Warracknabeal
Energy Park

Warracknabeal Energy Park

Attachment A.1: Aviation Impact Assessment

AVIATION PROJECTS

March 2023

PRELIMINARY AVIATION IMPACT ASSESSMENT

WARRACKNABEAL ENERGY PARK

Prepared for Warracknabeal Energy Park Pty Ltd

AVIATION PROJECTS

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ACRONYMS

AAAA	Aerial Agricultural Association of Australia
AC	Advisory Circular
ADS-B	Automatic Dependent Surveillance - Broadcast
AGL	above ground level
AHD	Australian Height Datum
PAIA	preliminary aviation impact assessment
AIP	Aeronautical Information Package
AIS	aviation impact statement
ALA	aircraft landing area
ALARP	as low as reasonably practicable
AMSL	above mean sea level
ARP	Aerodrome Reference Point
AS	Australian Standards
AsA	Airservices Australia
ATSB	Australian Transport Safety Bureau
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
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
LSALT	lowest safe altitude

MOS	Manual of Standards
MSA	minimum sector altitude
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
OLS	obstacle limitation surface
PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
RFDS	Royal Flying Doctor Service
RSR	route surveillance radar
SSR	secondary surveillance radar
VFR	visual flight rules
VMC	visual meteorological conditions
WMTs	wind monitoring towers
WTGs	wind turbine generators

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**

EXECUTIVE SUMMARY

Introduction

Warracknabeal Energy Park Pty Ltd is proposing the development of Warracknabeal Energy Park (WAEP) Project.

The WAEP involves the establishment of a wind energy facility including wind turbine generators (WTG) and associated electrical infrastructure approximately 40 km north of Horsham and 5 km from Warracknabeal in the Wimmera region of north-western Victoria.

Warracknabeal Energy Park Pty Ltd has engaged Aviation Projects to prepare a Preliminary Aviation Impact Assessment (PAIA) for the Project to review potential impacts and provide aviation safety advice in respect of relevant requirements of air safety regulations and procedures. Aviation Projects understands the PAIA will accompany an Environment Effects Statement (EES) referral to the Victorian Minister for Planning.

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

Project description

Warracknabeal Energy Park Pty Ltd provided the following description of the Project.

> *The Project has identified a specific 'Project Area' which ultimately accommodates the location of up to 220 WTGs. An indicative layout of the WTGs has been provided for preliminary assessment. The ultimate WTG layout will be informed by various planning and environmental studies (including the PAIA) and finalised via the planning approval process.*
>
> *The Project Area consists of two (2) project sections and two (2) easement corridors for overhead transmission lines.*
>
> *Combined, the total Project Area covers approximately 26,500 hectares (ha).*
>
> 1. *The Northern Section (WAEP-N) is approximately 14,300 ha in area and is located 5 km north-west of Warracknabeal.*
> 2. *The Southern Section (WAEP-S) is approximately 7,200 ha in area and is located 7 km south-west of Warracknabeal.*
> 3. *The northern easement corridor, hereby referred to as the North-South Link (N-S Link) is approx. 2,800 ha in area (only a small fraction of this corridor will eventually be used as a transmission line easement).*
> 4. *The southern easement corridor hereby referred to as the South-Murra Warra Link (S-MW Link) is approx. 900 ha in area (only a small fraction of this corridor will eventually be used as a transmission line easement).*
>
> *The proposed Project comprises up to 220 WTGs with a total generation capacity of approximately 1,600 megawatts (MW). The Project proposes the following infrastructure:*
>
> - *Up to 220 WTGs;*

- *Two substations, one in the Northern Section and one in the Southern Section;*
- *Two Battery Energy Storage Systems (BESS), co-located with the substations;*
- *Overhead high voltage transmission lines running between the two substations;*
- *Overhead high voltage transmission from the southern substation of the Project to the Murra Warra Terminal Station;*
- *Overhead 33kV transmission lines within the wind farm project sections, connecting groups of turbines that are furthest away from the substations;*
- *Transmission and grid connection infrastructure;*
- *Operations and maintenance facilities;*
- *Turbine foundations and hardstands;*
- *Site access points and access tracks with drainage where required;*
- *Underground cabling (33kV);*
- *Meteorological masts; and*
- *Business identification signage;*
- *Temporary concrete batching plants; and*
- *Temporary site compounds, equipment laydowns and storage yards.*[1]

Key Findings of the Aviation Impact Statement

The PAIA acknowledges that the following findings are based on an indicative WTG layout contained within a larger Project Area. The large size of the Project Area allows area for further refinements of the WTG layout to reduce the projects impact. The ultimate WTG layout will be informed by the various technical expert assessments including the following findings.

1.1. Aviation Impact Statement

Based on the Project WTG layout:

- would infringe the YWKB RWY 08 Approach Surface OLS surface
- would infringe the YWKB RWY 26 Take-off climb surface
- would require an increase in the 25 nm MSA and the 10 nm MSA minimum altitudes from 2300 ft to 2400 ft AMSL, to accommodate the Project
- Would require amendment of the RNAV-Z (GNSS) RWY 08 and RNAV-E (GNSS) approach procedures associated with the 25 nm MSA increased minimum altitude
- would not infringe any other PANS-OPS surfaces
- would not have an impact on the Grid LSALT

[1] WAEP_PROJDESC_V01-01.DOCX PROVIDED BY WESTWIND

- would require an increase to the LSALT from 2000 ft to 2400 ft for air route W414 to the north of YWKB
- is wholly contained within Class G airspace
- is outside the clearance zones associated with civil aviation navigation aids and communication facilities.

The WTGs located within 3 nm of the Koongarra ALA:

- are likely to present operational limitations for aircraft operating to/from and within the circuit area of the aerodrome
- are likely to create downstream wake turbulence hazard to aircraft operating in the circuit area.

Summary of key recommendations

A summary of the key recommendations of this PAIA is set out below.

General recommendations

1. 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 or not the structure will be hazardous to aircraft operations.
   The proponent is required to report the WMT to CASA in accordance with CASR 139.165, as soon as practicable after forming the intention to construct or erect the proposed object or structure.
   The notification should be provided to CASA via email to Airspace.Protection@casa.gov.au .
2. 'As constructed' details of WMT coordinates and elevation should be provided to Airservices Australia, 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 .
   Ideally this should only be done if potential impacts have been considered – through an aviation impact assessment or by sending the details to Airservices Australia in advance of the mast being erected, at this email address: airport.developments@airservicesaustralia.com .
3. Any obstacles above 100 m 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 wind farm should be provided to Warracknabeal Airport management, and to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm 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, WMTs 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.

Mitigation of impacts on YKWB

6. Consider options in dealing with the infringements to the OLS including:
    a. Seek CASA approval for the WTGs to infringe the Approach Surface subject to mitigations which might include obstacle lighting.
    b. Relocate WTGs from the lateral limits of the Approach Surface to other parts of the site;
    c. Restrict the overall height of the WTGs to below the Approach Surface;
    d. Remove the infringing WTGs altogether.

Operation

7. Whilst not a statutory requirement, the Proponent should consider engaging with any local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project.
8. The proponent should consult with the operator of Koongarra aerodrome to determine any impacts from the WTG proximity and potential wake turbulence effects and consider appropriate mitigations.

Marking of WTGs

9. The rotor blades, nacelle and the mast supporting the WTGs should be painted white, typical of most WTGs operational in Australia. No additional marking measures are required for WTGs.

Lighting of WTGs

10. Recommendations for obstacle lighting on WTGs will be outlined through a formal risk assessment process, as per NASF Guideline D guidance.
The Victorian Minister for Planning will make the final decision.

Marking of wind monitoring towers

11. Consideration should be given to marking the temporary and permanent WMTs according to the requirements set out in MOS 139 Section 8.10 (as modified by the guidance in NASF Guideline D). Specifically:
    a. marker balls or high visibility flags or high visibility sleeves should be placed on the outside guy wires
    b. paint markings should be applied in alternating contrasting bands of colour to at least the top 1/3 of the mast
    c. ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation.

Lighting of wind monitoring towers

12. Consideration should be given to lighting temporary WMTs installed prior to WTG installation and WMTs with medium intensity steady red obstacle lighting at the top of the WMT mast. Characteristics for medium-intensity obstacle lighting are contained in MOS 139, Section 9.33.

Micrositing

13. The potential micrositing of the WTGs and WMTs has been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level within 100 m of the nominal WTG and WMT positions. Providing the micrositing is within 100 m of the WTGs and WMTs is

likely to not 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 PAIA would remain the same.

Overhead transmission line

14. Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial application operators (if any exist) and marked in accordance with Part 139 MOS 2019 Chapter 8 Division 10 section 8.110 (7) and section 8.110 (8). Westwind has reported that aerial applications are not generally used in broad-acre cropping activities in the region.

Triggers for review

15. 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, including the regulatory framework

    c. following any near miss, incident or accident associated with operations considered in this risk assessment.

2. INTRODUCTION

2.1. Context

Warracknabeal Energy Park Pty Ltd is proposing the development of the Warracknabeal Energy Park (WAEP) project.

The WAEP involves the establishment of a wind energy facility including wind turbine generators (WTG) and associated electrical infrastructure approximately 40 km north of Horsham and 5 km from Warracknabeal in the Wimmera region of north-western Victoria.

Warracknabeal Energy Park Pty Ltd has engaged Aviation Projects to prepare a PAIA for the Project to review potential impacts and provide aviation safety advice in respect of relevant requirements of air safety regulations and procedures.

This PAIA 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 PAIA report includes an Aviation Impact Statement (AIS) and consideration of the need for obstacle lighting.

2.2. Purpose and Scope

The purpose and scope of work is to prepare a PAIA for consideration by Westwind in the preparation of a referral to the Minister for Planning to determine whether an Environment Effects Statement (EES) is required for the project.

The Project has identified a specific 'Project Area' which ultimately accommodates the location of up to 220 WTGs. An indicative layout of the WTGs has been provided for preliminary assessment. The ultimate WTG layout will be informed by various planning and environmental studies (including the PAIA) and finalised via the planning approval process.

The scope of works for this engagement includes:

1. General assessment of project area to confirm constraints, and any red flags, based on maximum elevation and tip height to help inform internal planning and development of the wind farm
2. Outline the planning context from an aviation perspective for the installation of wind turbine generators, including CASR Part 139 and the National Airports Safeguarding Framework (NASF) Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers*
3. Assess the potential impact on the obstacle limitation surfaces of nearby certified aerodromes (specifically YWKB)
4. Conduct a preliminary assessment of the proposed wind turbine generator locations in relation to ICAO Doc 8168 – Procedures for Air Navigation- Operations (PANS OPS) criteria surfaces for terminal instrument flight procedures at any certified aerodromes within 30 nm of the Project
5. Conduct a preliminary assessment of the potential impact to other identified unregulated aerodromes (Aircraft Landing Areas) located within 3 nm of the proposed wind turbine locations

6. Identify any other potential impacts on aviation resulting from the proposed wind turbine generators
7. Review advice already provided by applicable stakeholders
8. Provide a summary of the potential approval pathway(s) in relation to the aviation regulatory framework for the siting of the wind turbine generators in the intended locations
9. Determine subsequent stakeholder engagement requirements and pathway(s) required to resolve identified issues
10. Provide a written report that documents the findings of the analysis.

The PAIA does not include the following items which normally form part of a full aviation impact assessment:

- site visit
- consultation with aviation stakeholders including CASA, Airservices Australia, aerodrome operators and regional aircraft operators
- quantitative risk assessment conducted to inform the need for obstacle lighting.

It is anticipated that a full aviation impact assessment will accompany any planning permit application for the project.

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

- Civil Aviation Safety Authority (CASA):
    - Civil Aviation Safety Regulations 1998 (CASR) Part 139 Manual of Standards (MOS)
- Australian Government, Department of Infrastructure, Transport, Regional Development and Communication (DITRDC):
    - National Airports Safeguarding Framework (NASF) Guideline D: *Managing the Risk to aviation safety of wind turbine installations (wind farms)/Wind Monitoring Towers*
- Airservices Australia
    - Aeronautical Impact Statement requirements as advised by Airservices Australia at https://www.airservicesaustralia.com/industry-info/airport-development-assessments/

2.3. Methodology

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

The engagement will generally be delivered as outlined below:

- confirm scope and deliverables
- review client material
- review relevant regulatory requirements and information sources
- provide information on the findings of the assessments outlined in the scope
- prepare a draft report for client review
- prepare a final report for client acceptance.

2.4. Aviation Impact Statement (AIS)

The AIS included in this report (see Section 6) 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 flight procedures
- Nominate visual flight procedures and likely impacts
- Review the potential effect of the Project operations on the operational airspace of the aerodrome(s).

Air Routes:

- Nominate air routes 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, B, C, D, E, G etc and any designated Special Use Airspace where the project site is located

Navigation/Radar:

- Nominate radar navigation systems with coverage overlapping the site.

2.5. Material reviewed

Material provided by the Proponent for preparation of this assessment include:

- WAEP_SiteBoundary_v09-02.kml
- WAEP_WTGLayout_V09-01_Working.kml
- WAEP_WTGLayout_v09-01_Coordinates.xlsx
- WAEP_ProjDesc_v01-01.docx
- WAEP YWKB OLS July 2022.pptx.
- WAEP_HVPowerLines_v08-03_redacted.shp
- WAEP_MetmastLocations_v03-02_redacted.shp

3. BACKGROUND

3.1. Site overview

The Warracknabeal Energy Park (the Project) involves the establishment of a wind energy facility including wind turbine generators (WTG) and associated electrical infrastructure approximately 40 km north of Horsham and 5 km from Warracknabeal in the Wimmera region of north-western Victoria.

The site is located within the Yarriambiack Shire and the Western Victoria Renewable Energy Zone.

Warracknabeal Energy Park Pty Ltd provided the following description of the Project:

> *The Project Area consists of two (2) project sections and two (2) easement corridors for overhead transmission lines.*
>
> *Combined, the total Project Area covers approximately 26,500 hectares (ha).*
>
> a. *The Northern Section (WAEP-N) is approximately 14,300 ha in area and is located 5 km north-west of Warracknabeal.*
>
> b. *The Southern Section (WAEP-S) is approximately 7,200 ha in area and is located 7 km south-west of Warracknabeal.*
>
> c. *The northern easement corridor, hereby referred to as the North-South Link (N-S Link) is approx. 2,800 ha in area (only a small fraction of this corridor will eventually be used as a transmission line easement).*
>
> d. *The southern easement corridor hereby referred to as the South-Murra Warra Link (S-MW Link) is approx. 900 ha in area (only a small fraction of this corridor will eventually be used as a transmission line easement).*

An overview of the WAEP is provided in Figure 1 (Source: Westwind, Google Earth).

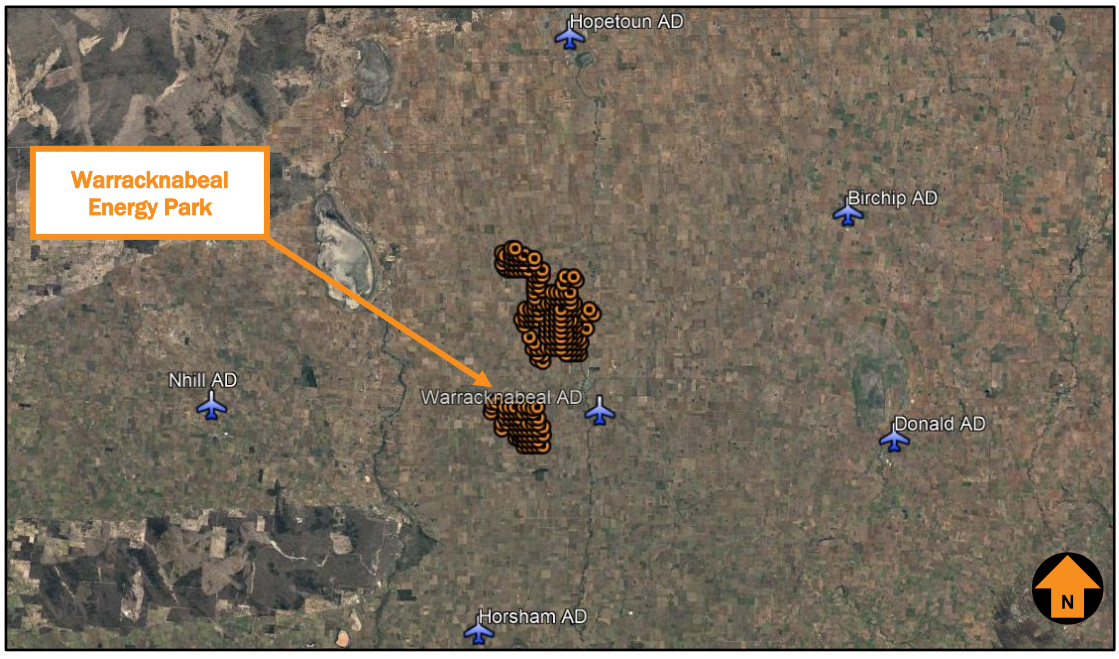

Figure 1 Project site location overview

3.2. Project Description

The Project is located at the following distances from certified airports within 30 nm of the Project site:

- 9.2 km (5 nm) west of Warracknabeal Airport (YWKB)
- 50 km (27 nm) north of Horsham Airport (YHSM)
- 49 km (26 nm) southwest of Birchip Airport (YBIR)
- 36.5 km (19.7 nm) south of Hopetoun Airport (YHPN).

Warracknabeal Energy Park Pty Ltd provided the following description of the Project:

> *In summary the Project will comprise of up to 220 WTGs with a total generation capacity of approximately 1,600 megawatts (MW). The Project proposes the following infrastructure:*
>
> - *Up to 220 WTGs;*
> - *Two substations, one in the Northern Section and one in the Southern Section;*
> - *Two Battery Energy Storage Systems (BESS), co-located with the substations;*
> - *Overhead high voltage transmission lines running between the two substations;*
> - *Overhead high voltage transmission from the southern substation of the Project to the Murra Warra Terminal Station;*
> - *Overhead 33kV transmission lines within the wind farm project sections, connecting groups of turbines that are furthest away from the substations;*
> - *Transmission and grid connection infrastructure;*
> - *Operations and maintenance facilities;*
> - *Turbine foundations and hardstands;*
> - *Site access points and access tracks with drainage where required;*
> - *Underground cabling (33kV);*
> - *Meteorological masts; and*
> - *Business identification signage;*
> - *Temporary concrete batching plants; and*
> - *Temporary site compounds, equipment laydowns and storage yards.*

The highest turbine (T206) is located on terrain with an elevation of approximately 131.1 m above the Australian Height Datum (AHD) and has an overall blade tip height of approximately 411.1 m (1348.6 ft) above mean sea level (AMSL)).

4. EXTERNAL CONTEXT

4.1. National Airports Safeguarding Framework

The National Airports Safeguarding Advisory Group (NASAG) was established by Commonwealth Department of Infrastructure and Transport 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 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.

The AIS of this report identifies high level risks, risk mitigation measures and development constraints that are likely to be applicable to an aviation risk assessment.

4.1. Civil Aviation Safety Authority

The following CASA publications informs pilots of their obligations at non-certified ALAs in uncontrolled airspace. The information provided relates directly to flight operations at Warracknabeal Airport. A detailed description of this ALA is provided later in this report.

4.1.1. Advisory Circular (AC) 91-02 V1.1, Guidelines for aeroplanes with MTOW not exceeding 5700 kg – suitable places to take off and land, dated November 2021

Relevant information from this AC includes:

> *Purpose*
>
> *This AC provides guidance to assist pilots when making a determination about the suitability of a place for an aeroplane to safely take off and land. It provides an overview of the pilot's responsibilities and discusses some, but not all, circumstances, including prevailing weather conditions, that are recommended to be considered. It also provides 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).

3.3 Performance Information

3.3.1 The AFM, POH, owner's manual or placarding should provide relevant performance information, but presentations are not standardised. Learning how to find and interpret a particular aircraft's performance information should be part of a pilot's familiarisation with the aeroplane.

4 Information about aerodrome publications

4.1.3 There are no standards for aerodromes that are not certified (listed in the En Route Supplement Australia (ERSA) as an uncertified aerodrome), but noting regulation 91.410 requires the aerodrome to be suitable. CASA has published recommended criteria for landowners or operators of these aerodromes, but these recommendations are guidelines only.

The ERSA only provides limited information for uncertified aerodromes and these aerodromes are not subject to NOTAM action, except in certain circumstances (refer to the ERSA for further details).

Take-off and landing guides are also commercially available which provide information for pilots about many aerodromes not included in the ERSA. Pilots should note that the information in these guides may not be subject to regular updating, and these aerodromes are not supported with NOTAM information. Pilots should therefore consider ways of mitigating the risk of such a document's information being out of date or inaccurate.

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.

Pilots and operators must consider ownership and management requirements for aircraft operations into any aerodrome. Unless a landing place is unambiguously open for public use for aviation purposes, the pilot should assume that permission is required from the land owner or occupier before using land or water for take-off and landing.

AC 91-10 v1.1, Operations in the vicinity of non-controlled aerodromes, date November 2021

Relevant information from this AC includes:

2 Introduction

2.1.3 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.

4 Related safety actions at non-controlled aerodromes

4.1.1 Subdivision D.4.6 of CASR Part 91 (prescribes the requirements for operating in the vicinity of a non-controlled aerodrome. Prior to flight, pilots should consult the current ERSA and NOTAMs to ascertain whether carriage of radio is required, special circuit procedures apply or, in the case of NOTAMs, whether the information contained within the ERSA has been modified.

4.1.5 Prior to operating at any non-controlled aerodrome, pilots should satisfy themselves that it is suitable for their operation by reference to ERSA, other commercial aerodrome guides, the company operations manual or by contacting the aerodrome operator.

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 active runway or the runway most closely aligned into wind.

7.2.3 If a secondary runway is being used (e.g. for crosswind or low-level circuits), pilots using the secondary runway should not impede the flow of traffic using the active runway.

7.2.4 Aerodromes that have right-hand circuits are listed in the ERSA.

7.4 Circuit Heights

7.4.1 By convention, aircraft should fly the standard traffic circuit at the heights shown.

7.4.2 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.

7.7 Final approach

7.7.1 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.

4.2. Aircraft operations at non-controlled aerodromes

Advisory Circulars (ACs) provide advice and guidance from CASA to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements. Advisory Circular (AC) 91-10 v1.1 *Operations in the vicinity of non-controlled aerodromes* provides guidance for pilots flying at or in the vicinity of non-controlled aerodromes, with respect to CASR 91.

A conventional circuit pattern and heights are provided in AC 91-10 v1.1. The standard circuit consists of a series of flight paths known as *legs* when departing, arrival or when conducting circuit practice. Illustrations of

the standard aerodrome traffic circuit procedures provided in AC 91-10 v1.1. are shown in Figure 2 and Figure 3.

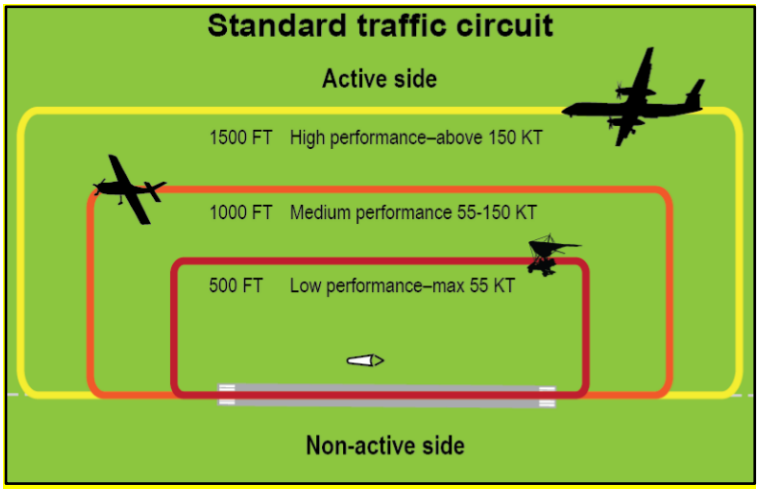

Figure 2 Lateral and vertical separation in the standard aerodrome traffic circuit

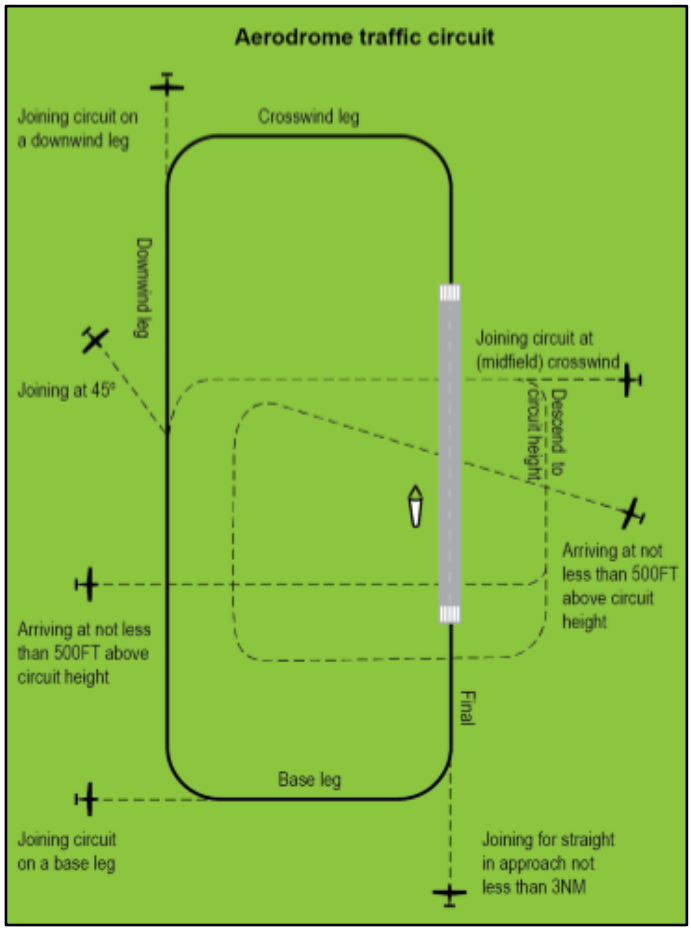

Figure 3 Aerodrome standard traffic circuit, showing arrival and joining procedures

AC 91-10 v1.1. paragraph 7.10 makes reference to a distance that is "normally" well outside the circuit area and where no traffic conflict exists, which is at least 3 nm (5556 m). The paragraph is copied below:

> *7.10 Departing the circuit area*
>
> *7.10.1 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 will normally be 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.*

4.3. Rules of flight

4.3.1. Flight under Day Visual Flight Rules (VFR)

According to CASR Part 91, Manual of Standards, Section 2.7, the visual meteorological conditions (VMC) 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 flight visibility
- Clear of clouds; and
- Aircraft must be operated in sight of ground or water.

CASR 1998, 91.267, prescribes the minimum height for flight operating in areas other than over a populous area or a public gathering.

Generally speaking, 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 of the point on the ground or water immediately below the aircraft, in visual flight during the day. This provision does not apply:

- during take-off and landing operations in circumstances prescribed by the CASR Part 91 Manual of Standards
- during the authorised conduct of low-flying training or a low-level flight operation in circumstances where the landowner has granted permission and the pilot has conducted a survey of the area for obstacles before the flight
- the aircraft is performing training circuits at an aerodrome
- the aircraft is engaged in a procedure to determine the suitability of an aerodrome for a landing; and
- other prescribed circumstances not relevant to this report.

4.3.2. Night VFR

CAR 1998, 91.277, prescribes the minimum heights for VFR flight at night.

> *(2) The minimum height is the lowest height of the following for the route or route segment:*
>
> *(a) the published lowest safe altitude for the route or route segment (if any);*
>
> *(b) the minimum sector altitude published in the authorised aeronautical information for the flight (if any);*
>
> *(c) the lowest safe altitude for the route or route segment;*

(d) 1,000 ft above the highest obstacle on the ground or water within 10 nautical miles ahead of, and to either side of, the aircraft at that point on the route or route segment;

(e) the lowest altitude for the route or route segment calculated in accordance with a method prescribed by the Part 91 Manual of Standards for the purposes of this paragraph.

(3) The circumstances are the following:

(a) the aircraft is taking off or landing;

*(b) the aircraft is within **3 nautical miles** of the aerodrome from which the aircraft has taken off, or at which the aircraft will land;*

(c) the aircraft is being flown in accordance with an air traffic control clearance.

4.3.3. Instrument Flight Rules (Day or night) (IFR

Aircraft operating under the IFR cannot necessarily see the ground, water or obstacles. They are required to operate at altitudes that ensure terrain and obstacle clearance is maintained. This is accomplished by instrument flight procedures that are designed in accordance with International Civil Aviation Organisation (ICAO) standards and recommended (SARPS) that are accepted or modified by CASA for use in Australia.

CAR 91, Subdivision 91.D.4.3 prescribes the Instrument Flight Rules (IFR).

Generally speaking, pilots of IFR aircraft operating under the IFR must comply with the following minimum altitudes published in the authorised aeronautical information for the flight:

- The lowest safe altitude (LSALT) along an IFR air route segment
- The minimum segment altitude detailed on instrument approach and departure charts; and/or
- The minimum Grid LSALT.

A pilot does not need to comply with these requirements during operations authorised visual flight operations in VMC by day, during take-off and landing operations, or during a visual approach or departure procedures in accordance with CASR Part 91.

4.4. Aircraft operator characteristics

Flying training may be conducted under either the instrument flight rules (IFR) or visual flight rules (VFR). Other general aviation operations under either IFR or VFR, during the day or at night, are also likely to be conducted at various aerodromes in the area.

Operations conducted under VFR are required to remain in visual meteorological conditions (VMC) (at least 5,000 m horizontal visibility at a similar height of the wind turbines). During the day, the wind turbines will likely be sufficiently conspicuous to allow adequate time for pilots to avoid the obstacles. Day VFR operators will most likely avoid the Project site once wind turbines are erected.

Flight under day VFR is conducted above 500 ft (152.4 m) 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.

Given the irregular shape, height, and off-white colour of the WTGs, it is expected that the WTGs will be sufficiently visually conspicuous to pilots conducting day VFR operations within the vicinity of the Project site 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.

4.5. Air transport operations

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

4.6. 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.

4.7. 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.

The potential wind farm is not located within any military training area.

4.8. 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 (2 m) and 100 ft (30.5 m) AGL.

Aerial application operations can be conducted in the area.

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

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.

The impact of the proposed WTGs on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the Project site was assessed.

4.9. Aerial Application Association of Australia (AAAA)

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

> *In other areas, AAAA is also opposed to wind farm developments unless the developer is able to clearly demonstrate they have:*
>
> *1. consulted honestly and in detail with local aerial application operators;*
>
> *2. sought and received an independent aerial application expert opinion on the safety and economic impacts of the proposed development;*
>
> *3. clearly and fairly identified that there will be no short or long term impact on the aerial application industry from either safety or economic perspectives;*

4. if there is an identified impact on local aerial application operators, provided a legally binding agreement for compensation over a fair period of years for loss of income to the aerial operators affected; and

5. adequately marked any wind farm infrastructure and advised pilots of its presence.

The AAAA's National Wind Farm Operating Protocols list considerations for developers during the design/build stage and the operational stage, for pilots/aircraft operators during aircraft operations and discusses economic compensation. NASF Guideline D is included in the Protocols document as Appendix 1, and AAAA Aerial Application Pilots Manual – excerpts on planning are provided as Appendix II.

This PAIA has been prepared in consideration of the National Windfarm Operating Protocols.

4.10. Local 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, not 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.

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 8.

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 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.

4.11. Aeromedical services

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.

Victoria's Ambulance Services uses helicopters and twin engine fixed-wing aircraft to provide aero-medical and medical retrieval services throughout Victoria.

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.

Medical flight operations could use Warracknabeal Airport, during the day and at night.

4.12. 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 verbatim 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:*
>
> - *liaison with the relevant fire and land management agencies is ongoing and effective*
> - *access is available to the wind farm site by emergency services response for on-ground firefighting operations*
> - *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.*

Warracknabeal Energy Park Pty Ltd intends to consult with fire services (aerial and ground) before making any commitment to operational procedures.

5. INTERNAL CONTEXT

5.1. Wind farm site description

The WAEP Project site is proposed to be located in open and generally cropping and pastoral land.

The site terrain elevations are between approximately 107 m at the northern boundary and 131 m AHD at the southern boundary of the Project area.

Figure 4 shows the area north of Borung Highway near the centre of the southern portion of the project area. (Google Earth)

Figure 4 Indicative cropping and pastoral land

Figure 5 Indicative cropping and pastoral land

5.2. Wind turbine generator (WTG) description

The maximum blade tip height of the proposed WTGs will be 280 m above ground level (AGL).

The ground elevation for the highest WTG (T206) is 131.1 m above mean seal level (AMSL) which, with a 280 m WTG, results in a maximum overall height of 411.1 m AMSL (1348.6 ft AMSL).

Figure 6 illustrates the preliminary Project layout identifying the highest WTG in red (source: WestWind, Google Earth)

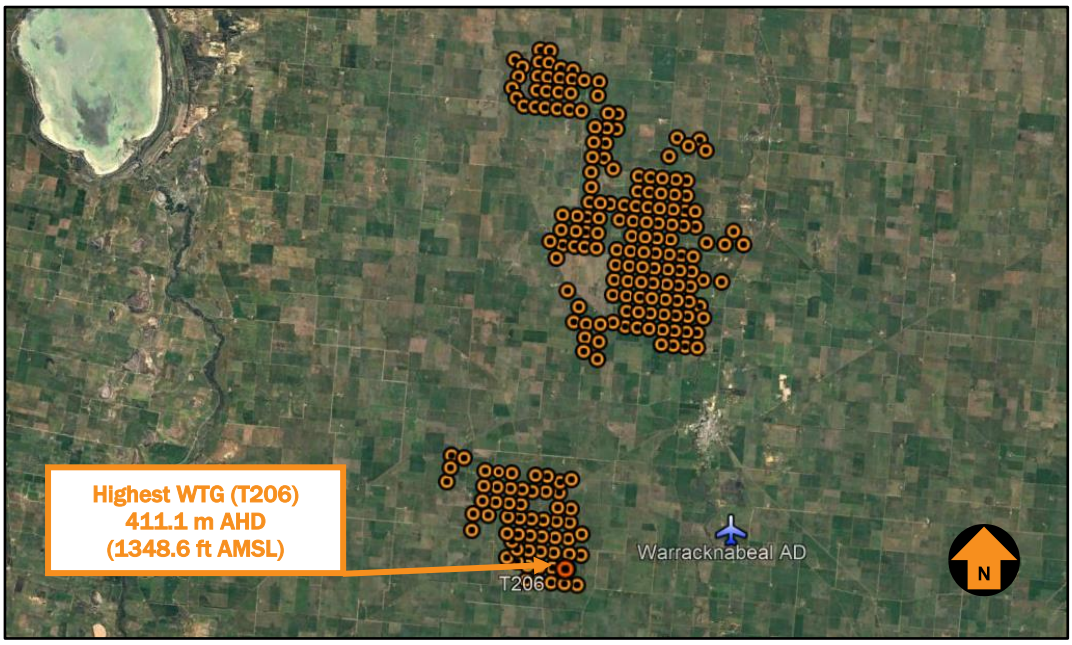

Figure 6 Project layout and highest WTG

The coordinates and ground elevations of the proposed WTGs analysed are listed in **Annexure 4.**

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 within 100 m of the nominal WTG position.

'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 micrositing of the WTGs is not likely to result in a significant change in the maximum overall blade tip height of the Project.

This PAIA assumes that a maximum blade tip height of 280 m AGL is implemented at all WTG locations.

6. AVIATION IMPACT STATEMENT

6.1. Overview

The NASF Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* provides information to proponents and planning authorities to help identify any potential safety risks posed by WTG and wind monitoring installations from an aviation perspective.

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 Aviation Impact Statement (AIS).

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

- The operation of nearby certified aerodromes
- The operation of nearby aircraft landing areas (uncertified aerodromes)
- Grid and air route LSALTS
- Airspace protection
- Aviation facilities
- Radar installations
- Local aircraft operations.

6.2. Nearby certified aerodromes

The area within 30 nm (56 km) from a certified airport's aerodrome reference point (ARP) or other navigation feature specified in AIP, is used to identify possible constraints from the Project.

Table 1 and Figure 7 details the Certified airports identified within 30 nm (55.6 km) of the Project site. (Source WAEP, OzRunways)

Table 1 Certified airports within 30 nm of Project Site

Certified Airport Name	*Distance and bearing from Project Site*	*Airport has Instrument Approach Procedures*
Warracknabeal (YWKB)	6.1 km / 3.31 nm east	Yes
Horsham (YHSM)	40 km / 22 nm south	Yes
Nhill (YNHL)	50 km / 27 nm west	Yes
Birchip (YBIR)	49 km / 26 nm northeast	No
Hopetoun (YHPN)	36km / 20 nm north	No

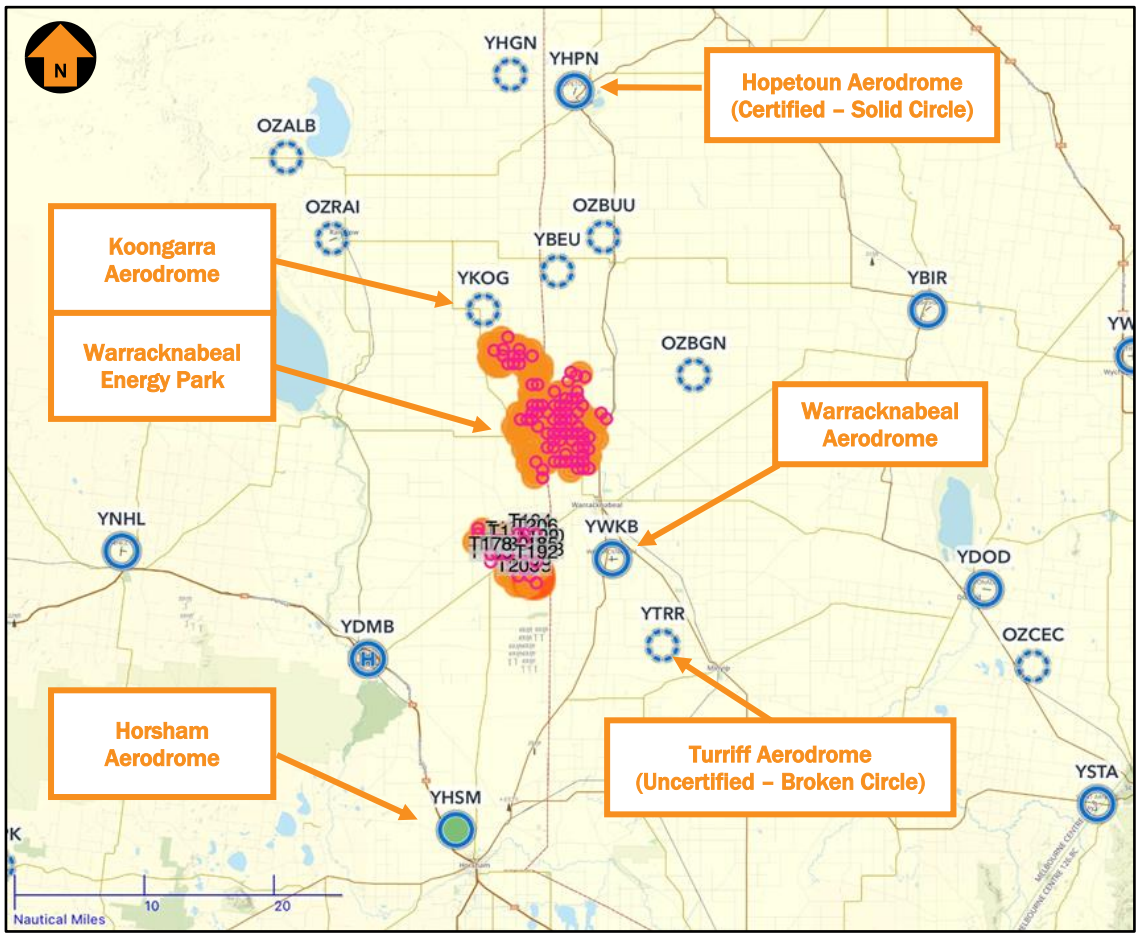

Figure 7 Certified aerodromes and ALAs within 30 nm of the Project

6.3. Warracknabeal Airport (YWKB)

Warracknabeal Airport is located 6.12 km (3.3 nm) east of the Project site. The nearest WTG is located 9.26 km / 5 nm west of the threshold for Runway 08.

A check of Aeronautical Information Package (AIP) via the Airservices Australia website showed that Warracknabeal Airport is served by non-precision instrument flight procedures (source: AsA, effective 23 March 2023).

The Project site is located within the lateral limits of the:

- 25 nm Minimum Safe Altitude (MSA) segment
- 10 nm MSA segment
- Intermediate approach segment of the RNAV (GNSS) RWY 08 approach.

6.3.1. 25 nm MSA

The 25 nm MSA encompasses an area within a radius of 30 nm from the reference point, in this case the Aerodrome Reference Point (ARP) at YWKB.

It provides IFR pilots with a known safe altitude that they can descend to in conditions where they cannot necessarily see the ground due to cloud or rain, etc, as they position the aircraft to commence an instrument approach to allow them to see the runway at an appropriate safe point prior to landing visually.

The 25 nm MSA determines the altitude at which IFR aircraft commence an instrument approach and also determines the minimum holding altitude for each approach.

The minimum altitude within the 25 nm MSA is determined by adding the appropriate Minimum Obstacle Clearance (MOC) buffer of 1000 ft to the highest obstacle within the 30 nm radius area.

The minimum altitude published for the 25 nm MSA is 2300 ft AMSL with a PANS-OPS surface of 1300 ft AMSL.

All WTGs are located within the lateral limits of the 25 nm MSA.

The highest WTG (T206) has a maximum height of 1328.7 ft AMSL and therefore infringes the 25 nm MSA by 28.7 ft, necessitating an increase to the 25 nm MSA minimum altitude by 100 ft to 2400 ft AMSL, or reducing the height of the turbines to beneath 1300 ft (396 m AHD).

An increase to the minimum altitude for the 25 nm MSA by 100 ft would not cause an adverse impact to IFR operations at YWKB due to the distance between the point where the aircraft intercept the final approach path (5nm from Runway 08 threshold) and the Initial approach fix at 15 nm from the Runway 08 threshold.

6.3.2. 10 nm MSA

The 10 nm MSA encompasses an area within a radius of 15 nm from the reference point, in this case the Aerodrome Reference Point (ARP) at YWKB. The minimum altitude within the 10 nm MSA is determined by adding the appropriate Minimum Obstacle Clearance (MOC) buffer of 1000 ft to the highest obstacle within the 15 nm radius area.

The minimum altitude published for the 10 nm MSA is also 2300 ft AMSL with a PANS-OPS surface of 1300 ft AMSL.

The majority of the WTGs are located within the 10 nm MSA. The 10 nm MSA has no relevance to the RNAV approaches at YWKB.

An increase to the minimum altitude to 2400 ft AMSL would have no impact to IFR aircraft operations at YWKB.

Whilst the highest WTG is located within the 10 nm MSA area, it also impacts the 25 nm MSA area all the way into the airport. Irrespective of the 10 nm MSA, aircraft can maintain the 25 nm MSA all the way to the initial approach fixes.

Figure 8 shows the location of the Project within the 25 nm MSA and 10 nm MSA areas.

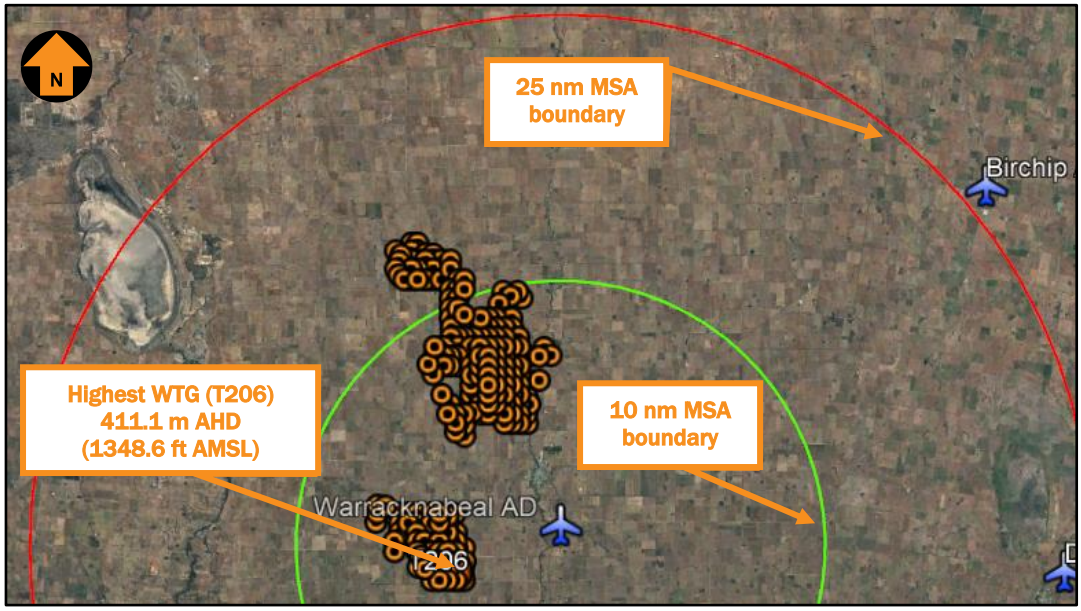

Figure 8 25 nm MSA and 10 nm MSA areas

6.3.3. RNAV-Z (GNSS) RWY 08 approach procedure

This approach is a GPS guided approach with a final approach aligned with Runway 08 at YWKB.

Several WTGs are located within the lateral limits of the primary area of the initial approach segments and the intermediate approach segment of this approach procedure. An MOC of 1000 ft is applied within the primary area of this segment.

The highest WTG within the right and initial approach segment between waypoints WKBWG and WKBWI is T158 at a height of 1308.6 ft AMSL. It is located within the secondary area of this segment and the MOC reduces linearly from the outer edge of the primary area to outer edge of the secondary. The applicable MOC for T158 is 930 ft (93%), providing a minimum height of 2238 ft AMSL, requiring an increase of 400 ft to the minimum altitude of 1900 ft AMSL to 2300 ft AMSL.

The other WTGs within the primary area of the right-hand initial approach segment also require an increase to the initial segment minimum altitude to 2300 ft AMSL. Refer to Figure 10.

This increase would not have an adverse impact on this instrument approach or to flight operations conducting the approach due to the available distance between the initial approach fixes and the final approach fix that does not impact the final approach path.

Many WTGs, including the highest WTG (T206) are located within the intermediate approach segment of this approach procedure. An MOC of 496 ft is applicable within the primary area of this segment.

WTG T206 has a maximum height of 1348.6 ft AMSL. Applying the MOC of 496 ft to this WTG provides a height of 1844.7 ft AMSL which is lower than the published minimum altitude of 1900 ft AMSL.

There are no WTGs located laterally within the final approach segment.

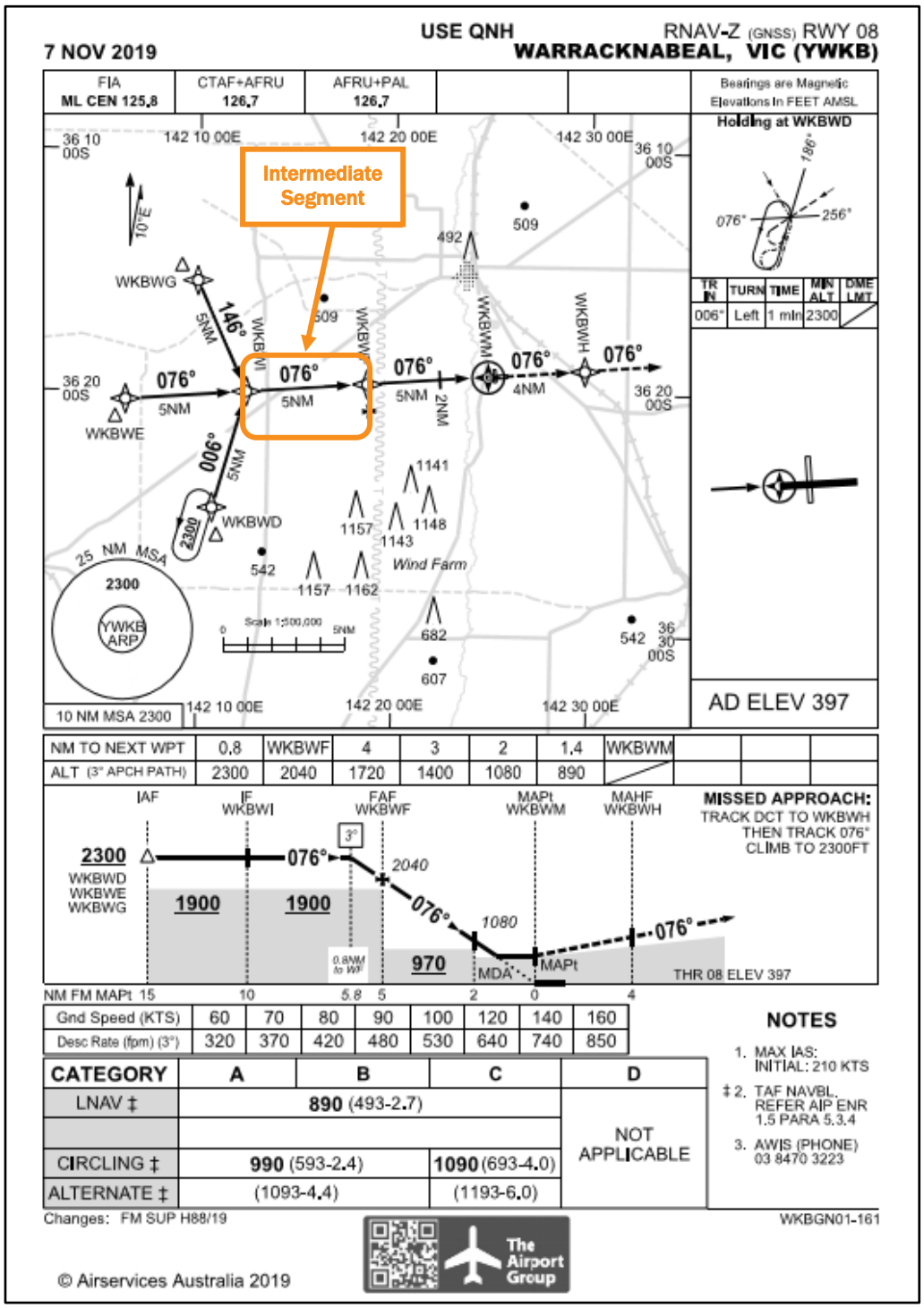

Figure 9 YWKB RNAV-Z (GNSS) RWY08 Approach Procedure

Figure 10 shows the location of the relevant WTGs within the right initial approach segment and the intermediate segment. They can be related to the approach shown in Figure 9.

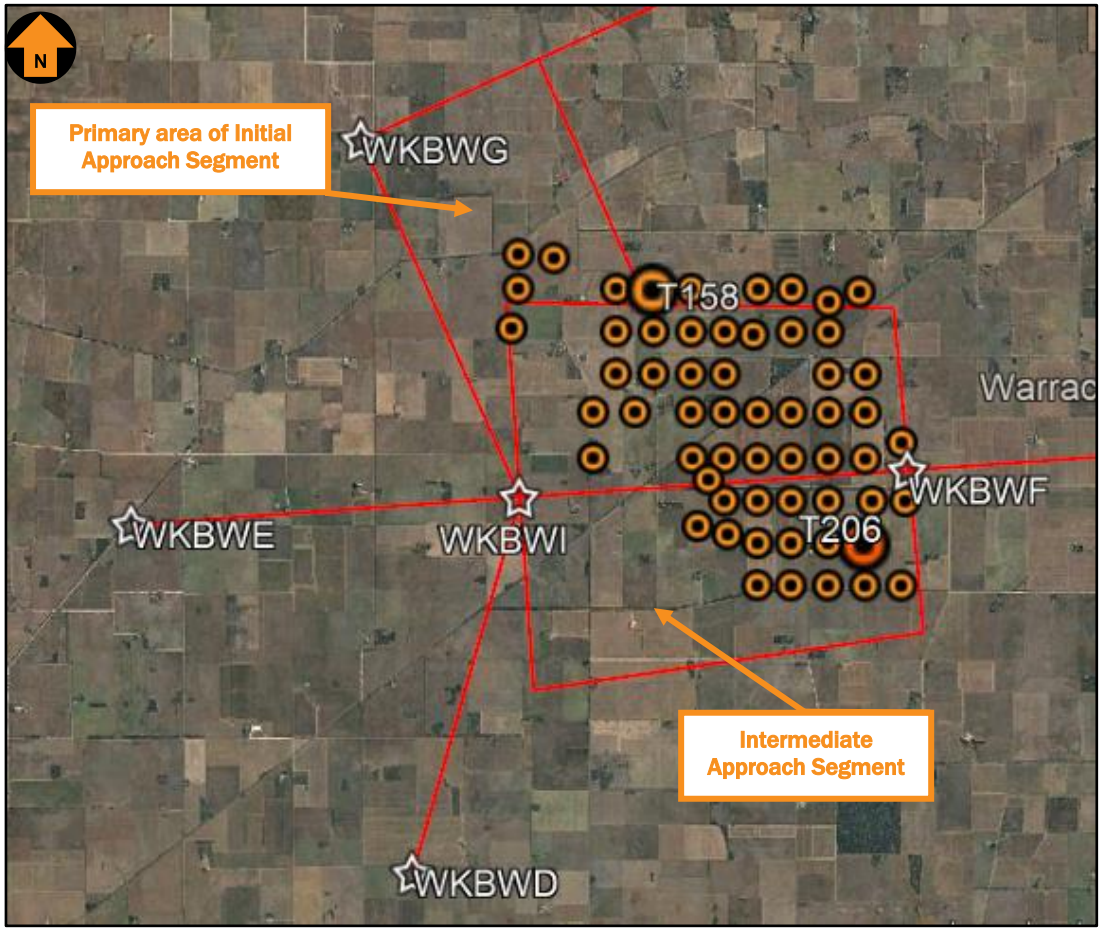

Figure 10 WTGs within right initial approach segment and intermediate segment

Summary

The proposed increase to the Initial Approach Segment minimum altitude from 1900 ft AMSL to 2300 ft AMSL is lower than the required increase to the 25 nm MSA and 10 nm MSA of 2400 ft AMSL, and therefore will not impact upon this approach procedure due to the available distance for descent on the final approach path.

Adjusting the minimum holding altitude at WKBWD will not have an adverse impact on this approach procedure.

The straight-in intermediate and final approach segments are not infringed by the Project therefore allowing IFR aircraft to continue to use this approach normally.

6.3.4. RNAV-E (GNSS) Approach Procedure

This approach is a GPS guided approach with a final approach aligned with Runway 26 at YWKB but limited to an IFR Circling minimum descent altitude, rather than a lower straight in approach minimum altitude provided to the RWY 08 approach procedure.

The approach segments of this approach are all on the eastern side of the airport and are not infringed by the Project's WTGs.

The missed approach climbs away to the west of the airport for 3 nm and then turns left to come back to the east of the airport.

Several of the WTGs are located within the protection area for the missed approach.

The closest WTG to the missed approach is located approximately 9326 m from a point called the "Start of Climb" (SOC), which is located approximately 1 nm (1852 m) from the missed approach point (MAPT). The missed approach climb gradient is published as 2.5%. An aircraft conducting a missed approach commences climb from the minimum descent altitude of 890 ft at the MAPT. The SOC is used as the origin of the missed approach climb under PANS-OPS criteria. Aircraft reach an altitude of 1654.9 ft AMSL, from which an MOC of 164 is applied below this – 1490.9 ft AMSL.

As the highest WTG (T206) has a maximum height of 411.1 m/1348.6 ft, the Project does not infringe the RNAV(E) GNSS approach procedure.

The changes to the RNAV-Z (GNSS) RWY 08 MSAs and holding pattern must be applied to this approach and will not have an adverse impact upon this RNAV-E approach.

There is sufficient distance for aircraft that are required to conduct a missed approach in weather conditions that preclude the pilot from establishing visual contact with the runway prior to the missed approach point (WKBEM) to climb above the WTGs by the required margin.

Figure 11 depicts the RNAV-E (GNSS) approach procedure.

Summary

Apart from the increases to the 25 nm MSA, holding pattern at WKBEB and the resulting approach commencement altitude to 2400 ft, this approach procedure is not impacted by the Project WTGs.

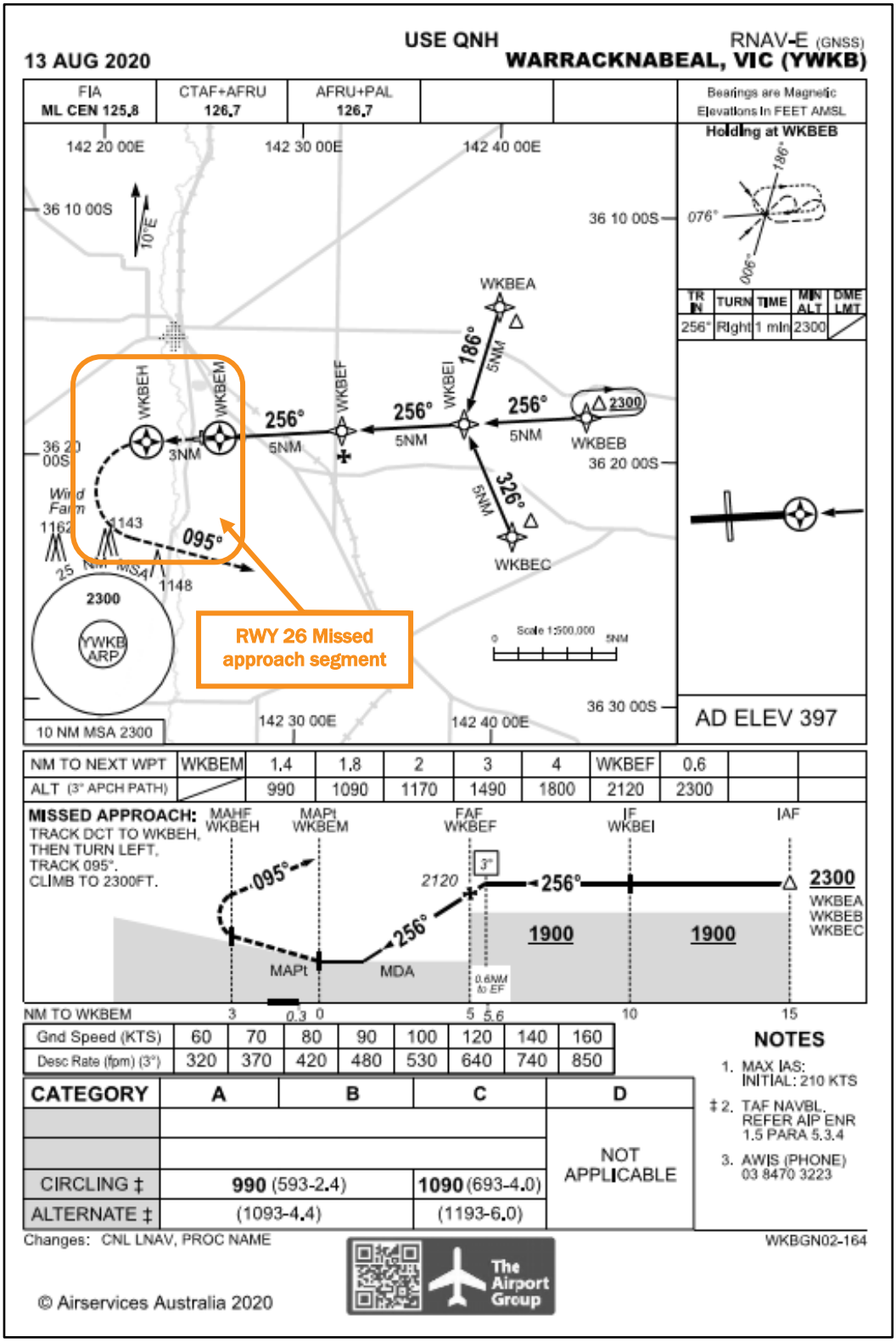

Figure 11 YWKB RNAV_E (GNSS) approach procedure

6.3.5. IFR Circling Areas

The approach procedures at YWKB include a minimum altitude that conduct an approach to one runway and then fly within prescribed limits to circle around to the other runway, when conditions are unsuitable for a landing on the approach runway.

Performance Category C aircraft, including high performance twin engine aircraft, and including up to Boeing 737 size aircraft, can operate at YWKB.

The IFR circling area at YWKB has a maximum radius of 7.85 km from each runway threshold, joined by a tangent from each circle.

The nearest WTG to YWKB is approximately 9.26 km from the nearest runway threshold (RWY 08) and is therefore outside the IFR circling area at YWKB.

Figure 12 shows the IFR circling area boundary in relation to the Project WTGs.

Figure 12 YWKB IFR Circling area

6.3.6. Obstacle Limitation Surfaces

The current entries for YKWB in the En Route Supplement Australia identify Runway 08/26 at Warracknabeal Airport as a Code 3 non-precision approach runway.

Note that the operational OLS may have been designed according to previous standards and subsequently grandfathered at the change to the new standards in August 2020.

The analysis contained herein is based on the parameters set out in CASR Part 139 (Aerodromes) Manual of Standards 2019. Of specific relevance is the lower gradient for the first section of the approach surface, which changed from 3.33% to 2%, resulting in a lower horizontal section, 150 m above the inner edge elevation, rather than 190 m.

The OLS at Warracknabeal comprise of:

- Inner Horizontal Surface (IHS) within a radius of 4 km from each runway strip end and 45 m above the airport's reference elevation datum. This surface is not infringed by the Project.
- Conical Surface from the edge of the IHS rising at 5% to 75 m above the IHS, a distance of 1500 m from the outer edge of the IHS. This surface is not infringed by the Project.
- An Approach Surface of various gradients and a horizontal section for each Code 3 runway. The total length of the Approach Surface is 15,000 m from the inner edge, which is located 60 m before the landing threshold. This surface for runway 08 is infringed by up to 140.05 m by the Project.
- A Take-off Climb Surface rising at 2% to 15000 m from near the runway end. This surface is infringed by up to 94.3 m by the project.
- A Transitional Surface parallel to the runway which is not relevant to this assessment.

Figure 13 shows the typical OLS (Source: CASR Part 139 Manual of Standards). The Outer Horizontal Surface is not relevant to this assessment.

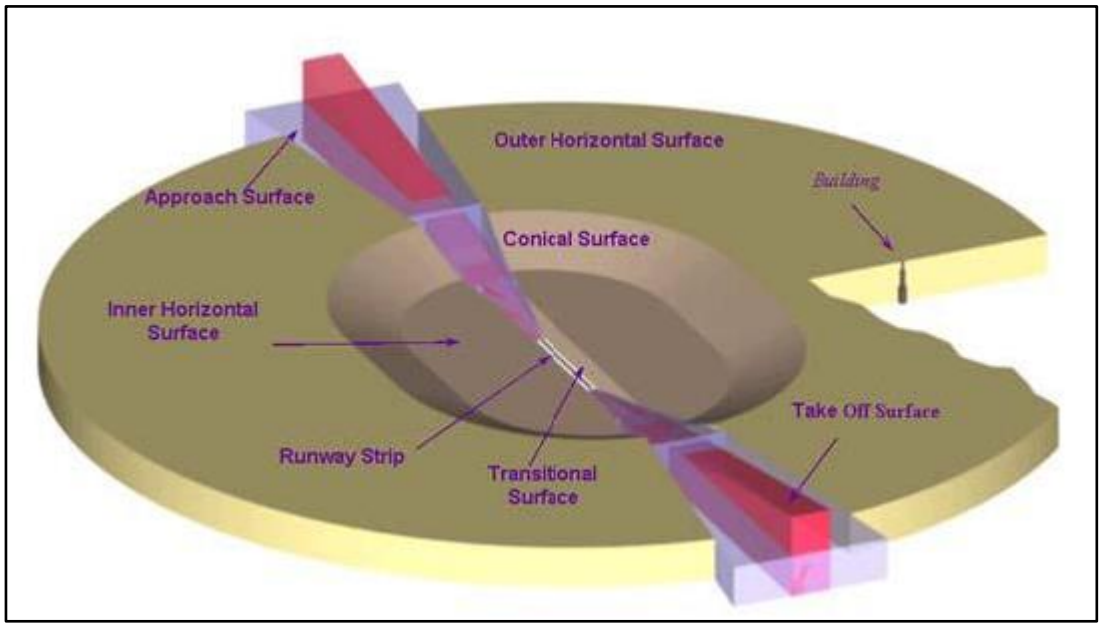

Figure 13 Typical OLS

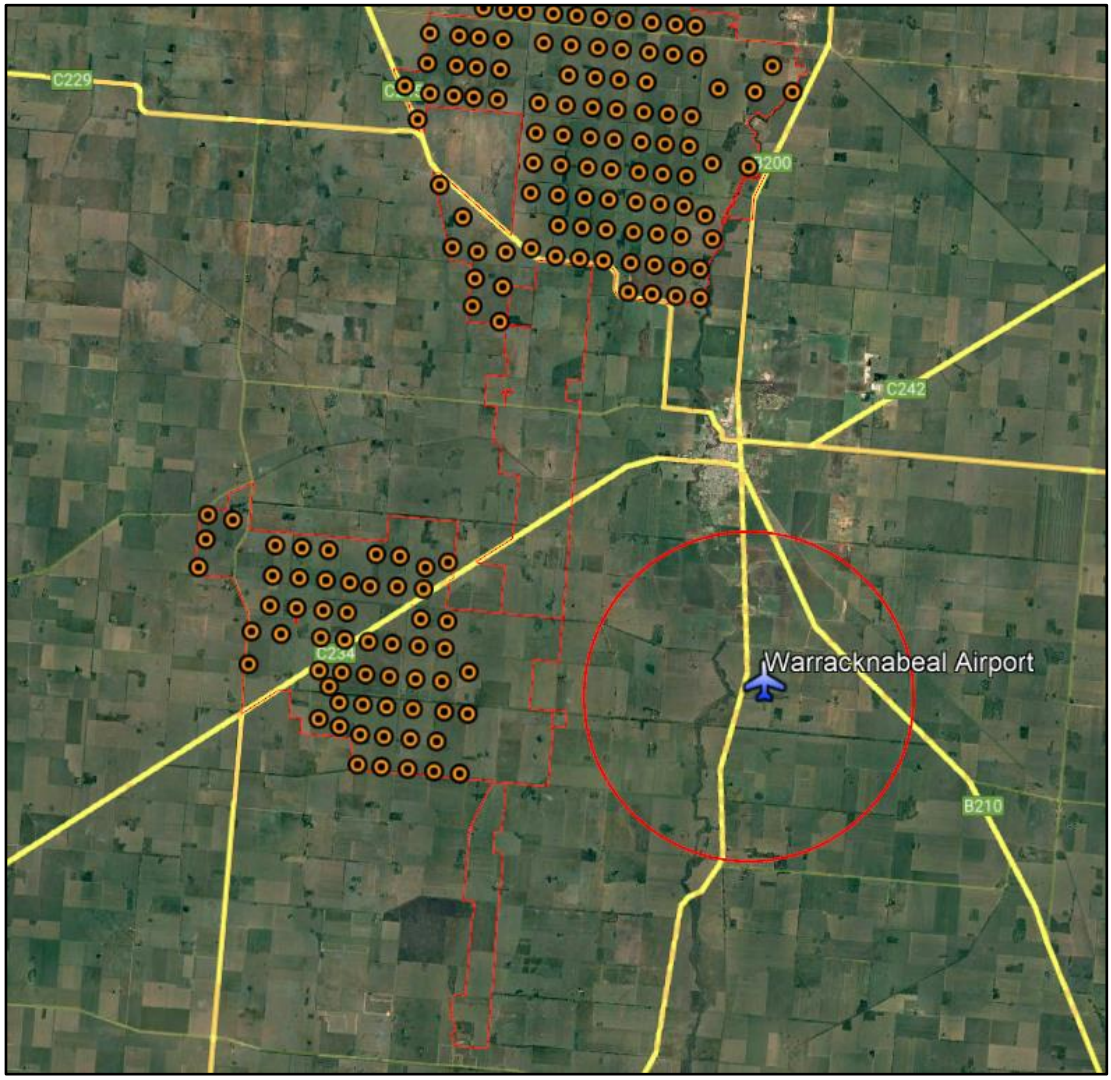

Figure 14 Extent of IHS and Conical Surface

Runway 08 Approach Surface

Twenty six (26) WTGs are located within the lateral limits of the horizontal section of the Runway 08 Approach Surface that has a height of 271.01 m AMSL as shown in Figure 15 and detailed in Table 2.

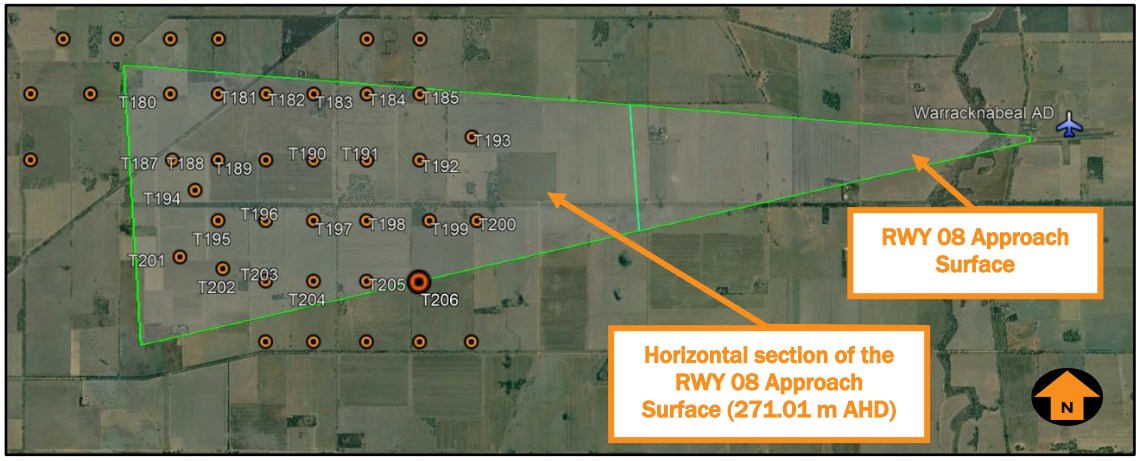

Figure 15 YWKB Runway 08 Approach Surface

The infringements range from 127.7 m to 140.04 m above the RWY 08 Approach Surface as detailed in Table 2.

These infringements to the RWY 08 Approach Surface do not create a significant impact to visual flight operations to/from Warracknabeal Airport due to the nominal altitudes that aircraft will fly over the wind farm when approaching YWKB from the west in visual conditions and conducting a straight-in approach. They will be at least 600 ft above the WTGs.

The PANS-OPS surfaces of the instrument approach procedures is above the WTGs and therefore IFR approaches are not impacted.

Aviation Projects notes that the WTG layout is indicative and recommendations from expert consultants will inform the final WTG layout. The following options are outlined to inform assessment of the EES referral and subsequent preparation of the final WTG layout.

Options to consider in dealing with the infringements to the western approach and take-off surface include:

- WTGs could be relocated to be outside the lateral limits of the Approach Surface altogether
- Restrict the overall height of the WTGs to below the Approach Surface
- Seek CASA approval for the WTGs to infringe the Approach Surface subject to mitigations which might include obstacle lighting.

The WTGs that infringe the Approach Surface do not infringe the PANS-OPS surfaces associated with the RNAV-Z (GNSS) RWY 08 approach procedure.

It is not uncommon to have obstacles and/or terrain infringing the Approach Surfaces at various certified airports in Australia. For example, Ballina Airport and Wagga Wagga Airport have terrain and/or obstacles infringing their Approach Surfaces.

Table 2 WTG infringements to the RWY 08 Approach Surface

WTG	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)
T180	121.17	280	401.17	1316.18	271.01	130.16
T181	124.30	280	404.30	1326.44	271.01	133.29
T182	119.40	280	399.40	1310.37	271.01	128.39
T183	121.53	280	401.53	1317.35	271.01	130.52
T184	121.91	280	401.91	1318.59	271.01	130.90
T185	120.68	280	400.68	1314.58	271.01	129.67
T187	120.76	280	400.76	1314.82	271.01	129.75
T188	123.80	280	403.80	1324.79	271.01	132.79
T189	123.92	280	403.92	1325.21	271.01	132.91
T190	126.19	280	406.19	1332.64	271.01	135.18
T191	123.12	280	403.12	1322.57	271.01	132.11
T192	126.82	280	406.82	1334.70	271.01	135.81
T193	118.37	280	398.37	1307.00	271.01	127.36
T194	125.83	280	405.83	1331.47	271.01	134.82
T195	124.29	280	404.29	1326.41	271.01	133.28
T196	127.25	280	407.25	1336.12	271.01	136.24
T197	126.04	280	406.04	1332.16	271.01	135.03
T198	125.43	280	405.43	1330.16	271.01	134.42
T199	130.54	280	410.54	1346.91	271.01	139.53
T200	121.19	280	401.19	1316.24	271.01	130.18
T201	128.41	280	408.41	1339.92	271.01	137.40
T202	128.68	280	408.68	1340.82	271.01	137.67
T203	126.03	280	406.03	1332.10	271.01	135.02
T204	126.47	280	406.47	1333.56	271.01	135.46
T205	126.47	280	406.47	1333.55	271.01	135.46
T206	131.06	280	411.06	1348.61	271.01	140.05

Runway 26 Take-Off Climb Surface

The Take-Off Climb surface for a Code 3 runway is an inclined plane commencing at 60 m after the runway end with an upward slope of 2% and ending at 15 km from its origin. It diverges at 12.5% from 90 m each side of the runway centreline until it becomes 1800 m wide and then it remains parallel to the runway centreline. (See Figure 16).

Fourteen WTGs infringe the Runway 26 Take-Off Climb Surface for Code 3 runways.

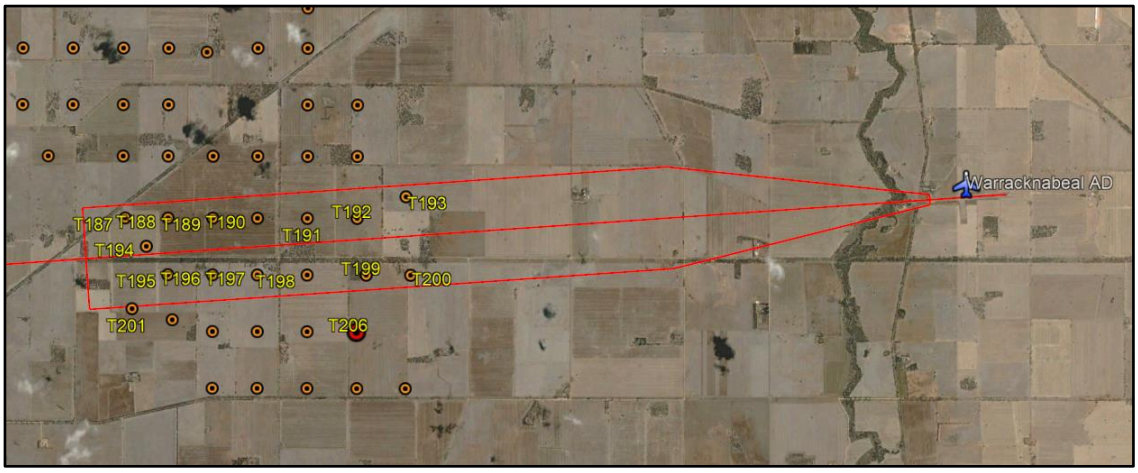

Figure 16 Runway 26 Take-off Climb Surface

The closest WTGs to the origin of the Take-Off Climb Surface are T193 and T200, at a maximum height of 398.4 m AHD and 401.2 m AHD respectively. The Take-Off Climb Surface at that point has a height of 306.9 m AHD. Therefore, the Take-Off Climb Surface is infringed by these WTGs.

WTG T200 creates the highest infringement of 94.3 m.

The infringements into the Runway 26 Take-Off Climb Surface could be considered inconsequential due to the distance of the nearest and highest WTGs to the departure end of Runway 26 and for those aircraft that cannot outclimb the WTGs by a safe margin, to be able to turn prior to reaching the WTGs to avoid them.

Table 3 details those WTGs within the Runway 26 Take-Off Climb Surface at YWKB.

Table 3 WTGs within Take-Off Climb Surface

WTG	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 26 T/O Climb SFC Elevation at WTG location (m AMSL)	Infringement (m)
T187	120.76	280	400.76	1314.82	406.1	Clear
T188	123.80	280	403.80	1324.79	391.2	12.6
T189	123.92	280	403.92	1325.21	375	28.9
T190	126.19	280	406.19	1332.64	359	47.2
T191	123.12	280	403.12	1322.57	341	62.1
T192	126.82	280	406.82	1334.70	323.9	82.9
T193	118.37	280	398.37	1307.00	306.9	91.5
T194	125.83	280	405.83	1331.47	384.9	20.9
T195	124.29	280	404.29	1326.41	392	12.3
T196	127.25	280	407.25	1336.12	376	31.3
T197	126.04	280	406.04	1332.16	360	46.0
T198	125.43	280	405.43	1330.16	343	62.4
T199	130.54	280	410.54	1346.91	322	88.5
T200	121.19	280	401.19	1316.24	306.9	94.3
T201	128.41	280	408.41	1339.92	406	2.4

6.4. Nhill Airport

Nhill Airport is located approximately 50 km / 27 nm from the nearest WTG within the Project area.

The 25 nm MSA is the only PANS-OPS surface overlying the Project.

The minimum altitude for the 25 nm MSA is 2500 ft AMSL with a PANS-OPS surface of 1500 ft/ 457.2 m AMSL.

The highest WTG is T206 at 1348.6 ft/ 411.06 m AHD and therefore the Project does not infringe this PANS-OPS surface.

Sections of the OLS extend to 15 km from the airport. The Project is located outside the OLS.

The Project will not have an impact upon flight operations at Nhill Airport.

6.5. Horsham Airport

Horsham Airport is located approximately 40 km / 22 nm from the nearest WTG within the Project area.

The 25 nm MSA is the only PANS-OPS surface overlying the Project.

The minimum altitude for the 25 nm MSA is 2400 ft AMSL with a PANS-OPS surface of 1400 ft/ 426.7 m AMSL.

The highest WTG is T206 at 1348.6 ft/ 411.06 m AHD and therefore the Project does not infringe this PANS-OPS surface.

Sections of the OLS extend to 15 km from the airport. The Project is located outside the OLS.

The Project will not have an impact upon flight operations at Horsham Airport.

6.6. Birchip Airport

Birchip Airport is located 49 km /26 nm from the nearest WTG within the Project area.

There are no Instrument approach procedures available or published for Birchip Airport.

OLS could extend to 2 km from the airport. The Project is located outside the OLS.

The Project will not have an impact upon flight operations at Birchip Airport.

6.7. Hopetoun Airport

Hopetoun Airport is located 36.5 km /19.7 nm from the nearest WTG within the Project area.

There are no Instrument approach procedures available or published for Birchip Airport.

OLS could extend to 2 km from the airport. The Project is located outside the OLS.

The Project will not have an impact upon flight operations at Hopetoun Airport.

6.8. Nearby aircraft landing areas (uncertified aerodromes)

The area within a radius of 3 nm from an aerodrome is considered to be the area in which aircraft that are either taking off or landing will conduct their operations either from their cruising altitude or to their cruising altitude. Obstacle within this 3 nm radius could impact upon flight operations at the aerodrome.

A search of AIP Aeronautical Charts and OzRunways, (which sources its data from Airservices Australia (AIP)) identified one ALA, Koongarra, within 5 nm of the nearest WTG, T001.

Koongarra ALA is shown on OzRunways approximately 1.9 nm / 3.4 km northeast of the nearest WTG at the northern boundary of the Project. Eleven WTGs are located within 3 nm of the ALA. Normal circuit operations would be conducted to a left-hand pattern from either runway up to a height of 1000 ft AGL.

The assumed runway alignment is indicated on the Google Earth image dated 12/2018 but barely recognisable on the Google Earth image dated 1/2019. This suggests that the ALA may no longer be in use. Liaison with the land-owner may be required to confirm its status.

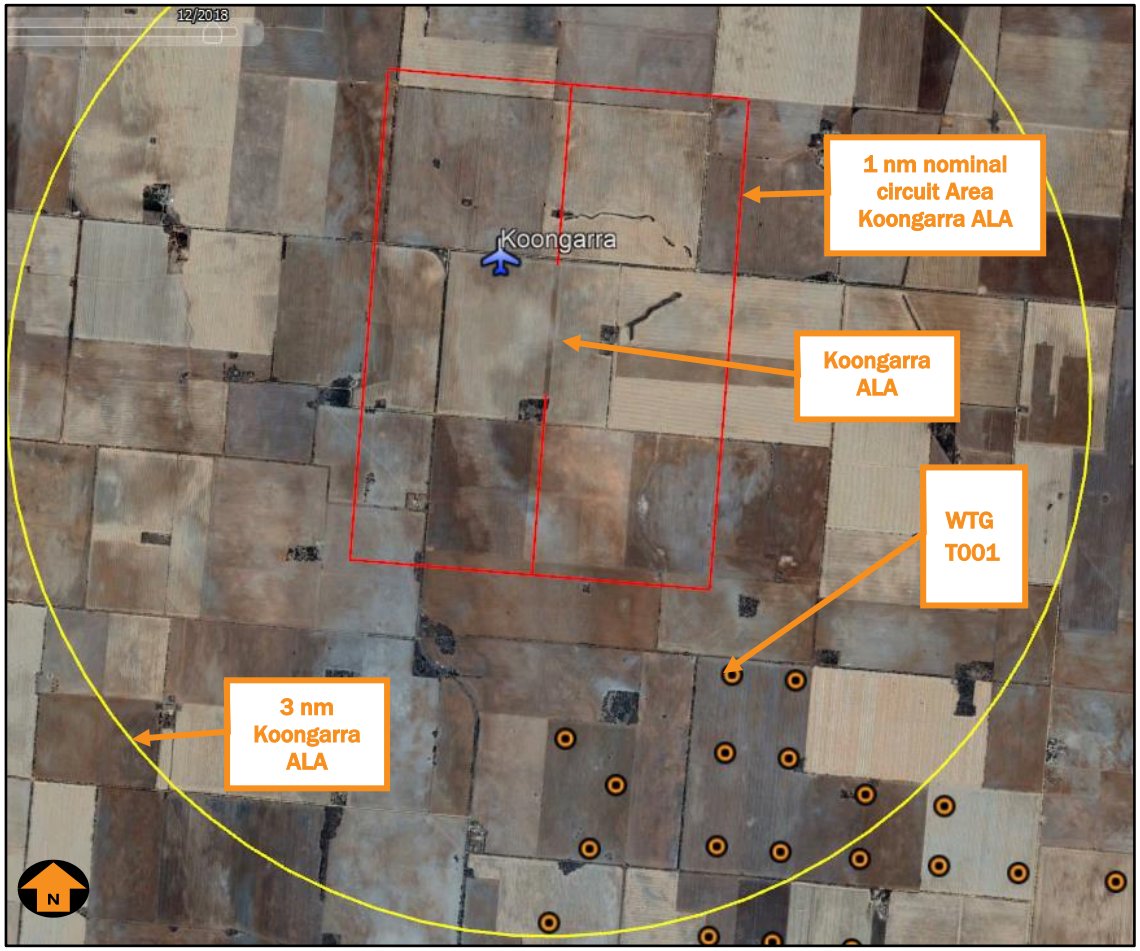

Figure 17 Koongarra ALA

Take-off and landing operations at this ALA are likely to be conducted within 1 nm of the runway, and even closer for aerial application operations.

It is likely that the physical part of the Project could create an impact upon take-off and landing operations at Koongarra ALA due to the runway end's proximity to the nearest WTG.

6.9. Potential wake turbulence impacts

National Airports Safeguarding Framework (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 preliminary WTG configuration provided are:

- Blade length to a maximum of 100 m, providing a rotor diameter of up to 200 m
- Tip height to a maximum of 280 m AGL.

Based on the 200 m rotor diameter the maximum extent of downwind wake turbulence referred to in the NASF guideline is 3200 m.

Aviation Projects, through research, has determined that any adverse turbulence would most likely be confined to within 7 rotor diameters of a WTG, but considers that a conservative area of 10 rotor diameters is likely to be the maximum area where wake turbulence from WTGs would be felt by pilots operating downstream of a WTG.

For WTGs with a 200 m rotor diameter, this area would therefore extend to a distance of 2000 m.

The closest WTGs is located approximately 6120 m from the closest parts of Warracknabeal Airport and will not create any downwind turbulence at the airport or in the circuit area.

Koongarra ALA is located 3.4 km from the nearest WTG is outside the area where downwind turbulence from the WTGs is likely to be encountered. However, flight operations in the southern portion of the circuit area would likely occur within 2000 m of T001 and therefore may encounter turbulence from the WTGs in southerly or south eastly winds when the WTGs are rotating.

Summary

The WTGs within the project area are located outside the area in which downwind turbulence from the turbines would be noticeable to pilots operating at Warracknabeal Airport.

Downwind turbulence is likely to be noticeable in some wind conditions in the southern part of the circuit area for Koongarra ALA.

Downwind turbulence from the WTGs may cause an impact to low level aircraft operations within 3.2 km of a WTG, but more likely within only 2 km.

6.10. Grid and Air routes LSALT

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

6.10.1. Grid LSALT

The Project site is located within a Grid LSALT of 3900 ft AMSL that has a protection surface of 2900 ft AMSL.

The highest WTG (T206) at a maximum height of 1348.6 ft AMSL will not infringe the Grid LSALT. Figure 18 refers.

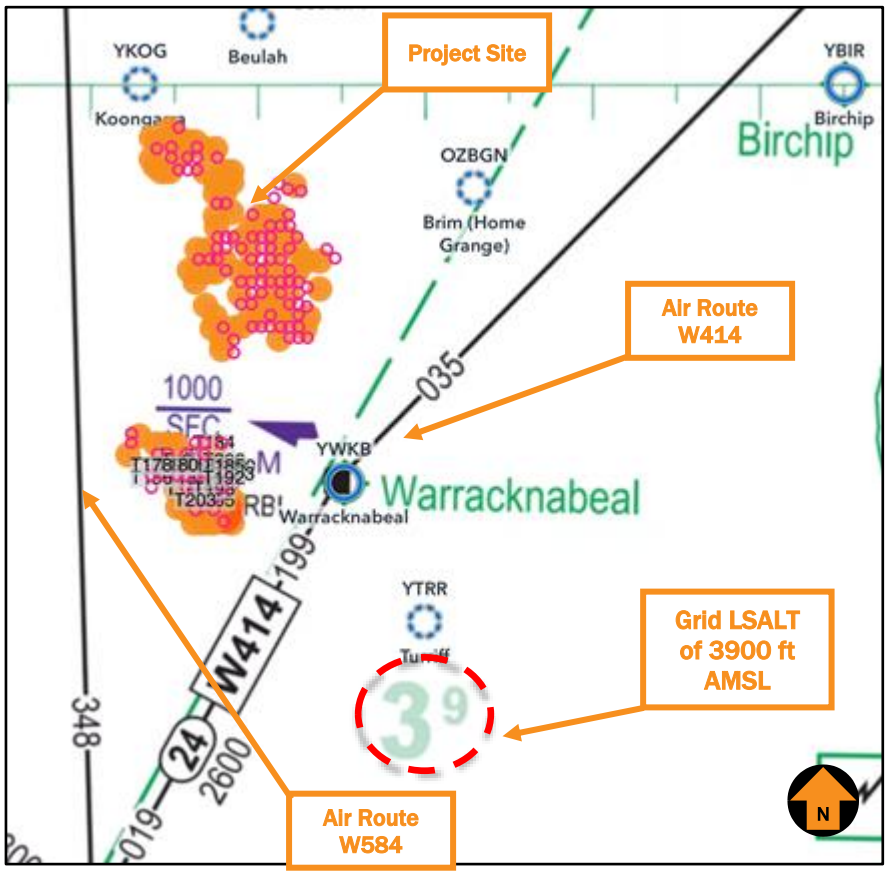

Figure 18 LSALTs in proximity to the Project site

6.10.2.Air Route LSALTs

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

There are two air routes within 7 nm of the Project Site shown in Figure 18 above, W414 from Horsham to Warracknabeal and then to Swan Hill and W584 from Horsham to Mildura (Galah Waypoint) (source: ERCL1, OzRunways, 1 December 2022).

The Project WTGs in the southern area of the Project, at a maximum height of 1348.6 ft AMSL will not infringe the W414 or the W584 LSALT protection surfaces of 1600 ft AMSL to the south of Warracknabeal.

The Project WTGs in the northern area of the Project, at a maximum height of 1278.14 ft AMSL will infringe the W414 LSALT protection surfaces of 1000 ft AMSL to the north of Warracknabeal, requiring a 300 ft increase to the LSALT.

Increases to Air Route LSALTs such as this have been approved in the majority of cases recently. Aviation Projects considers that there are no impediments to this proposed increase.

An impact analysis of the air route is provided in Table 4.

Table 4 Air route impact analysis

Air route	*Waypoint pair*	*Route LSALT*	*Protection Surface*	*Highest WTG*	*Impact on LSALT*
W414	Horsham to Warracknabeal	2600 ft AMSL	1300 ft AMSL	1348.6 ft AMSL	Nil
W414	Warracknabeal to Swan Hill	2000 ft AMSL	1000 ft AMSL	1278.14 ft AMSL	Increase LSALT to 2300 ft AMSL
W584	Horsham to Galah	2600 ft AMSL	1600 ft AMSL	1348.6 ft AMSL	Nil

6.11. Airspace Protection

The Project area is located outside of controlled airspace (wholly within Class G airspace).

6.12. Aviation facilities

The Project area is located sufficient distance away from certified airports and will not have an impact on the aviation facilities of those airports.

6.13. ATC Surveillance installations

Airservices Australia requires an assessment of the potential for the WTGs to affect radar line of sight.

The nearest ATC surveillance radar is located at Mount Macedon, approximately 232 km southeast of the Project area.

The Mount Macedon is located beyond the limit of any assessment area associated with it.

6.14. Nearby Wind Farms

Aeronautical charts show the Murra Murra Wind Farm approximately 4 nm south of the WAEP Project boundary.

Nomenclature on the aeronautical charts indicate that the Murra Wind Farm has WTGs with a maximum height of 722 ft AGL that are not provided with obstacle lighting.

Figure 19 provides an inset from the northwest extent of the Melbourne Visual Navigation Chart published by Airservices Australia. Warracknabeal Airport is off the chart to the north.

Figure 19 Murra Warra Wind Farm depiction on Aeronautical Chart

It is apparent that amendments to instrument approach procedures at Horsham Airport and at Warracknabeal Airport have been implemented to account for the Murra Warra wind farm.

To be consistent it would be best practice to not provide the WAEP with obstacle lighting as it could lead pilots flying at night, who see the WAEP lights, to fly to the south of the Project and not be aware of the unlit Murra Warra Wind Farm if they had not noticed it on their charts.

Aircraft flying at night have similar obstacle clearance requirements to those imposed by IFR flight, with a few exceptions when near airports equipped with runway and other aerodrome lighting.

Guideline D of the National Airports Safeguarding Framework provides the following guidance:

> *26. Following preliminary assessment by an aviation consultant of potential issues, proponents should expect to commission a formal assessment of any risks to aviation safety posed by the proposed development. This assessment should address any issues identified during stakeholder consultation.*
>
> *27. The risk assessment should address the merits of installing obstacle marking or lighting.*

The risk assessment would consider, among other things:

- Types of aircraft and their scope of operations, during the day and at night
- Whether the OLS is penetrated by WTGs and the relevant regulatory requirements relating to obstacle lighting
- Potential for human factors issues relating to putting obstacle lights on some WTGs in the area while other WTGs are not lit.

6.15. AIS Summary

Based on the Project WTG layout:

- would infringe the YWKB RWY 08 Approach Surface OLS surface
- would infringe the YWKB RWY 26 Take-off climb surface
- would require an increase in the 25 nm MSA and the 10 nm MSA minimum altitudes from 2300 ft to 2400 ft AMSL, to accommodate the Project
- Would require amendment of the RNAV-Z (GNSS) RWY 08 and RNAV-E (GNSS) approach procedures
- would not have an impact on the Grid LSALT
- would require an increase to the LSALT for air route H414 to the south and the north of YWKB
- is wholly contained within Class G airspace
- is outside the clearance zones associated with civil aviation navigation aids and communication facilities
- details of the Project must be provided to Airservices Australia to assess any impacts upon any nearby ADS-B systems and the increases to the 25 nm and 10 nm MSA minimum altitudes.

The WTGs located within 3 nm of the Koongarra ALA:

- are likely to present operational limitations for aircraft operating to/from and within the circuit area of the aerodrome
- are likely to create downstream wake turbulence hazard to aircraft operating in the circuit area.

The list of WTGs (obstacles), showing coordinates and elevation data that are applicable to this AIS, are provided in **Annexure 4**.

6.16. Assessment recommendations

Based on the information contained within this section and the analysis conducted, the following recommendations are made:

- Consult with Airservices Australia to assess potential impacts of the Project
- Consult with the airport operator of the Warracknabeal Airport to provide the manager with details of the Project and the likely impacts to aircraft operations there. The airport operator must approve any changes to the instrument approach procedures before Airservices Australia will consider any amendments
- Consult with the owner of Koongarra ALA to obtain details of aircraft operations from there and to provide details of the Project for them to assess
- Provide details of the wind farm including WMTs to CASA for them to assess the impacts of the wind farm upon aviation safety in the area
- Consider options in dealing with the infringements to the OLS includes:
    - WTGs could be relocated to outside the lateral limits of the Approach Surface altogether
    - Restrict the overall height of the WTGs to below the Approach Surface

- Seek CASA approval for the WTGs to infringe the Approach Surface subject to mitigations which might include obstacle lighting.

7. CONCLUSIONS

The key conclusions of this PAIA are summarised as follows:

7.1. Aviation Impact Statement

Based on the Project WTG layout:

- would infringe the YWKB RWY 08 Approach Surface OLS surface
- would infringe the YWKB RWY 26 Take-off climb surface
- would require an increase in the 25 nm MSA and the 10 nm MSA minimum altitudes from 2300 ft to 2400 ft AMSL, to accommodate the Project
- Would require amendment of the RNAV-Z (GNSS) RWY 08 and RNAV-E (GNSS) approach procedures associated with the 25 nm MSA increased minimum altitude
- would not infringe any other PANS-OPS surfaces
- would not have an impact on the Grid LSALT
- would require an increase to the LSALT from 2000 ft to 2400 ft for air route W414 to the north of YWKB
- is wholly contained within Class G airspace
- is outside the clearance zones associated with civil aviation navigation aids and communication facilities.

The WTGs located within 3 nm of the Koongarra ALA:

- are likely to present operational limitations for aircraft operating to/from and within the circuit area of the aerodrome
- are likely to create downstream wake turbulence hazard to aircraft operating in the circuit area.

The list of WTGs (obstacles), showing coordinates and elevation data that are applicable to this AIS, are provided in Annexure 4.

7.2. Aircraft operator characteristics

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

WTGs are generally not a safety concern to aerial agricultural operators. WMTs remain the primary safety concern to aerial agricultural operators, who have expressed a general desire for these towers to be more visible.

8. RECOMMENDATIONS

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

A summary of the key recommendations of this PAIA is set out below.

1. 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 or not the structure will be hazardous to aircraft operations.
   The proponent is required to report the WMT to CASA in accordance with CASR 139.165, as soon as practicable after forming the intention to construct or erect the proposed object or structure.
   The notification should be provided to CASA via email to Airspace.Protection@casa.gov.au .
   'As constructed' details of WTG and WMT coordinates and elevation should be provided to Airservices Australia, using the following email address: vod@airservicesaustralia.com.

2. 'As constructed' details of WMT coordinates and elevation should be provided to Airservices Australia, 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
   Ideally this should only be done if potential impacts have been considered – through an aviation impact assessment or by sending the details to Airservices Australia in advance of the mast being erected, at this email address: airport.developments@airservicesaustralia.com .

3. Any obstacles above 100 m 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 wind farm should be provided to Warracknabeal Airport management, and to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm on their operations.

5. Consider options in dealing with the infringements to the OLS includes:

   a. Seek CASA approval for the WTGs to infringe the Approach Surface subject to mitigations which might include obstacle lighting.
      If CASA does not approve the infringements, then remove all OLS issues.

   b. WTGs could be relocated to outside the lateral limits of the Approach Surface altogether

   c. Restrict the overall height of the WTGs to below the Approach Surface

6. To facilitate the flight planning of aerial application operators, details of the Project, including the 'as constructed' location and height information of WTGs, WMTs 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.

Operation

7. Whilst not a statutory requirement, the Proponent should consider engaging with any local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project.

8. The proponent should consult with the operator of Koongarra aerodrome to determine any impacts from the WTG proximity and potential wake turbulence effects and consider appropriate mitigations.

Marking of WTGs

9. The rotor blades, nacelle and the mast supporting the WTGs should be painted white, typical of most WTGs operational in Australia. No additional marking measures are required for WTGs.

Lighting of WTGs

10. The need for obstacle lighting on WTGs should be determined through a formal risk assessment process, as per NASF Guideline D guidance.

Marking of wind monitoring towers

11. Consideration should be given to marking the temporary and permanent WMTs according to the requirements set out in MOS 139 Section 8.10 (as modified by the guidance in NASF Guideline D). Specifically:

    d. marker balls or high visibility flags or high visibility sleeves should be placed on the outside guy wires

    e. paint markings should be applied in alternating contrasting bands of colour to at least the top 1/3 of the mast

    f. ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation.

Lighting of wind monitoring towers

12. Consideration should be given to lighting temporary WMTs installed prior to WTG installation and WMTs with medium intensity steady red obstacle lighting at the top of the WMT mast. Characteristics for medium-intensity obstacle lighting are contained in MOS 139, Section 9.33.

Micrositing

13. The potential micrositing of the WTGs and WMTs has been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level within 100 m of the nominal WTG and WMT positions. Providing the micrositing is within 100 m of the WTGs and WMTs is likely to not 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 PAIA would remain the same.

Overhead transmission line

14. Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial application operators and marked in accordance with Part 139 MOS 2019 Chapter 8 Division 10 section 8.110 (7) and section 8.110 (8).

Triggers for review

15. 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, including the regulatory framework

    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. WTG coordinates and heights

ANNEXURE 1 – REFERENCES

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

- Airservices Australia:
    - Aeronautical Information Package; including AIP Book, Departure and Approach Procedures and En Route Supplement Australia, dated 23 March 2023
    - Designated Airspace Handbook, effective 1 December 2022
- Australian Government, Department of Infrastructure, Transport, Regional Development and Communications:
    - National Airport Safeguarding Framework, Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers*, dated July 2012
- CASA:
    - Civil Aviation Regulations (CAR) 1998, as amended
    - Civil Aviation Safety Regulations (CASR) 1998, as amended
    - CASR Part 91, (*General Operating and Flight Rules*) MOS dated 2 April 2022
    - CASR Part 139 (*Aerodromes*) MOS 2019, dated 13 August 2020
    - CASR Part 173 MOS, *Standards Applicable to Instrument Flight Procedure Design*, V1.8 11 August 2022
    - Advisory Circular (AC) 91-02 v1.1*, Guidelines for aeroplanes with MTOW not exceeding 5700 kg – Suitable places to take off and land*, dated November 2021
    - AC 91-10 v1.1, *Operations in the vicinity of non-controlled aerodromes*, dated November 2021
    - AC 139.E-01 v1.0, *Reporting of Tall Structures*, dated December 2021
    - AC 139.E-05 v1.0, *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome*, dated May 2021
- EUROCONTROL, *European Organisation for the safety of air navigation, EUROCONTROL Guidelines, how to assess the potential impact of wind turbines surveillance sensors*, edition 1.2, ISBN: 978-2-87497-043-6, Reference number: EUROCONTROL-GUID-130, September 2014
- International Civil Aviation Organization (ICAO):
    - Doc 8168 *Procedures for Air Navigation Services—Aircraft Operations (PANS-OPS)*
    - Annex 14—*Aerodromes*
- Standards Australia:
    - ISO 31000:2018 *Risk management—Guidelines*
- OzRunways, aeronautical navigation chart extracts, dated 15 February 2023.

ANNEXURE 2 – DEFINITIONS

Term	*Definition*
Aerial Application 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: 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.

Term	*Definition*
Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.
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.

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 ☐ 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 ± 25% cd when the background luminance is 50 cd/m² 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.

Wind monitoring towers

The details of the WMT were introduced in **Section 4** of this report.

Consideration could be given to marking any WMTs according to the requirements set out in Part 139 MOS 2019 Chapter 8 Division 10 Obstacle Markings; specifically:

> *8.110 Marking of Hazardous Obstacles*
>
> *(5) As illustrated in Figure 8.110 (5), long, narrow structures like masts, poles and towers which are hazardous obstacles must be marked in contrasting colour bands so that the darker colour is at the top; and the bands are, as far as physically possible, marked at right angles along the length of the long, narrow structure; and have a length ("z" in Figure 8.110 (5)) that is, approximately, the lesser of: 1/7 of the height of the structure; or 30 m.*
>
> *(7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables. Note: Spheres and pyramids are examples of 3-dimensional objects.*
>
> *(8) The objects mentioned in subsection (7) must:*
> *(a) be approximately equivalent in size to a cube with 600 mm sides; and*
> *(b) be spaced 30 m apart along the length of the wire or cable.*

NASF Guideline D suggests consideration of the following measures specific to the marking and lighting of WMTs:

- the top 1/3 of wind monitoring towers to painted in alternating contrasting bands of colour. Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998. In areas where aerial application operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers
- marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires
- ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation **or**
- a flashing strobe light during daylight hours.

Temporary WMTs installed prior to WTG installation and WMTs not in close proximity to a WTG should be lit with medium-intensity steady red obstacle lighting at the top of the WMT mast. Characteristics of medium-intensity obstacle lighting is contained in MOS 139, Section 9.33

Overhead transmission lines

Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial application operators and marked in accordance with Part 139 MOS 2019 Chapter 8 Division 10 section 8.110 (7) and section 8.110 (8):

8.110 Marking of hazardous obstacles

(7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables. Note: Spheres and pyramids are examples of 3-dimensional objects.

(8) The objects mentioned in subsection (7) must:

(a) be approximately equivalent in size to a cube with 600 mm sides; and

(b) be spaced 30 m apart along the length of the wire or cable.

ANNEXURE 4 – PROJECT TURBINE COORDINATES AND HEIGHTS

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T001	6011499.6	612350.0	100.36	280	380.36	1247.89	N/A	N/A	N/A	N/A
T002	6011490.3	613006.1	100.68	280	380.68	1248.94	N/A	N/A	N/A	N/A
T003	6010723.2	610692.5	102.67	280	382.67	1255.49	N/A	N/A	N/A	N/A
T004	6010698.8	612338.1	99.25	280	379.25	1244.26	N/A	N/A	N/A	N/A
T005	6010689.1	612994.2	99.31	280	379.31	1244.44	N/A	N/A	N/A	N/A
T006	6010379.7	613807.2	104.12	280	384.12	1260.22	N/A	N/A	N/A	N/A
T007	6010320.2	614624.0	103.03	280	383.03	1256.66	N/A	N/A	N/A	N/A
T008	6010288.5	611245.5	103.05	280	383.05	1256.74	N/A	N/A	N/A	N/A
T009	6009740.3	612323.9	102.88	280	382.88	1256.18	N/A	N/A	N/A	N/A
T010	6009730.5	612980.0	104.56	280	384.56	1261.68	N/A	N/A	N/A	N/A
T011	6009718.4	613797.4	102.93	280	382.93	1256.35	N/A	N/A	N/A	N/A
T012	6009706.3	614614.9	101.49	280	381.49	1251.60	N/A	N/A	N/A	N/A
T013	6009694.1	615432.3	99.51	280	379.51	1245.10	N/A	N/A	N/A	N/A
T014	6009679.3	616435.5	104.74	280	384.74	1262.26	N/A	N/A	N/A	N/A
T015	6009620.8	611023.8	105.30	280	385.30	1264.12	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T016	6008835.5	610664.5	105.67	280	385.67	1265.32	N/A	N/A	N/A	N/A
T017	6008811.1	612310.1	103.78	280	383.78	1259.12	N/A	N/A	N/A	N/A
T018	6008801.4	612966.2	101.96	280	381.96	1253.13	N/A	N/A	N/A	N/A
T019	6008789.2	613783.6	104.45	280	384.45	1261.33	N/A	N/A	N/A	N/A
T020	6008777.1	614601.1	99.57	280	379.57	1245.29	N/A	N/A	N/A	N/A
T021	6008750.1	616421.7	106.95	280	386.95	1269.52	N/A	N/A	N/A	N/A
T022	6008192.5	610992.7	103.59	280	383.59	1258.50	N/A	N/A	N/A	N/A
T023	6007710.5	611530.2	106.73	280	386.73	1268.79	N/A	N/A	N/A	N/A
T024	6007699.1	612293.6	103.54	280	383.54	1258.34	N/A	N/A	N/A	N/A
T025	6007689.4	612949.7	104.85	280	384.85	1262.64	N/A	N/A	N/A	N/A
T026	6007677.3	613767.1	103.27	280	383.27	1257.43	N/A	N/A	N/A	N/A
T027	6007665.2	614584.6	101.32	280	381.32	1251.04	N/A	N/A	N/A	N/A
T028	6007653.0	615402.0	95.56	280	375.56	1232.15	N/A	N/A	N/A	N/A
T029	6007626.3	617203.3	106.67	280	386.67	1268.59	N/A	N/A	N/A	N/A
T030	6007616.7	617853.4	104.39	280	384.39	1261.12	N/A	N/A	N/A	N/A
T031	6006638.3	616390.4	106.17	280	386.17	1266.96	N/A	N/A	N/A	N/A
T032	6006626.4	617188.5	109.51	280	389.51	1277.91	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T033	6006616.7	617840.8	111.96	280	391.96	1285.97	N/A	N/A	N/A	N/A
T034	6006327.4	621916.5	97.55	280	377.55	1238.69	N/A	N/A	N/A	N/A
T035	6006304.6	623433.9	99.45	280	379.45	1244.93	N/A	N/A	N/A	N/A
T036	6005845.4	622716.5	98.22	280	378.22	1240.87	N/A	N/A	N/A	N/A
T037	6005638.4	616375.6	103.06	280	383.06	1256.77	N/A	N/A	N/A	N/A
T038	6005634.7	623886.8	98.65	280	378.65	1242.28	N/A	N/A	N/A	N/A
T039	6005626.5	617175.5	106.42	280	386.42	1267.79	N/A	N/A	N/A	N/A
T040	6005065.1	621474.4	99.15	280	379.15	1243.94	N/A	N/A	N/A	N/A
T041	6004638.5	616360.7	100.25	280	380.25	1247.55	N/A	N/A	N/A	N/A
T042	6004626.6	617160.6	102.93	280	382.93	1256.33	N/A	N/A	N/A	N/A
T043	6003952.6	617807.0	110.16	280	390.16	1280.06	N/A	N/A	N/A	N/A
T044	6003638.6	616345.9	105.70	280	385.70	1265.42	N/A	N/A	N/A	N/A
T045	6003591.1	619532.0	113.96	280	393.96	1292.52	N/A	N/A	N/A	N/A
T046	6003579.5	620331.9	104.95	280	384.95	1262.97	N/A	N/A	N/A	N/A
T047	6003567.6	621131.8	101.11	280	381.11	1250.38	N/A	N/A	N/A	N/A
T048	6003554.1	622043.3	99.78	280	379.78	1246.01	N/A	N/A	N/A	N/A
T049	6003543.3	622769.7	100.04	280	380.04	1246.86	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T050	6002637.2	616433.2	107.07	280	387.07	1269.91	N/A	N/A	N/A	N/A
T051	6002591.0	619548.1	113.39	280	393.39	1290.66	N/A	N/A	N/A	N/A
T052	6002579.6	620317.1	106.51	280	386.51	1268.08	N/A	N/A	N/A	N/A
T053	6002567.5	621117.0	102.96	280	382.96	1256.44	N/A	N/A	N/A	N/A
T054	6002554.2	622028.5	101.52	280	381.52	1251.71	N/A	N/A	N/A	N/A
T055	6002542.3	622828.4	100.47	280	380.47	1248.28	N/A	N/A	N/A	N/A
T056	6001637.9	616378.8	106.30	280	386.30	1267.38	N/A	N/A	N/A	N/A
T057	6001626.9	617116.1	106.45	280	386.45	1267.86	N/A	N/A	N/A	N/A
T058	6001617.2	617774.3	108.00	280	388.00	1272.95	N/A	N/A	N/A	N/A
T059	6001603.2	618716.9	110.63	280	390.63	1281.58	N/A	N/A	N/A	N/A
T060	6001591.6	619502.3	115.13	280	395.13	1296.36	N/A	N/A	N/A	N/A
T061	6001579.7	620302.3	110.55	280	390.55	1281.33	N/A	N/A	N/A	N/A
T062	6001567.8	621102.2	104.36	280	384.36	1261.01	N/A	N/A	N/A	N/A
T063	6001554.3	622013.7	104.15	280	384.15	1260.33	N/A	N/A	N/A	N/A
T064	6001542.4	622814.2	103.17	280	383.17	1257.14	N/A	N/A	N/A	N/A
T065	6001532.5	623484.8	103.21	280	383.21	1257.24	N/A	N/A	N/A	N/A
T066	6000663.3	614655.4	105.46	280	385.46	1264.63	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T067	6000648.9	615630.6	107.89	280	387.89	1272.61	N/A	N/A	N/A	N/A
T068	6000638.9	616301.4	104.87	280	384.87	1262.71	N/A	N/A	N/A	N/A
T069	6000627.1	617101.3	110.01	280	390.01	1279.56	N/A	N/A	N/A	N/A
T070	6000606.7	618472.1	108.01	280	388.01	1273.01	N/A	N/A	N/A	N/A
T071	6000593.1	619387.8	116.17	280	396.17	1299.77	N/A	N/A	N/A	N/A
T072	6000579.8	620287.4	115.61	280	395.61	1297.93	N/A	N/A	N/A	N/A
T073	6000567.9	621087.3	106.45	280	386.45	1267.89	N/A	N/A	N/A	N/A
T074	6000554.4	621998.8	104.28	280	384.28	1260.76	N/A	N/A	N/A	N/A
T075	6000542.5	622798.7	106.13	280	386.13	1266.84	N/A	N/A	N/A	N/A
T076	6000530.7	623599.8	104.36	280	384.36	1261.02	N/A	N/A	N/A	N/A
T077	6000400.5	626138.5	104.43	280	384.43	1261.26	N/A	N/A	N/A	N/A
T078	5999663.5	614640.6	106.81	280	386.81	1269.05	N/A	N/A	N/A	N/A
T079	5999649.0	615615.7	111.89	280	391.89	1285.74	N/A	N/A	N/A	N/A
T080	5999639.0	616286.6	112.81	280	392.81	1288.75	N/A	N/A	N/A	N/A
T081	5999627.2	617086.5	107.22	280	387.22	1270.40	N/A	N/A	N/A	N/A
T082	5999593.3	619372.9	113.90	280	393.90	1292.32	N/A	N/A	N/A	N/A
T083	5999587.7	626866.3	101.73	280	381.73	1252.40	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T084	5999579.9	620272.6	118.55	280	398.55	1307.56	N/A	N/A	N/A	N/A
T085	5999568.0	621072.5	108.91	280	388.91	1275.94	N/A	N/A	N/A	N/A
T086	5999556.0	621985.2	104.42	280	384.42	1261.23	N/A	N/A	N/A	N/A
T087	5999518.7	624396.8	104.34	280	384.34	1260.96	N/A	N/A	N/A	N/A
T088	5999500.5	625623.4	104.70	280	384.70	1262.15	N/A	N/A	N/A	N/A
T089	5998847.1	613949.9	110.23	280	390.23	1280.29	N/A	N/A	N/A	N/A
T090	5998660.9	614804.9	107.35	280	387.35	1270.85	N/A	N/A	N/A	N/A
T091	5998649.1	615600.9	105.85	280	385.85	1265.91	N/A	N/A	N/A	N/A
T092	5998639.1	616271.7	111.59	280	391.59	1284.75	N/A	N/A	N/A	N/A
T093	5998627.3	617071.6	110.32	280	390.32	1280.59	N/A	N/A	N/A	N/A
T094	5998606.9	618442.4	111.88	280	391.88	1285.70	N/A	N/A	N/A	N/A
T095	5998593.4	619358.1	114.83	280	394.83	1295.36	N/A	N/A	N/A	N/A
T096	5998580.0	620257.8	112.86	280	392.86	1288.93	N/A	N/A	N/A	N/A
T097	5998568.2	621057.7	111.42	280	391.42	1284.20	N/A	N/A	N/A	N/A
T098	5998554.6	621969.2	108.56	280	388.56	1274.81	N/A	N/A	N/A	N/A
T099	5998542.8	622769.1	110.13	280	390.13	1279.96	N/A	N/A	N/A	N/A
T100	5998530.9	623569.0	108.35	280	388.35	1274.12	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T101	5997771.7	614455.7	109.95	280	389.95	1279.35	N/A	N/A	N/A	N/A
T102	5997607.1	618427.6	108.54	280	388.54	1274.74	N/A	N/A	N/A	N/A
T103	5997593.5	619343.3	109.77	280	389.77	1278.76	N/A	N/A	N/A	N/A
T104	5997580.1	620242.9	117.26	280	397.26	1303.34	N/A	N/A	N/A	N/A
T105	5997568.3	621042.8	112.60	280	392.60	1288.06	N/A	N/A	N/A	N/A
T106	5997554.7	621954.3	108.70	280	388.70	1275.27	N/A	N/A	N/A	N/A
T107	5997542.9	622754.2	110.22	280	390.22	1280.25	N/A	N/A	N/A	N/A
T108	5997531.0	623554.2	104.61	280	384.61	1261.86	N/A	N/A	N/A	N/A
T109	5997019.0	624359.7	105.19	280	385.19	1263.75	N/A	N/A	N/A	N/A
T110	5997000.8	625586.3	103.88	280	383.88	1259.45	N/A	N/A	N/A	N/A
T111	5996607.2	618412.7	109.32	280	389.32	1277.29	N/A	N/A	N/A	N/A
T112	5996593.6	619328.4	109.95	280	389.95	1279.38	N/A	N/A	N/A	N/A
T113	5996580.2	620228.1	117.75	280	397.75	1304.97	N/A	N/A	N/A	N/A
T114	5996568.2	621028.0	113.20	280	393.20	1290.02	N/A	N/A	N/A	N/A
T115	5996554.8	621939.5	110.85	280	390.85	1282.31	N/A	N/A	N/A	N/A
T116	5996543.0	622739.4	108.79	280	388.79	1275.56	N/A	N/A	N/A	N/A
T117	5996531.1	623539.3	107.92	280	387.92	1272.69	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T118	5995652.5	615351.8	109.52	280	389.52	1277.94	N/A	N/A	N/A	N/A
T119	5995607.3	618397.9	106.14	280	386.14	1266.87	N/A	N/A	N/A	N/A
T120	5995593.7	619313.6	108.86	280	388.86	1275.77	N/A	N/A	N/A	N/A
T121	5995580.3	620213.3	114.49	280	394.49	1294.27	N/A	N/A	N/A	N/A
T122	5995568.3	621013.2	120.49	280	400.49	1313.93	N/A	N/A	N/A	N/A
T123	5995555.0	621924.7	109.52	280	389.52	1277.94	N/A	N/A	N/A	N/A
T124	5995543.1	622724.6	110.28	280	390.28	1280.46	N/A	N/A	N/A	N/A
T125	5995531.2	623524.5	105.41	280	385.41	1264.48	N/A	N/A	N/A	N/A
T126	5995282.8	624264.2	102.47	280	382.47	1254.83	N/A	N/A	N/A	N/A
T127	5994639.8	616194.8	108.73	280	388.73	1275.37	N/A	N/A	N/A	N/A
T128	5994592.3	619398.5	111.11	280	391.11	1283.16	N/A	N/A	N/A	N/A
T129	5994580.5	620198.4	111.29	280	391.29	1283.75	N/A	N/A	N/A	N/A
T130	5994568.4	620998.3	119.56	280	399.56	1310.89	N/A	N/A	N/A	N/A
T131	5994555.1	621909.8	109.24	280	389.24	1277.02	N/A	N/A	N/A	N/A
T132	5994543.2	622709.7	110.94	280	390.94	1282.61	N/A	N/A	N/A	N/A
T133	5994531.3	623509.7	104.60	280	384.60	1261.80	N/A	N/A	N/A	N/A
T134	5994515.8	624556.9	106.19	280	386.19	1267.03	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T135	5993767.8	618551.9	108.61	280	388.61	1274.97	N/A	N/A	N/A	N/A
T136	5993613.8	615924.2	109.90	280	389.90	1279.20	N/A	N/A	N/A	N/A
T137	5993587.2	617714.8	109.47	280	389.47	1277.80	N/A	N/A	N/A	N/A
T138	5993562.5	619383.2	109.77	280	389.77	1278.77	N/A	N/A	N/A	N/A
T139	5993550.6	620183.1	111.13	280	391.13	1283.22	N/A	N/A	N/A	N/A
T140	5993538.8	620983.1	114.66	280	394.66	1294.81	N/A	N/A	N/A	N/A
T141	5993535.2	616765.4	108.71	280	388.71	1275.28	N/A	N/A	N/A	N/A
T142	5993525.2	621895.0	111.96	280	391.96	1285.95	N/A	N/A	N/A	N/A
T143	5993513.4	622694.5	107.55	280	387.55	1271.49	N/A	N/A	N/A	N/A
T144	5993501.5	623496.0	105.79	280	385.79	1265.70	N/A	N/A	N/A	N/A
T145	5993490.9	624211.6	103.90	280	383.90	1259.53	N/A	N/A	N/A	N/A
T146	5992631.4	616752.4	113.71	280	393.71	1291.71	N/A	N/A	N/A	N/A
T147	5992555.3	621881.3	111.40	280	391.40	1284.13	N/A	N/A	N/A	N/A
T148	5992543.4	622681.2	107.03	280	387.03	1269.77	N/A	N/A	N/A	N/A
T149	5992531.5	623481.1	109.58	280	389.58	1278.14	N/A	N/A	N/A	N/A
T150	5992519.5	624290.3	106.37	280	386.37	1267.62	N/A	N/A	N/A	N/A
T151	5992425.2	617697.5	109.93	280	389.93	1279.29	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T152	5991718.5	616738.8	111.44	280	391.44	1284.25	N/A	N/A	N/A	N/A
T153	5991263.2	617680.3	113.50	280	393.50	1291.01	N/A	N/A	N/A	N/A
T154	5984162.8	608431.2	111.25	280	391.25	1283.63	N/A	N/A	N/A	N/A
T155	5984058.2	609279.4	115.38	280	395.38	1297.18	N/A	N/A	N/A	N/A
T156	5983348.1	608418.6	112.79	280	392.79	1288.69	N/A	N/A	N/A	N/A
T157	5983312.0	610753.2	113.45	280	393.45	1290.84	N/A	N/A	N/A	N/A
T158	5983298.2	611647.4	118.84	280	398.84	1308.55	N/A	N/A	N/A	N/A
T159	5983284.3	612541.5	116.56	280	396.56	1301.04	N/A	N/A	N/A	N/A
T160	5983259.7	614135.2	119.65	280	399.65	1311.19	N/A	N/A	N/A	N/A
T161	5983247.4	614929.0	123.78	280	403.78	1324.73	N/A	N/A	N/A	N/A
T162	5983165.4	616543.8	120.49	280	400.49	1313.96	N/A	N/A	N/A	N/A
T163	5982938.9	615807.1	122.95	280	402.95	1322.01	N/A	N/A	N/A	N/A
T164	5982406.6	608246.6	113.53	280	393.53	1291.09	N/A	N/A	N/A	N/A
T165	5982305.5	610737.7	117.17	280	397.17	1303.03	N/A	N/A	N/A	N/A
T166	5982291.7	611631.8	118.48	280	398.48	1307.34	N/A	N/A	N/A	N/A
T167	5982277.8	612526.0	121.01	280	401.01	1315.65	N/A	N/A	N/A	N/A
T168	5982265.5	613325.9	116.59	280	396.59	1301.13	N/A	N/A	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T169	5982240.9	614913.5	123.14	280	403.14	1322.65	N/A	N/A	N/A	N/A
T170	5982227.2	615796.1	123.27	280	403.27	1323.06	N/A	N/A	N/A	N/A
T171	5982185.0	614007.1	118.98	280	398.98	1308.99	N/A	N/A	N/A	N/A
T172	5981305.6	610722.2	115.47	280	395.47	1297.46	N/A	N/A	N/A	N/A
T173	5981291.8	611616.3	115.72	280	395.72	1298.30	N/A	N/A	N/A	N/A
T174	5981277.9	612510.5	123.26	280	403.26	1323.03	N/A	N/A	N/A	N/A
T175	5981265.6	613310.4	118.15	280	398.15	1306.27	N/A	N/A	N/A	N/A
T176	5981227.4	615780.7	122.88	280	402.88	1321.77	N/A	N/A	N/A	N/A
T177	5981213.7	616663.3	119.52	280	399.52	1310.76	N/A	N/A	N/A	N/A
T178	5980407.3	610169.7	120.22	280	400.22	1313.05	N/A	N/A	N/A	N/A
T179	5980391.9	611164.1	120.42	280	400.42	1313.70	N/A	N/A	N/A	N/A
T180	5980371.3	612496.5	121.17	280	401.17	1316.18	271.01	130.16	N/A	N/A
T181	5980358.9	613296.1	124.30	280	404.30	1326.44	271.01	133.29	N/A	N/A
T182	5980346.7	614090.2	119.40	280	399.40	1310.37	271.01	128.39	N/A	N/A
T183	5980334.4	614884.0	121.53	280	401.53	1317.35	271.01	130.52	N/A	N/A
T184	5980320.7	615766.6	121.91	280	401.91	1318.59	271.01	130.90	N/A	N/A
T185	5980307.1	616649.3	120.68	280	400.68	1314.58	271.01	129.67	N/A	N/A

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T186	5979314.2	610152.8	118.71	280	398.71	1308.10	271.01	127.70	N/A	N/A
T187	5979277.6	612518.0	120.76	280	400.76	1314.82	271.01	129.75	406.1	Clear
T188	5979265.8	613279.5	123.80	280	403.80	1324.79	271.01	132.79	391.2	12.595448
T189	5979253.5	614073.3	123.92	280	403.92	1325.21	271.01	132.91	375	28.923164
T190	5979241.3	614867.1	126.19	280	406.19	1332.64	271.01	135.18	359	47.18882
T191	5979226.3	615749.7	123.12	280	403.12	1322.57	271.01	132.11	341	62.117943
T192	5979214.0	616632.4	126.82	280	406.82	1334.70	271.01	135.81	323.9	82.917047
T193	5979584.7	617500.5	118.37	280	398.37	1307.00	271.01	127.36	306.9	91.474321
T194	5978771.8	612891.0	125.83	280	405.83	1331.47	271.01	134.82	384.9	20.930856
T195	5978265.9	613264.0	124.29	280	404.29	1326.41	271.01	133.28	392	12.291229
T196	5978253.7	614057.8	127.25	280	407.25	1336.12	271.01	136.24	376	31.250793
T197	5978241.2	614851.6	126.04	280	406.04	1332.16	271.01	135.03	360	46.041122
T198	5978227.7	615734.3	125.43	280	405.43	1330.16	271.01	134.42	343	62.432968
T199	5978211.6	616779.7	130.54	280	410.54	1346.91	271.01	139.53	322	88.53862
T200	5978199.4	617565.6	121.19	280	401.19	1316.24	271.01	130.18	306.9	94.289713
T201	5977674.3	612622.7	128.41	280	408.41	1339.92	271.01	137.40	406	2.408096
T202	5977470.1	613334.3	128.68	280	408.68	1340.82	271.01	137.67	392	16.68074

WTG	Northing	Easting	Terrain Elevation (m AHD)	WTG (m AGL)	Max Elevation (m)	Max Elevation (ft)	RWY 08 APCH SFC Horizontal Section Elevation (m AMSL)	Infringement (m)	RWY 26 T/O CLIMB SFC Elevation (m AMSL)	Infringement (m)
T203	5977253.8	614042.4	126.03	280	406.03	1332.10	271.01	135.02	N/A	N/A
T204	5977241.5	614836.2	126.47	280	406.47	1333.56	271.01	135.46	N/A	N/A
T205	5977227.9	615718.5	126.47	280	406.47	1333.55	271.01	135.46	N/A	N/A
T206	5977214.2	616601.4	131.06	280	411.06	1348.61	271.01	140.05	N/A	N/A
T207	5976253.9	614026.9	128.39	280	408.39	1339.86	N/A	N/A	N/A	N/A
T208	5976241.6	614820.7	126.54	280	406.54	1333.80	N/A	N/A	N/A	N/A
T209	5976228.0	615703.3	126.07	280	406.07	1332.24	N/A	N/A	N/A	N/A
T210	5976214.3	616586.0	128.63	280	408.63	1340.64	N/A	N/A	N/A	N/A
T211	5976201.0	617445.5	127.44	280	407.44	1336.73	N/A	N/A	N/A	N/A

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