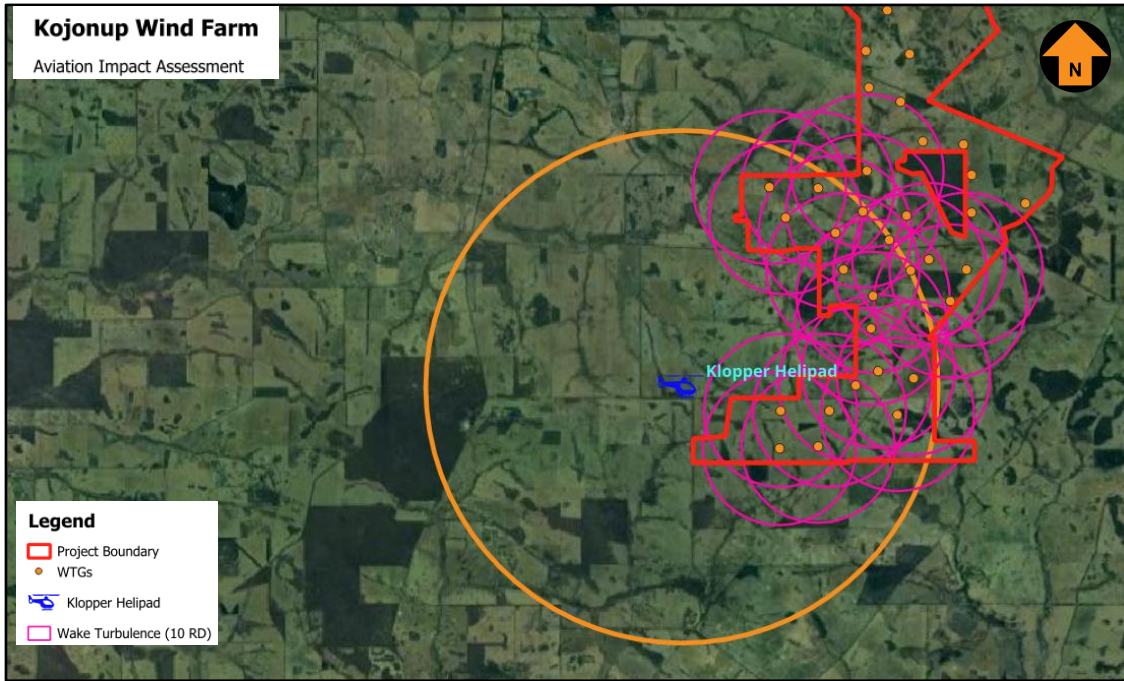


Figure 23 Wake turbulence of closer WTGs in relation to the helipad

When the wind blows from the east or northeast, downwind wake turbulence from the nearest WTGs would be experienced by helicopters operating near to the HLS..

A helipad pilot can land and take off from any direction. The pilot should be aware of the Project Site and use the west side to avoid impact.

Initial consultation with the owner has already started. And the owner don't think the Project wont be a issue for its helipad operation. The ongoing consultation with the helipad owner regarding the Project is encouraged..

9. HAZARD LIGHTING AND MARKING

Based on the risk assessment set out in Section 11 It is concluded that aviation lighting is not likely to be required.

For completeness, relevant lighting standards and guidelines are summarised in **Annexure 3**.

Once the details of the wind farm, along with this report, are provided by the planning authority to CASA, CASA is likely to recommend obstacle lighting be fitted to sufficient obstacles to delineate the outline of the wind farm and the highest WTGs within it.

10. ACCIDENT STATISTICS

This section establishes the external context to ensure that stakeholders and their objectives are considered when developing risk management criteria and that externally generated threats and opportunities are properly considered.

10.1. General aviation operations

The general aviation (GA) activity group is considered by the Australian Transport Safety Bureau (ATSB) to be all flying activities that do not involve commercial air transport (activity group), which includes scheduled (RPT) and non-scheduled (charter) passenger and freight type. It may involve Australian civil (VH-) registered aircraft, or aircraft registered outside of Australia. General aviation/recreational encompasses:

- **Aerial work (activity type).** Includes activity subtypes: agricultural mustering, agricultural spreading/spraying, other agricultural flying, photography, policing, firefighting, construction – sling loads, other construction, search and rescue, observation and patrol, power/pipeline surveying, other surveying, advertising, and other aerial work.
- **Own business travel (activity type).**
- **Instructional flying (activity type).** Includes activity subtypes: solo and dual flying training, and other instructional flying.
- **Sport and pleasure flying (activity type).** Includes activity subtypes: pleasure and personal transport, glider towing, aerobatics, community service flights, parachute dropping, and other sport and pleasure flying.
- **Other general aviation flying (activity type).** Includes activity subtypes: test flights, ferry flights and other flying.

10.2. ATSB occurrence taxonomy

The ATSB uses a taxonomy of occurrence sub-type. Of specific relevance to the subject assessment are terms associated with **terrain collision**. Definitions sourced from the ATSB website are provided below:

- **Collision with terrain:** Occurrences involving a collision between an airborne aircraft and the ground or water, where the flight crew were aware of the terrain prior to the collision.
- **Controlled flight into terrain (CFIT):** Occurrences where a serviceable aircraft, under flight crew control, is inadvertently flown into terrain, obstacles, or water without either sufficient or timely awareness by the flight crew to prevent the event.
- **Ground strike:** Occurrences where a part of the aircraft drags on, or strikes, the ground or water while the aircraft is in flight, or during take-off or landing.
- **Wirestrike:** Occurrences where an aircraft strikes a wire, such as a powerline, telephone wire, or guy wire, during normal operations.

10.3. National aviation occurrence statistics 2010-2019

The Australian Transport Safety Bureau (ATSB) published a summary of aviation occurrence statistics for the period 2010-2019 (AR-2020-047, Final - 4 November 2020). A later version of this report is not yet available. Aviation Projects subscribes to the ATSB occurrence reports. There have been no collisions or incidents involving wind farms since 2019.

According to the report, there were no fatalities in high or low capacity RPT operations during the period 2010-2019. In 2019, 220 aircraft were involved in accidents in Australia, and a further 154 aircraft involved in serious incidents (an incident with a high probability of becoming an accident). In 2019 there were 35 fatalities from 22 fatal accidents. There have been no fatalities in scheduled commercial air transport in Australia since 2005.

Of the 326 fatalities recorded in the 10-year period, almost two thirds (175 or 53.68%) occurred in the general aviation segment. On average, there were 1.51 fatalities per aircraft associated with a fatality in this segment. The fatalities to aircraft ratio ranges from 1.09 to 177:1. Whilst it can be inferred from the data that the majority of fatal accidents are single person fatalities, it is reasonable to assert that the worst credible effect of an aircraft accident in the general aviation category will be multiple fatalities.

A breakdown of aircraft and fatalities by general aviation sub-categories is provided in Table 7 (source: ATSB).

Table 7 Number of fatalities by General Aviation sub-category – 2010 to 2019

<i>Sub-category</i>	<i>Aircraft assoc. with fatality</i>	<i>Fatalities</i>	<i>Fatalities to aircraft ratio</i>
Aerial work	37	44	1.18:1
Instructional flying	11	19	1.72:1
Own business travel	3	5	1.6:1
Sport and pleasure flying	53	94	1.77:1
Other general aviation flying	11	12	1.09:1
Totals	115	174	1.51:1

Figure 24 refers to Fatal Accident Rate by operation type per million departures over the 6-year period (source: ATSB). Note the rates presented are not the full year range of the study (2010–2019). This was due to the availability of exposure data (departures and hours flown) which was only available between these years. According to the ATSB report, the number of fatal accidents per million departures for GA aircraft over the 6-year reporting period ranged between 6.6 in 2014 and 4.9 in 2019.

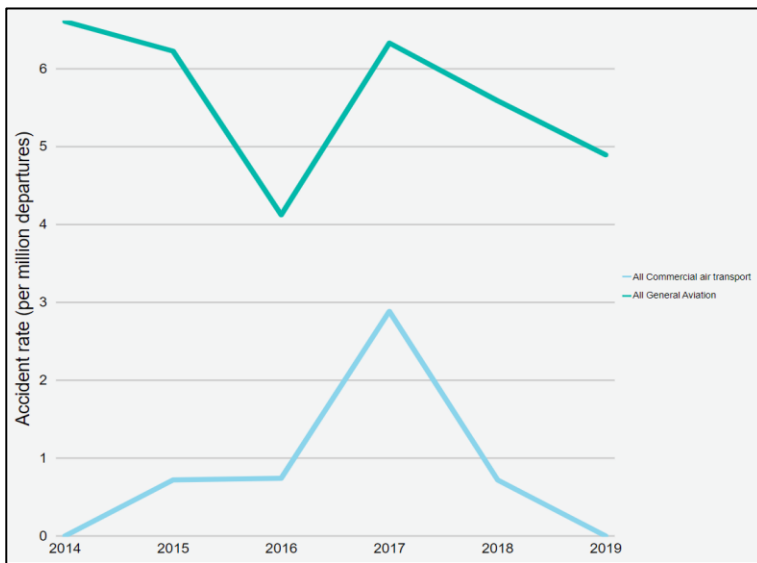


Figure 24 Fatal Accident Rate (per million departures) by Operation Type

In 2018, there were 9 fatal accidents and 9 fatalities involving GA aircraft, resulting in a rate of 5.6 fatal accidents per million departures and 7.7 fatal accidents per million hours flown.

In 2019, there were 1,760,000 landings, and 1,320,000 hours flown by VH-registered general aviation aircraft in Australia, with 8 fatal accidents and 17 fatalities. Based on these results, in 2019 there were 4.9 fatal accidents per million departures and 6.4 fatal accidents per million hours flown. A summary of fatal accidents from 2010-2019 by GA sub-category is provided in Table 8 (source: ATSB).

Table 8 Fatal accidents by GA sub-category – 2010 -2019

<i>Sub-category</i>	<i>Fatal accidents</i>	<i>Fatalities</i>
Agricultural spreading/spraying	13	13
Agricultural mustering	11	12
Other agricultural	1	1
Survey and photographic	5	10
Search and rescue	2	2
Firefighting	2	2
Other aerial work	3	4
Instructional flying	11	19
Own business travel	3	5
Sport and pleasure flying	53	94
Other general aviation flying	11	12
Total	115	174

Over the 10-year period and subsequently, no aircraft collided with a WTG or a WMT in Australia.

Of the 20,529 incidents, serious incidents and accidents in GA operations in the 10-year period, 1,404 (6.83%) were terrain collisions.

The underlying fatality rate for GA operations discussed above is considered tolerable within Australia's regulatory and social context.

10.4. Worldwide accidents involving wind farms

Worldwide since aviation accident statistics have been recorded, there have been a total of 5 aviation accidents involving a wind farm (i.e. where WTGs were erected). To provide some perspective on the likelihood of a VFR aircraft colliding with a WTG, a summary of the 5 accidents and the relevant factors applicable to this assessment is incorporated in this section.

Based on the statistics set out in the Global Wind Energy Council (GWEC) report 2024, Total installations of 117GW in 2023 represents a 50% year-on-year increase from 2022.

Based on the Australia's Clean Energy Council statistics there were 110 wind farms in Australia at 2023. Aviation Projects has researched public sources of information, accessible via the world wide web, regarding aviation safety occurrences associated with wind farms. Occurrence information published by Australia, Canada, Europe (Belgium, Denmark, France, Germany, Norway, Sweden and The Netherlands), New Zealand, the United Kingdom and the United States of America was reviewed.

The 5 recorded aviation accidents involving a wind farm are summarised as follows:

- One accident occurred in Texas, United States in October 2019 resulting in minor aircraft damage no injury to the pilot and significant injury to a person on the ground. The aircraft, an Air Tractor AT502, was returning from a local aerial application flight and was flown deliberately at low-level in close vicinity to a wind turbine generator (WTG) because the pilot believed his friend was working on the turbine. The aircraft collided with a tagline rope that was attached to a blade of the WTG and which was being held by a person working on the ground. The worker was thrown about 20 ft in the air and experienced significant non-life-threatening injuries. The aircraft sustained minor damage however the pilot landed the aircraft without further incident.
- One accident, which resulted in 2 fatalities, occurred in Palm Springs in 2001. This accident involved a wind farm but was not caused by the wind farm. The cause of the accident was the inflight separation of the majority of the right canard and all of the right elevator resulting from a failure of the builder to balance the elevators per the kit manufacturer's instructions. The accident occurred above a wind farm, and the aircraft struck a WTG on its descent and therefore the cause of the accident was not attributable to the wind farm and not applicable to this AIA.
- Two accidents involving collision with a WTG were during the day, as follows:
 - One accident occurred in Melle, Germany in 2017 as the result of a collision with a WTG mounted on a steel lattice tower at a very low altitude during the day with good visibility and no cloud. The accident resulted in one fatality. If the tower was solid and painted white, as is standard on contemporary wind farms, then it more than likely would have been more visible than if it were to be equipped with an obstacle light which in all likelihood would not have been operating during daylight with good visibility conditions.
 - One accident occurred in Plouguin, France in 2008 when the pilot decided to descend below cloud in an attempt to find the destination aerodrome. The aircraft was flying in conditions of significantly reduced horizontal visibility in fog where the top of the WTGs were obscured by cloud. The WTGs became visible too late for avoidance manoeuvring and the aircraft

made contact with two WTGs. The aircraft was damaged but landed safely. No fatalities were recorded.

- In both of the above cases, it is difficult to conclude that obstacle lighting would have prevented the accidents.
- One fatal accident, near Highmore, South Dakota in 2014 occurred at night in Instrument Meteorological Conditions (IMC).

There is one other accident mentioned in a database compiled by an anti-wind farm lobby group (wind-watch.org), which suggests a Cessna 182 collided with a WTG near Baraboo, Wisconsin, on 29 July 2000. The NTSB database records details of an accident involving a Cessna 182 that occurred on 28 July 2000 in the same area. For this particular accident, NTSB found that the probable cause of the accident was VFR flight into IMC encountered by the pilot and exceeding the design limits of the aircraft. A factor was flight to a destination alternate not performed by the pilot. No mention in the NTSB database is made of WTGs or a wind farm.

There is one accident occurred in near Nettersheim, Kreis Euskirchen, North Rhine Westphalia, Germany in August 2024. Unconfirmed information suggests that the aircraft impacted a wind turbine in poor visibility conditions. The accident resulted in one fatality and 2 occupants.

11. RISK ASSESSMENT

A risk management framework comprises likelihood and consequence descriptors, a matrix used to derive a level of risk, and actions required of management according to the level of risk.

The risk assessment framework used by Aviation Projects and risk event description is provided in **Annexure 4**.

11.1. Risk Identification

The primary risk being assessed is that of aviation safety associated with the height and location of WTGs and WMTs proposed by the Project.

Based on an extensive review of accident statistics data (see summary in Section 10 above) and stakeholders who were consulted during the preparation of this AIA (see Section 5), 4 identified risk events associated with WTGs and WMTs relate to aviation safety or potential visual impact, and are listed as follows:

1. Potential for an aircraft to collide with a WTG, controlled flight into terrain (CFIT) (related to aviation safety)
2. Potential for a pilot to initiate manoeuvring in order to avoid colliding with a WTG or WMT resulting in collision with terrain (related to aviation safety)
3. Potential for the hazards associated with the Project to invoke operational limitations or procedures on operating crew (related to aviation safety)
4. Potential effect of obstacle lighting on neighbours (related to potential visual impact).

It should be noted that according to guidance provided by the Commonwealth Department of Infrastructure Transport, Regional Development, Communications and the Arts (Airspace and Air Traffic Management Risk Management Policy Statement), and in line with generally accepted practice, the risk to be assessed should primarily be associated with passenger transport services. Therefore, the risk being assessed herein is primarily associated with smaller aircraft likely to be flying under the VFR, and so the maximum number of passengers exposed to the nominated consequences is likely to be limited.

The four risk events identified here are assessed in detail in the following section.

11.2. Risk Analysis, Evaluation and Treatment

For the purpose of considering applicable consequences, the concept of worst credible effect has been used. Untreated risk is first evaluated, then, if the resulting level of risk is unacceptable, further treatments are identified to reduce the residual level of risk to an acceptable level.

A summary of the level of risk associated with the Project, under the proposed treatment regime, with specific consideration of the effect of obstacle lighting, is provided in Table 9 through to Table 12.

Table 9 Aircraft collision with wind turbine generator (WTG)

Risk ID:	1. Aircraft collision with wind turbine generator (WTG) (CFIT)	
Discussion		
<p>An aircraft collision with a WTG would result in harm to people and damage to property. Property could include the aircraft itself, as well as the WTG.</p> <p>There have been 5 reported occurrences worldwide of aircraft collisions with a component of a WTG structure since the year 2000 as discussed in Section 8 These reports show a range of situations where pilots were conducting various flying operations at low level and in the vicinity of wind farms in both IMC and VMC. No reports of aircraft collisions with wind farms in Australia have been found.</p> <p>In consideration of the circumstances that would lead to a collision with a WTG:</p> <ul style="list-style-type: none"> GA VFR aircraft operators generally don't individually fly a significant number of hours in total, let alone in the area in question There is a very small chance that a pilot, suffering the stress of weather, will continue into poor weather conditions (contrary to the rules of flight) rather than divert away from it, is not aware of the wind farm, will not consider it or will not be able to accurately navigate around it. If the aircraft was flown through the wind farm, there is still a very small chance that it would hit a WTG. <p>There are no known aerial application operations conducted at night in the vicinity of the Project site.</p> <p>If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing:</p> <ul style="list-style-type: none"> (a) Whether the object or structure will be a hazard to aircraft operations (b) Whether it requires an obstacle light that is essential for the safety of aircraft operations <p>The Project site is clear of the obstacle OLS of any aerodrome.</p>		
Consequence		
If an aircraft collided with a WTG, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.		
		Consequence Catastrophic
Untreated Likelihood		
<p>There have been 5 reports of aircraft collisions with WTGs worldwide, which have resulted in a range of consequences, where aircraft occupants sustained minor injury in some cases and fatal injuries in others (see Section 10). Similarly, aircraft damage sustained ranged from minor to catastrophic. One of these accidents resulted from structural failure of the aircraft before the collision with the WTG. Only two relevant accidents occurred during the day, and only one resulted in a single fatality. It is assessed that collision with a WTG resulting in multiple fatalities and damage beyond repair is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.</p>		
		Untreated Likelihood Possible

Current Treatments (without lighting)

- The Project site is clear of the obstacle OLS of any certified aerodrome.
- Aircraft are restricted to a minimum height of 500 ft (152.4 m) AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas. The proposed WTGs would be a maximum height of 206 m (676 ft) at the top of the blade tip. The rotor blade at its maximum height would be approximately 53.6 m (175.9 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).
- Aircraft are restricted to a minimum height of 304.8 m (1,000 ft) above obstacles (including terrain) which are within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).
- Aircraft authorised to intentionally fly below 152.4 m (500 ft) AGL (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities undertaken specifically for and prior to undertaking such authorised flights. Any obstacle including WTGs in the path of the authorised flight would be specifically risk assessed during that process.
- The WTGs are typically coloured white so they should be visible to pilots during the day.

Level of Risk

The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8 (Unacceptable).

Current Level of Risk	8 - Unacceptable
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Risk Decision

A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.

Risk Decision	Unacceptable
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Recommended Treatments

The following treatments which can be implemented at little cost will provide an acceptable level of safety:

- Details of the Project should be communicated to local and regional aircraft operators prior to construction to heighten their awareness of its location and so that they can plan their operations accordingly. Specifically:
 - a. The final layout details of WTGs are required to be notified to Airservices Australia so that the location and height of all WTGs can be noted on aeronautical maps and charts.
 - b. Because the Project WTGs are proposed to be above 100 m AGL, there is a statutory requirement to report the WTGs to CASA and notified to Airservices Australia prior to construction
 - c. Engage with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, stopping the rotation of the WTG blades prior to the commencement of the subject aircraft operations within the Project site.

- d. Arrangements should be made to publish details of the Project in ERSA for surrounding aerodromes, which would involve notification to Airservices Australia.

Residual Risk

With the implementation of the Recommended Treatments listed above, the likelihood of an aircraft collision with a WTG resulting in multiple fatalities and damage beyond repair will be **Unlikely**, and the consequence remains **Catastrophic**, resulting in an overall risk level of **7 - Tolerable**.

It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified.

In the circumstances, the level of risk under the proposed treatment plan is considered **as low as reasonably practicable (ALARP)**.

It is our assessment that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines of the Project.

Residual Risk **7 - Tolerable**

Table 10 Harsh manoeuvring leading to controlled flight into terrain

Risk ID:	2. Harsh manoeuvring leads to controlled flight into terrain (CFIT)	
Discussion		
<p>An aircraft colliding with terrain as a result of manoeuvring to avoid colliding with a WTG would result in harm to people and damage to property.</p> <p>There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day.</p> <p>The Project is clear of the OLS of any aerodrome.</p> <p>Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas.</p> <p>The proposed WTGs would be a maximum of 206 m (675.9 ft) at the top of the blade tip. The rotor blade at its maximum height would be approximately 53.6 m (175.9 ft) above aircraft flying at the minimum altitude of 152.4 m (500 ft) AGL.</p> <p>Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of WTGs.</p> <p>Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).</p> <p>Aircraft authorised to intentionally fly below 152.4 m (500 ft) AGL (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.</p>		
Assumed risk treatments		
<ul style="list-style-type: none"> • The WTGs are typically coloured white so they should be visible during the day. • Final details of WTG coordinates and elevation should be provided to Airservices Australia at least two weeks prior to construction commencing, so that the location and height of all WTGs can be noted on aeronautical maps and charts • Since the WTGs would be higher than 100 m AGL, there is a statutory requirement to report the WTG to CASA. 		
Consequence		
<p>If an aircraft collided with terrain, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.</p>		
		Consequence
		Catastrophic
Untreated Likelihood		
<p>There are a few ground collision accidents resulting from manoeuvring to avoid WTGs, but none in Australia, and all were during the day (see Section 10). It is assessed that a ground collision accident following manoeuvring to avoid a WTG is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.</p>		
		Untreated Likelihood
		Possible

Current Treatments (without lighting)

- The Project is clear of the OLS of any aerodrome.
- Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas.
- WTGs would be a maximum of 206 m (675.9 ft) at the top of the blade tip. The rotor blade at its maximum height would be approximately 53.6 m (175.9 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).
- Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of WTGs.
- The WTGs and masts would be shown on aeronautical charts at the next publication cycle date available and NOTAMS prior to the publication date. This allows pilots to be aware of the existence of the wind farm at the pre-flight planning stage and during flight with reference to the aeronautical chart.
- If cloud descends below the WTG hub, obstacle lighting would be obscured and therefore ineffective.
- Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).
- Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.
- The WTGs are typically coloured white, typical of most WTGs operational in Australia, so they should be visible during the day.

Level of Risk

The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.

Current Level of Risk	8 – Unacceptable
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Risk Decision

A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.

Risk Decision	Unacceptable
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Recommended Treatments

The following treatments which can be implemented at little cost will provide an acceptable level of safety:

- The WTGs and masts will be shown on aeronautical charts at the next publication cycle date available and NOTAMS prior to the publication date. This allows pilots to be aware of the existence of the wind farm at the pre-flight planning stage and during flight with reference to the aeronautical chart
- The final layout details of WTGs are required to be notified to Airservices Australia so that the location and height of all WTGs can be noted on aeronautical maps and charts.

- Because the Project WTGs are proposed to be above 100 m AGL, there is a statutory requirement to report the WTGs to CASA and notified to Airservices Australia prior to construction
- Ensure details of the Project WTGs have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators prior to construction.
- Although there is no requirement to do so, the Proponent may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for their safe operation within the Project site.

With the additional recommended treatments, the likelihood of ground collision resulting from manoeuvring to avoid a wind turbine resulting in multiple fatalities and damage beyond repair will be **Unlikely**, and the consequence remains **Catastrophic**, resulting in an overall risk level of **7 – Tolerable**.

It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified.

In the circumstances, the level of risk under the proposed treatment plan is considered **ALARP**.

It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for ground collision resulting from manoeuvring to avoid a wind turbine, without obstacle lighting on the turbines of the Project.

Residual Risk | 7 – Tolerable

Table 11 Effect of the Project on operating crew

Risk ID:	3. Effect of the Project on operating crew
Discussion	
Introduction or imposition of additional operating procedures or limitations can affect an aircraft's operating crew.	
There are no known aerial application operations conducted at night in the vicinity of the Project site.	
Consequence	
The worst credible effect a wind farm could have on flight crew would be the imposition of operational limitations, and in some cases, the potential for use of emergency procedures. This would be a Minor consequence.	
Consequence	Minor
Untreated Likelihood	
The imposition of operational limitations is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.	
Untreated Likelihood	Possible
Current Treatments	
<ul style="list-style-type: none"> • The Project is clear of the OLS of any aerodrome. • Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas. • The WTGs and masts would be shown on aeronautical charts at the next publication cycle date available and NOTAMS prior to the publication date. This allows pilots to be aware of the existence of the wind farm at the pre-flight planning stage and during flight with reference to the aeronautical chart. • WTGs would be a maximum of 206 m (675.9 ft) at the top of the blade tip. The rotor blade at its maximum height would be approximately 53.6 m (175.9 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft). • Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of WTGs. • If cloud descends below the WTG hub, obstacle lighting would be obscured and therefore ineffective. • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night). • Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The WTGs are typically coloured white so they should be visible during the day. 	

Level of Risk	
The level of risk associated with a Possible likelihood of a Moderate consequence is 5.	
Current Level of Risk	5 - Tolerable
Risk Decision	
A risk level of 6 is classified as Tolerable: Treatment action possibly required to achieve ALARP - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.	
Risk Decision	Accept, conduct cost benefit analysis
Recommended Treatments	
<p>WMTs installed prior to WTG installation and those that are not in relatively close proximity to a WTG should be lit to ensure they are visible in low light and deteriorating atmospheric conditions. (see Risk ID: 2)</p> <p>The following additional treatments will provide an additional margin of safety:</p> <ul style="list-style-type: none"> • The final layout details of WTGs are required to be notified to Airservices Australia so that the location and height of all WTGs can be noted on aeronautical maps and charts. • Because the Project WTGs are proposed to be above 100 m AGL, there is a statutory requirement to report the WTGs to CASA and notified to Airservices Australia prior to construction • Ensure details of the Project WTGs and WMTs have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators prior to construction. • Although there is no requirement to do so, the Proponent may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for such aircraft operations in the vicinity of the Project site. 	
Residual Risk	
<p>Notwithstanding the current level of risk is considered Tolerable, the additional Recommended Treatments listed above will enhance aviation safety. The likelihood remains Possible, and consequence remains Minor. In the circumstances, the risk level of 5 is considered Tolerable.</p> <p>It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for operational limitations to affect aircraft operating crew, without obstacle lighting on the Project WTGs and Permanent WMTs in close proximity to a WTG, and with obstacle lighting for temporary WMTs installed prior to WTG installation and WMTs that are not in close proximity to a WTG.</p>	
Residual Risk	5 – Tolerable

Table 12 Effect of obstacle lighting on neighbours

Risk ID:	4. Effect of obstacle lighting on neighbours	
Discussion		
<p>This scenario discusses the consequential impact of a decision to install obstacle lighting on the wind farm.</p> <p>Installation and operation of obstacle lighting on WTGs or WMT can have an effect on neighbours' visual amenity and enjoyment, specifically at night and in good visibility conditions.</p> <p>If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing:</p> <ul style="list-style-type: none"> (a) Whether the object or structure will be a hazard to aircraft operations (b) Whether it requires an obstacle light that is essential for the safety of aircraft operations. <p>In general, objects outside an OLS and above 100 m would require obstacle lighting unless CASA, in an aeronautical study, assesses it is shielded by another lit object or it is of no operational significance.</p>		
Consequence		
<p>The worst credible effect of obstacle lighting specifically at night in good visibility conditions would be:</p> <ul style="list-style-type: none"> • Moderate site impact, minimal local impact, important consideration at local or regional level, possible long-term cumulative effect. Not likely to be decision making issues. Design and mitigation measures may ameliorate some consequences. <p>This would be a Moderate consequence.</p>		
Consequence		Moderate
Untreated Likelihood		
<p>The likelihood of moderate site impact, minimal local impact is Almost certain - the event is likely to occur many times (has occurred frequently).</p>		
Untreated Likelihood		Almost certain
Current Treatments		
<p>If the WTGs or WMTs would be higher than 150 m (492 ft) AGL, they must be regarded as obstacles unless CASA assess otherwise. In general, objects outside an OLS and above 100 m would require obstacle lighting unless CASA, in an aeronautical study, assesses it is shielded by another lit object or it is of no operational significance.</p>		
Level of Risk		
<p>The level of risk associated with an Almost certain likelihood of a Moderate consequence is 8.</p>		
Current Level of Risk		8 - Unacceptable
Risk Decision		
<p>A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.</p>		
Risk Decision		Unacceptable

Recommended Treatments

Not installing obstacle lighting would completely remove the source of the impact.

As per the above safety risk assessment, the provision of lighting for the WTGs and permanent WMTs is not necessary to provide an acceptable level of safety. For temporary WMTs installed prior to WTG installation and WMTs that are not in close proximity to a WTG, obstacle lighting is recommended to ensure visibility in low light and deteriorating atmospheric conditions.

If CASA or a planning authority decide that obstacle lighting is required there are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours, including:

- Reducing the number of WTGs with obstacle lights
- Specifying an obstacle light that minimises light intensity at ground level
- Specifying an obstacle light that matches light intensity to meteorological visibility
- Mitigating light glare from obstacle lighting through measures such as baffling.

These measures are designed to optimise the benefit of the obstacle lights to pilots while minimising the visual impact to residents within and around the Project site.

Consideration may be given to activating the obstacle lighting via a pilot activated lighting system.

An option is to consider using Aircraft Detection Lighting Systems (referred in the United States Federal Aviation Administration Advisory Circular AC70/7460-1L CHG1 – *Obstruction Marking and Lighting*). Such a system would only activate the lights when an aircraft is detected in the near vicinity and deactivate the lighting once the aircraft has passed. This technology reduces the impact of night lighting on nearby communities and migratory birds and extends the life expectancy of obstruction lights.

Residual Risk

Not installing obstacle lights would clearly be an acceptable outcome to those potentially affected by visual impact.

If lighting is required, consideration of visual impact in the lighting design should enable installation of lighting that reduces the impact to neighbours.

The likelihood of a **Moderate** consequence remains **Likely**, with a resulting risk level of **7 – Tolerable**.

It is our assessment that visual impact from obstacle lights can be negated if they are not installed. If obstacle lights are to be installed, they can be designed so that there is an acceptable risk of visual impact to neighbours.

Residual Risk	7 - Tolerable
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12. CONCLUSIONS

The key conclusions of this AIA are summarised as follows:

12.1. Planning considerations

The Project, as proposed, satisfies the planning provisions related to aviation safety matters and will not create incompatible intrusions or compromise the safety of existing airports and associated navigation and communication facilities.

12.2. Aviation Impact Statement

Based on the WTG layout and maximum blade tip height of up to 206 m AGL, the blade tip elevation of the highest WTG, which is WTG T11, will not exceed 587 m AHD (1925.9 ft AMSL) and;

- There is one certified aerodrome located within 30 nm (56 km) of the Project - Katanning Airport (YKNG)
 - The WTGs would not impact the OLS surfaces.
 - The WTGs would not impact the IFR circling areas.
 - The 25 nm MSA would need to be increased by 100 ft to 3000 ft or sectorised to exclude the wind farm area.
 - The WTGs would not impact the PANS-OPS surfaces of the RNP RWY 25 instrument approach procedures. However, if the 25 nm MSA is not sectorised for the wind farm, increasing the 25 nm MSA to 3000 ft would require the minimum altitudes in the initial approach segments to be increased to be consistent with the 25 nm MSA minimum altitude
- The WTGs would not impact any Grid LSALT and air route LSALT
- The Project area is located within Class G airspace and outside of controlled airspace, Prohibited, Restricted and Danger areas.
- The WTGs would not impact the aviation navigation facilities.
- The WTGs would not impact the closest ATC surveillance radar installations.

12.3. Aircraft operator characteristics

Aircraft will be required to navigate around the project site in low cloud conditions where aircraft need to fly at 500 ft AGL.

Aircraft flying at night in visual conditions are permitted to descend or climb to or from an appropriate minimum altitude only when within 3 nm of the aerodrome. The existence of WTGs within the 3 nm area would require

careful consideration of flight paths in the vicinity of aerodromes (Kitto Aerodrome, Heggaton Aerodrome, Fares Aerodrome and Klopper Helipad) that would likely cause some flight restrictions in that area.

WTGs are generally not a safety concern to aerial agricultural operators.

The closest WTGs are 6.5 km away from the boundary of the Jingalup Nature Reserve. To confirm the buffer area of the forest boundary, consultation with Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service is required.

12.4. Hazard marking and lighting

The following conclusions apply to hazard marking and lighting:

- With respect to CASR Part 139 Division 139.E., the proposed WTGs and WMT must be reported to CASA.
- CASA will review the proposed WTG development and are likely to recommend obstacle lighting.
- With respect to marking of WTGs, a low reflective off-white or white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.

12.5. Summary of risks

A summary of the level of residual risk associated with the Project with the Recommended Treatments implemented, is provided in Table 13.

Table 13 Summary of Residual Risks

<i>Identified Risk</i>	<i>Consequence</i>	<i>Likelihood</i>	<i>Risk</i>	<i>Actions Required</i>
Aircraft collision with wind turbine generator (WTG)	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project WTGs to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Avoidance manoeuvring leads to ground collision	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project WTGs and WMTs to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Effect on crew	Minor	Possible	5	Acceptable without obstacle lighting (ALARP) Communicate details of the Project WTGs and WMTs to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.

<i>Identified Risk</i>	<i>Consequence</i>	<i>Likelihood</i>	<i>Risk</i>	<i>Actions Required</i>
Visual impact from obstacle lights	Moderate	Likely	7	Acceptable without obstacle lighting (zero risk of visual impact from obstacle lighting). If lights are installed, design to minimise impact.

13. RECOMMENDATIONS

Recommended actions resulting from the conduct of this assessment are provided below.

Notification and reporting

1. Details of WTGs 100 m or more AGL must be reported to CASA as soon as practicable after forming the intention to construct or erect the proposed object or structure, in accordance with CASR Part 139.165(1)(2)
2. Final details of WTG coordinates and elevation should be provided to Airservices Australia at least two weeks prior to construction commencing, by submitting the form at this webpage: https://www.airservicesaustralia.com/wp-content/uploads/ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf to the following email address: vod@airservicesaustralia.com
3. Any obstacles 100 m or more AGL (including temporary construction equipment) should be reported to Airservices Australia NOTAM office until they are incorporated in published operational documents. With respect to crane operations during the construction of the Project, a notification to the NOTAM office may include, for example, the following details:
 - a. The planned operational timeframe and maximum height of the crane; and
 - b. Either the general area within which the crane will operate and/or the planned route with timelines that crane operations will follow.
4. Details of the Project should be provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the Project on their operations
5. To facilitate the flight planning of aerial application operators, details of the Project, including the 'as constructed' location and height information of WTGs and overhead transmission lines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information
6. Jinalup Nature Reserve is 4.8 km from the project's boundary. Some low-level flight operations might occur in Jinalup Nature Reserve, which will require a safe flight corridor without turbines along the park's boundaries. Liaison with Western Australia Department of Biodiversity, Conservation and Attractions - Parks and Wildlife Service will be required regarding the buffer area of the boundary.

Marking of WTGs

7. The rotor blades, nacelle and the supporting mast of the WTGs should be in a low reflective off-white or white, typical of most WTGs operational in Australia. No additional marking measures are required for WTGs

Lighting of WTGs

8. CASA will determine whether obstacle lighting is recommended for the WTGs. It is not a formal requirement to light the WTGs. Based on the risk assessment set out in Section 9 It is concluded that aviation lighting is not likely to be required

Micrositing

9. Providing the micrositing is within 100 m of the planned WTGs it is not likely to result in a change in the maximum overall blade tip height of the Project. No further assessment is likely to be required from micrositing and the conclusions of this AIA would remain the same.

Aerial firefighting

10. The developer or operator should consider the guidance contained in the National Council for Fire and Emergency Services, Wind Farms and Bushfire Operations to ensure:
 - a. Liaison with the relevant fire and land management agencies is ongoing and effective
 - b. Access is available to the wind farm site by emergency services for on-ground firefighting operations.
 - c. Wind turbines are shut down immediately during emergency operations
 - d. Where possible, blades should be stopped in the 'Y' or 'rabbit ear' position, as this positioning allows for the maximum airspace for aircraft to manoeuvre underneath the blades and removes one of the blades as a potential obstacle. Note: This may not always be possible due to the risk to equipment and personnel as a fire approaches or exists in or near to the WTGs.

Aviation Projects considers that it may be impractical to stop and lock the turbine blades in a Y configuration due to the time needed to stop and lock the turbine and the risk to personnel having to climb into the WTG tower as a bush fire approaches. WTG blades can be feathered to effectively stop or reduce the rotation rate of the turbine to a very slow speed

Triggers for review

11. Triggers for review of this risk assessment are provided for consideration:
 - a. Prior to construction to ensure the regulatory framework has not changed
 - b. Following any significant changes to the context in which the assessment was prepared
 - c. Following any near miss, incident or accident associated with operations considered in this risk assessment.

ANNEXURES

1. References
2. Definitions
3. CASA regulatory requirements – Lighting and Marking
4. Risk Framework
5. WTG coordinates and heights

ANNEXURE 1 – REFERENCES

References used or consulted in the preparation of this report include:

- Airservices Australia
 - Aeronautical Information Package, effective 12 June 2025
- Australian Government, Department of Infrastructure, Transport, Regional Development, Communications and the Arts:
 - National Airport Safeguarding Framework, Guideline D *Managing the Risk To Aviation Safety of Wind Turbine Installation (Wind Farms)/Wind Monitoring Towers*.
- Civil Aviation Safety Authority
 - AC 139.E-01 v1.0—*Reporting of Tall Structures*, dated December 2021
 - AC 139.E-05 v1.1 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome* (October 2022)
 - AC 91-02 V1.2, *Guidelines for aeroplanes with MTOW not exceeding 5700 kg – suitable places to take off and land*, dated November 2022
 - AC 91-10 v1.6: *Operations in the vicinity of non-controlled aerodromes*, dated September 2025
 - Civil Aviation Regulations 1988 (CAR)
 - Civil Aviation Safety Regulations 1998 (CASR)
 - CASR Part 173 Manual of Standards (MOS)— *Standards Applicable to Instrument Flight Procedure Design*, F2022L01052, dated August 2022
 - CASR Part 139 Manual of Standards (MOS)— *Aerodromes*, F2024L01671, dated December 2024
- International Civil Aviation Organization (ICAO):
 - Annex 14—*Aerodromes*
 - Doc 8168 *Procedures for Air Navigation Services—Aircraft Operations (PANS-OPS)*.
- OzRunways, aeronautical navigation charts extracts, dated June 2025
- Western Australia Planning Commission, *Position Statement: Renewable energy facilities*, March 2020
- Standards Australia, ISO 31000:2018 *Risk management – Guidelines*.

ANNEXURE 2 – DEFINITIONS

<i>Term</i>	<i>Definition</i>
Aerial Agricultural Operator	Specialist pilot and/or company who are required to have a commercial pilot's licence, an agricultural rating and a chemical distributor's licence
Aerodrome	A defined area on land or water (including any buildings, installations, and equipment) intended to be used either wholly or in part for the arrival, departure, and surface movement of aircraft.
Aerodrome facilities	Physical things at an aerodrome which could include: <ul style="list-style-type: none"> a. the physical characteristics of any movement area including runways, taxiways, taxilanes, shoulders, aprons, primary and secondary parking positions, runway strips and taxiway strips; b. infrastructure, structures, equipment, earthing points, cables, lighting, signage, markings, visual approach slope indicators.
Aerodrome reference point (ARP)	The designated geographical location of an aerodrome.
Aeronautical Information Publication (AIP)	Details of regulations, procedures, and other information pertinent to the operation of aircraft
Aeronautical Information Publication En-route Supplement Australia (AIP ERSA)	Contains information vital for planning a flight and for the pilot in flight as well as pictorial presentations of all licensed aerodromes
Civil Aviation Safety Regulations 1998 (CASR)	Contain the mandatory requirements in relation to airworthiness, operational, licensing, enforcement.
Instrument meteorological conditions (IMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minimum specified for visual meteorological conditions.
Manual of Standards (MOS)	The means CASA uses in meeting its responsibilities under the Act for promulgating aviation safety standards
National Airports Safeguarding Framework (NASF)	The Framework has the objective of developing a consistent and effective national framework to safeguard both airports and communities from inappropriate on and off airport developments.
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.

<i>Term</i>	<i>Definition</i>
Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.
Runway strip	A defined area including the runway and stopway, if provided, intended: <ul style="list-style-type: none"> a. to reduce the risk of damage to aircraft running off a runway; and b. to protect aircraft flying over it during take-off or landing operations.
Safety Management System	A systematic approach to managing safety, including organisational structures, accountabilities, policies and procedures.

ANNEXURE 3 – CASA REGULATORY REQUIREMENTS – LIGHTING AND MARKING

In considering the need for aviation hazard lighting and marking, the applicable regulatory context was determined.

The Civil Aviation Safety Authority (CASA) regulates aviation activities in Australia. Applicable requirements include the Civil Aviation Regulations 1988 (CAR), Civil Aviation Safety Regulations 1998 (CASR) and associated Manual of Standards (MOS) and other guidance material. Relevant provisions are outlined in further detail in the following section.

Civil Aviation Safety Regulations 1998, Part 139—Aerodromes

CASR 139.165 requires the owner of a structure (or proponents of a structure) that will be 100 m or more above ground level to inform CASA. This must be given in written notice and contain information on the proposal, the height and location(s) of the object(s) and the proposed timeframe for construction. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether the structure will be hazardous to aircraft operations.

Manual of Standards Part 139—Aerodromes

Chapter 9 sets out the standards applicable to Visual Aids Provided by Aerodrome Lighting.

Section 9.30 provides guidance on Types of Obstacle Lighting and Their Use:

1. *The following types of obstacle lights must be used, in accordance with this MOS, to light hazardous obstacles:*
 - a. *low-intensity;*
 - b. *medium-intensity;*
 - c. *high-intensity;*
 - d. *a combination of low, medium or high-intensity.*
2. *Low-intensity obstacle lights:*
 - a. *are steady red lights; and*
 - b. *must be used on non-extensive objects or structures whose height above the surrounding ground is less than 45 m.*
3. *Medium-intensity obstacle lights must be:*
 - a. *flashing white lights; or*
 - b. *flashing red lights; or*
 - c. *steady red lights.*

Note CASA recommends the use of flashing red medium-intensity obstacle lights.
4. *Medium-intensity obstacle lights must be used if:*
 - a. *the object or structure is an extensive one; or*

- b. *the top of the object or structure is at least 45 m but not more than 150 m above the surrounding ground; or*
- c. *CASA determines in writing that early warning to pilots of the presence of the object or structure is desirable in the interests of aviation safety.*

Note For example, a group of trees or buildings is regarded as an extensive object.

- 5. *For subsection (4), low-intensity and medium-intensity obstacle lights may be used in combination.*
- 6. *High-intensity obstacle lights:*
 - a. *must be used on objects or structures whose height exceeds 150 m; and*
 - b. *must be flashing white lights.*
- 7. *Despite paragraph (6) (b), a medium-intensity flashing red light may be used if necessary, to avoid an adverse environmental impact on the local community.*

Sections 9.31 (8) and (9) provide guidance on obstacle lighting specific to wind farms:

- 8. *Subject to subsection (9), for wind turbines in a wind farm, medium-intensity obstacle lights must:*
 - a. *mark the highest point reached by the rotating blades; and*
 - b. *be provided on a sufficient number of individual wind turbines to indicate the general definition and extent of the wind farm, but such that intervals between lit turbines do not exceed 900 m; and*
 - c. *all be synchronised to flash simultaneously; and*
 - d. *be seen from every angle in azimuth.*

Note: This is to prevent obstacle light shielding by the rotating blades of a wind turbine and may require more than 1 obstacle light to be fitted.

- 9. *If it is physically impossible to light the rotating blades of a wind turbine:*
 - a. *the obstacle lights must be placed on top of the generator housing; and*
 - b. *a note must be published in the AIP-ERSA indicating that the obstacle lights are not at the highest position on the wind turbines.*
- 10. *If the top of an object or structure is more than 45 m above:*
 - a. *the surrounding ground (ground level); or*
 - b. *the top of the tallest nearby building (building level); then the top lights must be medium-intensity lights, and additional low-intensity lights must be:*
 - c. *provided at lower levels to indicate the full height of the structure; and*
 - d. *spaced as equally as possible between the top lights and the ground level or building level, but not so as to exceed 45 m between lights.*

Advisory Circular 139.E-01 v1.0—Reporting of Tall Structures

In Advisory Circular (AC) 139.E-01 v1.0—Reporting of Tall Structures, CASA provides guidance to those

authorities and persons involved in the planning, approval, erection, extension or dismantling of tall structures so that they may understand the vital nature of the information they provide.

Airservices Australia has been assigned the task of maintaining a database of tall structures. RAAF and Airservices Australia require information on structures which are:

- a) 30 metres or more above ground level—within 30 kilometres of an aerodrome; or
- b) 45 metres or more above ground level elsewhere for the RAAF, or
- c) 30 m or more above ground level elsewhere for Airservices Australia.

The purpose of notifying Airservices Australia of these structures is to enable their details to be provided in aeronautical information databases and maps/charts etc used by pilots, so that the obstacles can be avoided.

The proposed WTGs must be reported to Airservices Australia. This action should occur once the final layout after micrositing is confirmed and prior to construction.

International Civil Aviation Organisation

Australia, as a contracting State to the International Civil Aviation Organisation (ICAO) and signatory to the Chicago Convention on International Civil Aviation (the Convention), has an obligation to implement ICAO's standards and recommended practices (SARPs) as published in the various annexes to the Convention.

Annex 14 to the Convention – *Aerodromes, Volume 1*, Section 6.2.4 provides SARPs for the obstacle lighting and marking of WTGs, which is copied below:

6.2.4 Wind turbines

6.2.4.1 A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

Note 1. – Additional lighting or markings may be provided where in the opinion of the State such lighting or markings are deemed necessary.

Note 2. – See 4.3.1 and 4.3.2

Markings

6.2.4.2 Recommendation. – The 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.

Lighting

6.2.4.3 Recommendation. – When lighting is deemed necessary, in the case of a wind farm, i.e. a group of two or more wind turbines, the wind farm should be regarded as an extensive object and the lights should be installed:

- a) to identify the perimeter of the wind farm;*
- b) respecting the maximum spacing, in accordance with 6.2.3.15, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;*
- c) so that, where flashing lights are used, they flash simultaneously throughout the wind farm;*
- d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and*
- e) at locations prescribed in a), b) and d), respecting the following criteria:*

i) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium-intensity lighting on the nacelle should be provided;

ii) for wind turbines from 150 m to 315 m in overall height, in addition to the medium-intensity light installed on the nacelle, a second light serving as an alternate should be provided in case of failure of the operating light. The lights should be installed to assure that the output of either light is not blocked by the other; and

iii) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low-intensity Type E lights, as specified in 6.2.1.3, should be provided. If an aeronautical study shows that low-intensity Type E lights are not suitable, low-intensity Type A or B lights may be used.

Note. — The above 6.2.4.3 e) does not address wind turbines of more than 315 m of overall height. For such wind turbines, additional marking and lighting may be required as determined by an aeronautical study.

6.2.4.4 Recommendation. — The obstacle lights should be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.

6.2.4.5 Recommendation. — Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation should be in accordance with 6.2.4.3 e) or as determined by an aeronautical study.

As referenced in Section 6.2.4.3(e)(iii), Section 6.2.1.3 is copied below:

6.2.1.3 The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked shall be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object, or by an adjacent object, additional lights shall be provided on that adjacent object or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

As referenced in Section 6.2.4.3(b), Section 6.2.3.15 is copied below:

6.2.3.15 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and

a) low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m; and

b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.

Section 4.3 Objects outside the OLS states the following:

4.3.1 Recommendation.— Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.

4.3.2 Recommendation. — In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded

as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.

Note. – This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

ICAO Doc 9774 Manual on Certification of Airports defines an aeronautical study as:

An aeronautical study is a study of an aeronautical problem to identify potential solutions and select a solution that is acceptable without degrading safety.

Light characteristics

If obstacle lighting is required, installed lights should be designed according to the criteria set out in the applicable regulatory material and taking CASA's recommendations into consideration in the case that CASA has reviewed this risk assessment and provided recommendations.

The characteristics of the obstacle lights should be in accordance with the applicable standards in Part 139 MOS 2019.

The characteristics of low and medium intensity obstacle lights specified in Part 139 MOS 2019, Chapter 9, are provided below.

CASR Part 139 MOS 2019 Chapter 9 Division 4 – Obstacle Lighting section 9.32 outlines Characteristics of Low Intensity Obstacle Lights.

1. *Low-intensity obstacle lights must have the following:*
 - a. *fixed lights showing red;*
 - b. *a horizontal beam spread that results in 360-degree coverage around the obstacle;*
 - c. *a minimum intensity of 100 candela (cd);*
 - d. *a vertical beam spread (to 50% of peak intensity) of 10 degrees;*
 - e. *a vertical distribution with 50 cd minimum at +6 degrees and +10 degrees above the horizontal;*
 - f. *not less than 10 cd at all elevation angles between –3 degrees and +90 degrees above the horizontal.*

Note: The intensity requirement in paragraph (c) may be met using a double-bodied light fitting. CASA recommends that double-bodied light fittings, if used, should be orientated so that they show the maximum illuminated surface towards the predominant, or more critical, direction of aircraft approach.

2. *To indicate the following:*
 - a. *taxiway obstacles;*
 - b. *unserviceable areas of the movement area; low-intensity obstacle lights must have a peak intensity of at least 10 cd.*

Part 139 MOS 2019 Chapter 9 Division 4 – Obstacle Lighting section 9.33 outlines Characteristics of Medium Intensity Obstacle Lights.

1. *Medium-intensity obstacle lights must:*

- a. *be visible in all directions in azimuth; and*
 - b. *if flashing – have a flash frequency of between 20 and 60 flashes per minute.*
2. *The peak effective intensity of medium-intensity obstacle lights must be $2\,000 \pm 25\%$ cd with a vertical distribution as follows:*
- a. *for vertical beam spread – a minimum of 3 degrees;*
 - b. *at -1-degree elevation – a minimum of 50% of the lower tolerance value of the peak intensity;*
 - c. *at 0 degrees elevation – a minimum of 100% of the lower tolerance value of the peak intensity.*
3. *For subsection (2), vertical beam spread means the angle between 2 directions in a plane for which the intensity is equal to 50% of the lower tolerance value of the peak intensity.*
4. *If, instead of obstacle marking, a flashing white light is used during the day to indicate temporary obstacles in the vicinity of an aerodrome, the peak effective intensity of the light must be increased to $20\,000 \pm 25\%$ cd when the background luminance is 50 cd/m^2 or greater.*

Visual impact of night lighting

Annex 14 Section 6.2.4 and Part 139 MOS 2019 Chapter 9 are specifically intended for WTGs and recommends that medium intensity lighting is installed.

Generally accepted considerations regarding minimisation of visual impact are provided below for consideration in this aeronautical study:

- To minimise the visual impact on the environment, some shielding of the obstacle lights is permitted, provided it does not compromise their operational effectiveness;
- Shielding may be provided to restrict the downward component of light to either, or both, of the following:
 - such that no more than 5% of the nominal intensity is emitted at or below 5 degrees below horizontal; and
 - such that no light is emitted at or below 10 degrees below horizontal;
- If a light would be shielded in any direction by an adjacent object or structure, the light so shielded may be omitted, provided that such additional lights are used as are necessary to retain the general definition of the object or structure.
- If flashing obstacle lighting is required, all obstacle lights on a wind farm should be synchronised so that they flash simultaneously; and
- A relatively small area on the back of each blade near the rotor hub may be treated with a different colour or surface treatment, to reduce reflection from the rotor blades of light from the obstacle lights, without compromising the daytime visibility of the overall WTG.

Marking of WTGs

ICAO Annex 14 Vol 1 Section 6.2.4.2 recommends that the rotor blades, nacelle and upper 2/3 of the supporting mast of the WTGs should be painted a shade of white, unless otherwise indicated by an aeronautical study.

It is generally accepted that a shade of white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.

ANNEXURE 4 – RISK FRAMEWORK

A risk management framework is comprised of likelihood and consequence descriptors, a matrix used to derive a level of risk, and actions required of management according to the level of risk.

The risk assessment framework used by Aviation Projects has been developed in consideration of ISO 31000:2018 *Risk management—Guidelines* and the guidance provided by CASA in its Safety Management System (SMS) for Aviation guidance material, which is aligned with the guidance provided by the International Civil Aviation Organization (ICAO) in Doc 9589 *Safety Management Manual*, Third Edition, 2013. Doc 9589 is intended to provide States (including Australia) with guidance on the development and implementation of a State Safety Programme (SSP), in accordance with the International SARPs, and is therefore adopted as the primary reference for aviation safety risk management in the context of the subject assessment.

Section 2.1 of the ICAO Doc 9589 *The concept of safety* defines safety as follows [author’s underlining]:

2.1.1 Within the context of aviation, safety is “the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management.”

Likelihood

Likelihood is defined in ISO 31000:2018 as the chance of something happening. Likelihood descriptors used in this report are as indicated in Table 1.

Table 1 Likelihood Descriptors

No	Descriptor	Description
1	Rare	It is almost inconceivable that this event will occur
2	Unlikely	The event is very unlikely to occur (not known to have occurred)
3	Possible	The event is unlikely to occur, but possible (has occurred rarely)
4	Likely	The event is likely to occur sometimes (has occurred infrequently)
5	Almost certain	The event is likely to occur many times (has occurred frequently)

Consequence

Consequence is defined as the outcome of an event affecting objectives, which in this case is the safe and efficient operation of aircraft, and the visual amenity and enjoyment of local residents.

Consequence descriptors used in this report are as indicated in Table 2.

Table 2 Consequence Descriptors

No	Descriptor	People Safety	Property/Equipment	Effect on Crew	Environment
1	Insignificant	Minor injury – first aid treatment	Superficial damage	Nuisance	No effects or effects below level of perception
2	Minor	Significant injury – outpatient treatment	Moderate repairable damage – property still performs intended functions	Operations limitation imposed. Emergency procedures used.	Minimal site impact – easily controlled. Effects raised as local issues, unlikely to influence decision making. May enhance design and mitigation measures.
3	Moderate	Serious injury – hospitalisation	Major repairable damage – property performs intended functions with some short-term rectifications	Significant reduction in safety margins. Reduced capability of aircraft/crew to cope with conditions. High workload/stress on crew. Critical incident stress on crew.	Moderate site impact, minimal local impact, and important consideration at local or regional level, possible long-term cumulative effect. Not likely to be decision making issues. Design and mitigation measures may ameliorate some consequences.
4	Major	Permanent injury	Major damage rendering property ineffective in achieving design functions without major repairs	Large reduction in safety margins. Crew workload increased to point of performance decrement. Serious injury to small number of occupants. Intense critical incident stress.	High site impact, moderate local impact, important consideration at state level. Minor long-term cumulative effect. Design and mitigation measures unlikely to remove all effects.
5	Catastrophic	Multiple Fatalities	Damaged beyond repair	Conditions preventing continued safe flight and landing. Multiple deaths with loss of aircraft	Catastrophic site impact, high local impact, national importance. Serious long-term cumulative effect. Mitigation measures unlikely to remove effects.

Risk matrix

The risk matrix, which correlates likelihood and consequence to determine a level of risk, used in this report is shown in Table 3.

Table 3 Risk Matrix

		CONSEQUENCE				
		INSIGNIFICANT 1	MINOR 2	MODERATE 3	MAJOR 4	CATASTROPHIC
LIKELIHOOD	ALMOST CERTAIN 5	6	7	8	9	10
	LIKELY 4	5	6	7	8	9
	POSSIBLE 3	4	5	6	7	8
	UNLIKELY 2	3	4	5	6	7
	RARE 1	2	3	4	5	6

Actions required

Actions required according to the derived level of risk are shown in Table 4.

Table 4 Actions Required

8-10	Unacceptable Risk	Immediate action required by either treating or avoiding risk. Refer to executive management.
5-7	Tolerable Risk	Treatment action possibly required to achieve As Low As Reasonably Practicable (ALARP) - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.
0-4/5	Broadly Acceptable Risk	Managed by routine procedures, and can be accepted with no action.

ANNEXURE 5 – PROJECT TURBINE COORDINATES AND HEIGHTS

Reference file: 20250502 Information for Aviation Projects WTG & WMT.xlsx

(Highest WTG highlighted in yellow)

<i>WTG ID</i>	<i>Easting</i>	<i>Northing</i>	<i>Base Elevation (m AHD)</i>	<i>Tip Height (m AGL)</i>	<i>Max Height (m AHD)</i>	<i>Max Height (ft AMSL)</i>
T01	511792	6246625	353	206	559.0	1834.0
T02	512288	6245670	357	206	563.0	1847.1
T03	511331	6245747	345	206	551.0	1807.7
T04	512090	6244645	346	206	552.0	1811.0
T05	511399	6244933	351	206	557.0	1827.4
T06	511360	6243131	351	206	557.0	1827.4
T07	512562	6243769	346	206	552.0	1811.0
T08	513448	6243714	356	206	562.0	1843.8
T09	513618	6243049	359	206	565.0	1853.7
T10	514798	6242430	358	206	564.0	1850.4
T11	513616	6242224	381	206	587.0	1925.9
T12	512216	6242161	349	206	555.0	1820.9
T13	511270	6242262	362	206	568.0	1863.5
T14	510287	6242752	346	206	552.0	1811.0
T15	509243	6242775	318	206	524.0	1719.2
T16	509592	6242115	337	206	543.0	1781.5
T17	510669	6241802	355	206	561.0	1840.6
T18	511839	6241639	376	206	582.0	1909.4
T19	512699	6241210	370	206	576.0	1889.8
T20	513508	6240997	375	206	581.0	1906.2
T21	512294	6240979	367	206	573.0	1879.9
T22	511492	6240416	365	206	571.0	1873.4
T23	510836	6240988	341	206	547.0	1794.6
T24	513168	6240310	380	206	586.0	1922.6
T25	511445	6239717	358	206	564.0	1850.4
T26	511600	6238792	349	206	555.0	1820.9

<i>WTG ID</i>	<i>Easting</i>	<i>Northing</i>	<i>Base Elevation (m AHD)</i>	<i>Tip Height (m AGL)</i>	<i>Max Height (m AHD)</i>	<i>Max Height (ft AMSL)</i>
T27	512369	6238638	355	206	561.0	1840.6
T28	512022	6237850	351	206	557.0	1827.4
T29	511102	6238495	352	206	558.0	1830.7
T30	510544	6237941	359	206	565.0	1853.7
T31	509485	6237939	357	206	563.0	1847.1
T32	510299	6237162	353	206	559.0	1834.0
T33	509461	6237113	359	206	565.0	1853.7



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