

**FINAL REPORT**

**GELLIONDALE WIND FARM**

**AVIATION IMPACT ASSESSMENT**

*CCP60*

Report to:



**Synergy Wind Pty Ltd**

**22 August 2024**



**Chiron Aviation Consultants**  
**Essendon Vic 3040**  
**Australia**

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## EXECUTIVE SUMMARY

The proposed Gelliondale Wind Farm (GWF) will comprise 13 turbines with a tip height of 210m above ground level (AGL) located to the southwest of Yarram, toward Alberton and east of Welshpool.

There are two certified aerodromes, LaTrobe Valley (YLTV) and Yarram (YYRM) within 30nm (56km) of the GWF boundary. Each of these aerodromes has Pilot Activated Lighting (PAL) and published non-precision Instrument Approach Procedures (IAP). Three significant aerodromes, West Sale (YWSL) [certified], East Sale RAAF Base (YMES) [Military] and Longford Heliport (YUOF) [uncertified] are within 40nm of the GWF boundary. The uncertified aerodromes at Leongatha (YLEG) and Inverloch (YIVE) are within 35nm of the GWF boundary. An airstrip at Fish Creek has been identified on the aeronautical charts at approximately 25nm from the GWF boundary.

The Aviation Impact Statement (AIS) concluded that the GWF will not impact on the following:

- The Obstacle Limitation Surface (OLS) of the certified aerodromes
- The Lowest Safe Altitudes (LSALT) for air routes in the vicinity
- The Procedures for Air Navigation Services . Aircraft Operations (PANS-OPS) protected airspace associated with the Instrument Approach Procedures at Yarram and LaTrobe Valley certified aerodromes
- The performance of Civil Air Traffic Control (ATC) Communications, Navigation Aids and Surveillance (CNS) facilities
- The performance of Military Air Traffic Control (ATC) Communications, Navigation Aids and Surveillance (CNS) facilities at RAAF East Sale.

The AIS concluded that the GWF will not impact on the operations at West Sale, RAAF East Sale and the Longford Heliport. Similarly, the uncertified aerodromes at Leongatha and Inverloch as well as the airstrip at Fish Creek are sufficiently distant from the GWF for it to not impact on operations at these aerodromes.

The Qualitative Risk Assessment demonstrates that for the GWF:

- By day the wind turbines are conspicuous by their size and colour
- Night operations of aircraft do not occur below published or calculated LSALT
- Aerodromes equipped for night operations are not affected by the GWF

The GWF is below the East Sale RAAF Military Operating Areas.

The GWF turbines and meteorological monitoring masts are considered to be tall structures and must be reported to the Vertical Obstacles Database administered by Airservices Australia in accordance with CASA Advisory Circular AC139.E-01 v1.0 *Reporting tall structures*.

The GWF is considered to be a low risk to aviation safety and is therefore not a hazard to aircraft safety.



## 1. INTRODUCTION

The Gelliondale Wind Farm (GWF) is centred around the district of Gelliondale in southeast Victoria. The site is approximately 7.5km southwest of Yarram, 3km west of Alberton and 8km east of Welshpool. The GWF is located on open farmland and comprises 13 turbines with a tip height of 210m above ground level (AGL).



Figure 1 – Gelliondale Wind Farm Site Boundary (Google Earth)

### 1.1 Aerodromes and Airstrips

Aerodromes fall into three categories:

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

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

A Certified aerodrome is regulated under Civil Aviation Safety Regulation (CASR) 139.030. An aerodrome with a published instrument flight procedure must be Certified.

An Uncertified aerodrome is any other aerodrome, Aeroplane Landing Area (ALA) or airstrip. These range in capability and size from having a sealed runway with lighting



capable of accommodating corporate jet aircraft to a grass paddock that is smooth enough to land a single engine light aircraft or a purpose built aerial agricultural aircraft.

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

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

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

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

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

## 1.2 Aerodromes in the Area

There are two certified aerodromes within 30nm (56km) of the GWF boundary at: -

- Yarram (YYRM) - 6.7nm (12.41km) north northeast of turbine GWT11
- LaTrobe Valley (YLTV) . 25.29nm (46.84km) north of turbine GWT10.

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

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

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

<sup>4</sup> DAH, part of the AIP that lists the pertinent details of Australian airspace and aerodromes



Two significant aerodromes, one certified and one military are outside 30nm at -

- West Sale (YWSL) . 35.31nm (65.95km) north northeast of turbine GWT11.and
- RAAF East Sale (YMES) . 39.66nm (73.45km) north northeast of turbine GWT11.

The uncertified Longford Heliport (YUOF) is the base for helicopter operations supporting the Bass Strait oil and gas field. It is 34.83nm (64.50km) northeast of turbine GWT03.

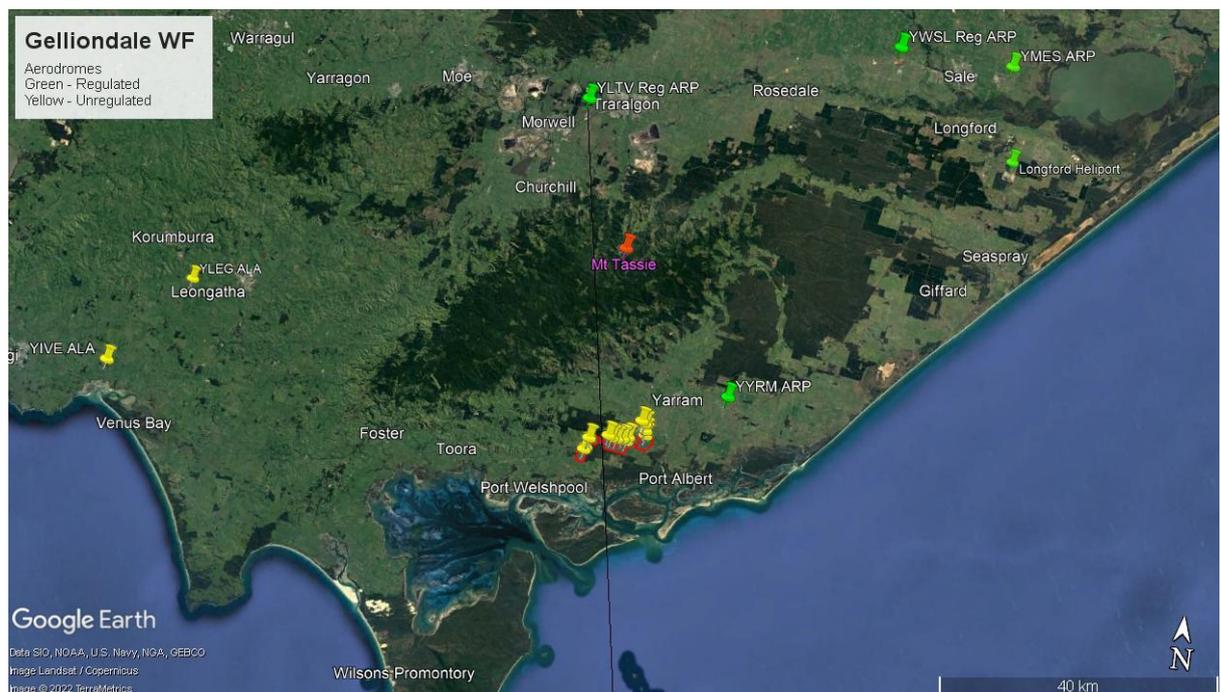


Figure 2 – Aerodromes in the area

The uncertified aerodromes at Leongatha (YLEG) and Inverloch (YIVE) are sufficiently distant from the GWF boundary for aerodrome operations to continue without impact.



### 1.3 Air Routes in the Area

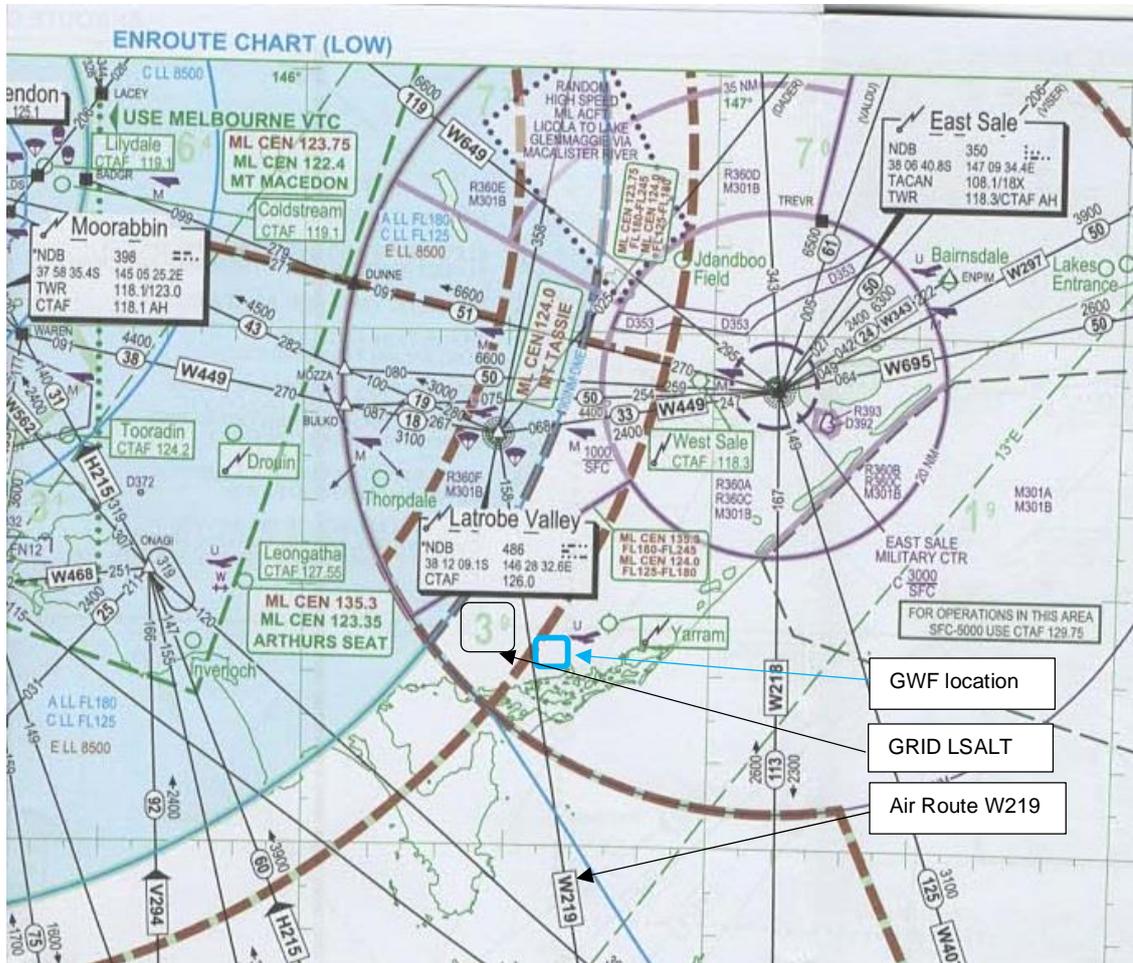


Figure 3 – Air Routes over GWF (AIP Charts ERC L1 13 June 2024)

The Lowest Safe Altitudes adjacent to the GWF are: -

Route	Segment	LSALT (ft)
Grid		3900
W219	ELMOR . LTV (northbound)	6500
W219	LTV . ELMOR (southbound)	3900

Table 1 – Lowest Safe Altitudes (AIP DAH section 23, 13 June 2024)



## 1.4 Airspace

The GWF is in Class G airspace with Class E airspace above having a lower limit of FL125 (12,500ft).

The GWF sits below East Sale Military Operating Areas M301A and M301B. These areas are used for military flying training associated with the RAAF Base at East Sale.

M301A has a lower limit of 4000ft and M301B has a lower limit of FL210 (21,000ft) and are part of a suite of Military Operating Airspace extending to a 50nm (92.6km) radius from the East Sale aerodrome.

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

Class E airspace is controlled airspace open to both IFR and VFR flights. IFR aircraft must have an ATC clearance and communicate with the ATC Centre.

A Control Area (CTA) is defined as a controlled airspace extending upwards from a specified limit above the earth.<sup>5+</sup>

Within Class G airspace an aircraft flying in accordance with the Visual Flight Rules (VFR) away from a populous area is, when flying below 3000ft, required by Civil Aviation Safety Regulation (CASR) 91.267 to remain at 500ft above the highest point of the terrain and any obstacle on it within a radius of 300m from a point on the terrain directly below the aircraft. For a wind farm this equates to 500ft above the turbine tip height. For the GWF, with a maximum tip height of 920ft (280m) Above Ground Level (AGL), this is  $920 + 500 = 1420$ ft AGL.

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

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<sup>5</sup> AIP Enroute, ENR 1.4 . 5, para 1.2.1, 13 June 2024



## 2. SCOPE

To meet the requirements of Synergy Wind Pty Ltd, the study required Chiron Aviation Consultants to examine the Gelliondale Wind Farm (GWF) development in relation to any impacts on aviation activity in the area and undertake the following tasks.

### 2.1 Aviation Impact Statement

Airservices Australia (AsA) require an Aviation Impact Statement (AIS) for wind farm developments. The Aviation Impact Statement is submitted to AsA and the Department of Defence for evaluation and consideration.

The AIS required the following tasks to be undertaken: -

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

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

### 2.2 Qualitative Risk Assessment

The QRA required the following tasks to be undertaken: -

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



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



### 3. METHODOLOGY

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

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

#### 3.1 Qualitative Risk Assessment

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

The methodology for the Qualitative Risk Assessment was as follows:

- The Australian AIP and CASA documents were reviewed to identify relevant physical and operational aviation issues that may impact on the requirement for lighting of the wind farm;
- Current topographical maps were studied to assess the local terrain and identify any local airstrips and any other relevant features;
- Key stakeholders, including local operators, recreational aviation groups and State Government Police Air Wing, Air Ambulance and Fire Services, were identified, contacted and interviewed to ascertain the extent of local aviation activity in the vicinity of the proposed wind farm. This included any informal



low flying areas and highly trafficked unpublished air routes that may exist within the vicinity of the proposed wind farm;

- Based on the above, the nature of any impacts as a consequence of the operation of the wind farm was considered and discussed in regard to;
  - General Aviation training;
  - Recreational and sport aviation activities;
  - Approved low flying activities (including aerial agricultural applications)
  - Any known highly trafficked VFR routes; and
  - Emergency Services (air ambulance, police and fire service);
- In addition, further consideration was given to the consequences (for the above elements) of the potential influence of topography and poor weather; and

Consideration of the NASF, Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* in relation to the QRA findings.



## 4. AVIATION IMPACT STATEMENT

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

### 4.1 Location



Figure 4 – GWF turbine locations (Google Earth)

### 4.2 Obstacles

The GWF proposes 13 turbines with a tip height of up to 210m AGL. The tallest turbine is GWT03 with a tip height of 220.6m above the Australian Height Datum (AHD). This equates to a tip height of 723.568ft AHD, adding the Minimum Obstacle Clearance (MOC) of 1000ft gives a safe altitude of 1723.568ft AHD. Rounded up to the nearest hundred feet provides a Lowest Safe Altitude (LSALT) of 1800ft.

The LSALT over the GWF is 1800ft.



### 4.3 Drawings

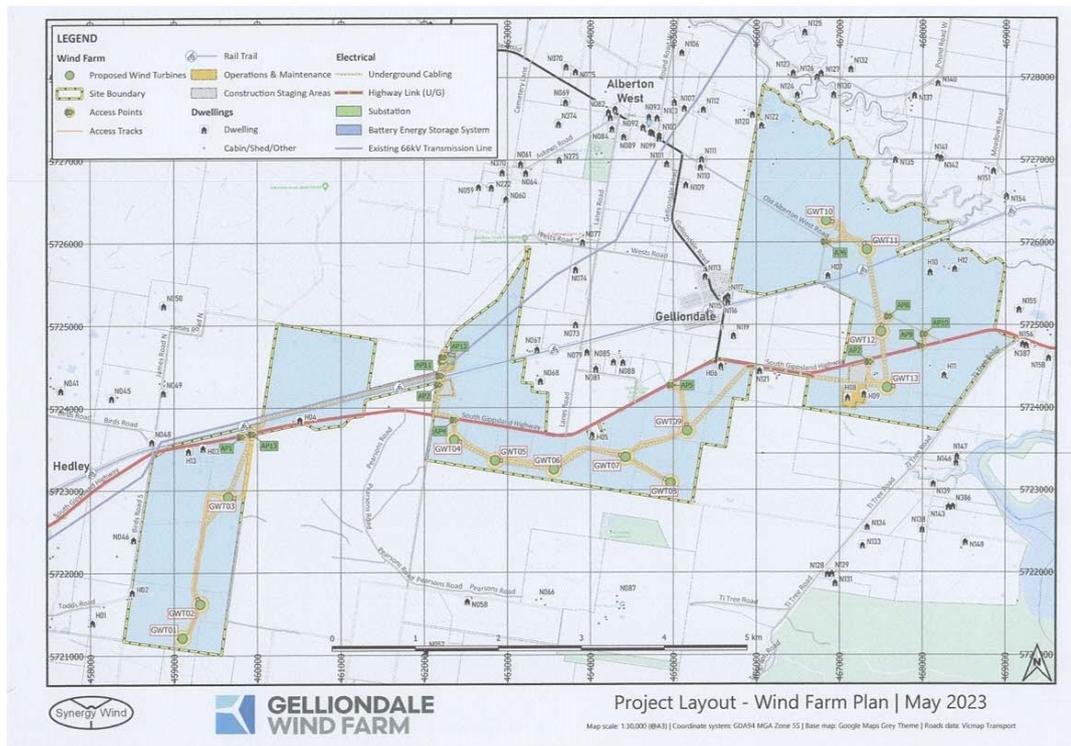


Figure 5 – Indicative Turbine Layout (GWF Pty Ltd)

### 4.4 Aerodromes within 30nm

There are two certified aerodromes within 30nm (56km) of the GWF boundary.

#### 4.4.1 LaTrobe Valley (YLTV)

LaTrobe Valley is a certified aerodrome with two runways. It is located 25.29nm north of turbine GWT10. At this distance, the GWF is beyond the Obstacle Limitation Surfaces (maximum 8.1nm) for each of the runways.

The sealed runway, RWY 03/21, is 1430m in length and is equipped with Pilot Activated Lighting (PAL). The second unsealed runway, RWY 09/27 is 919m in length. The aerodrome is operated by the LaTrobe Regional Airport Board. The aerodrome is limited to aircraft with a Maximum Take-Off Weight (MTOW) not above 5700kg.

YLTV has published instrument approach procedures (IAP) for RWY03 and RWY21. The 25nm MSA in the segment closest to the GWF is 3900ft, which is above the GWF LSALT of 1800ft.

The GWF will not impact on operations at YLTV.



#### 4.4.2 Yarram (YYRM)

Yarram is a certified aerodrome with two runways. It is located 6.7nm (12.41km) north northeast of turbine GWT11.

The main runway, RWY 09/27 is 756m in length, unrated gravel and equipped with PAL and RNP instrument approach procedures. The second, runway, RWY 05/23 is 1090m in length, unrated grass. The Wellington Shire Council operate the aerodrome.

The GWF is outside the Obstacle Limitation Surfaces (OLS) for YYRM. The OLS chart for YYRM shows RWY09/27 being a Code 2 non-precision Instrument Approach runway with standard approach and take-off surfaces as per CASA MOS 139 Chapter 7, tables 7.15(1) and 7.16(1). These surfaces extend to 5500m from the end of the runway as a trapezoid shape. RWY 05/23 is a Code 2 non-instrument runway. The GWF is beyond the OLS for each runway.

Yarram has published instrument approach procedures (IAP) for RWY09 and RWY27.

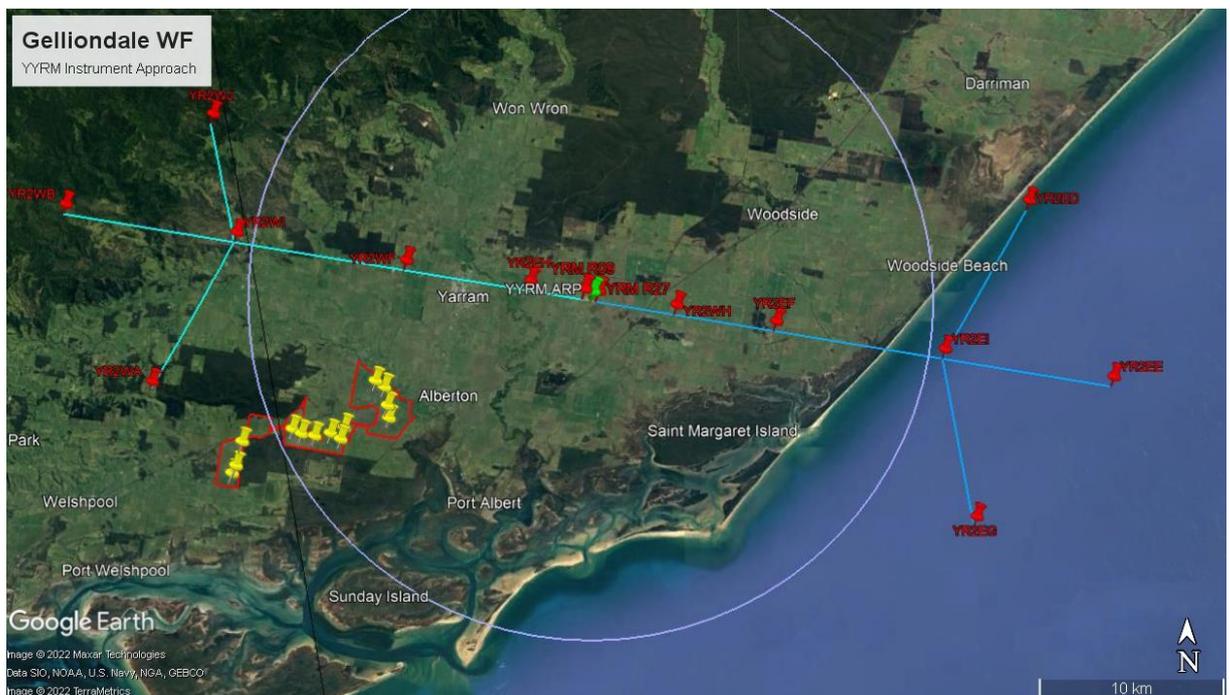


Figure 6 GWF and YYRM Instrument Approach Paths

The blue circle is the 10nm MSA, the green line is the RWY09 instrument approach path and the blue line is the RWY27 instrument approach path.

The GWF sits below the 10nm MSA for the YYRM RNP IAP. The MSA over the GWF is 3900ft. At an LSALT of 1800ft the GWF is below the 10nm MSA.

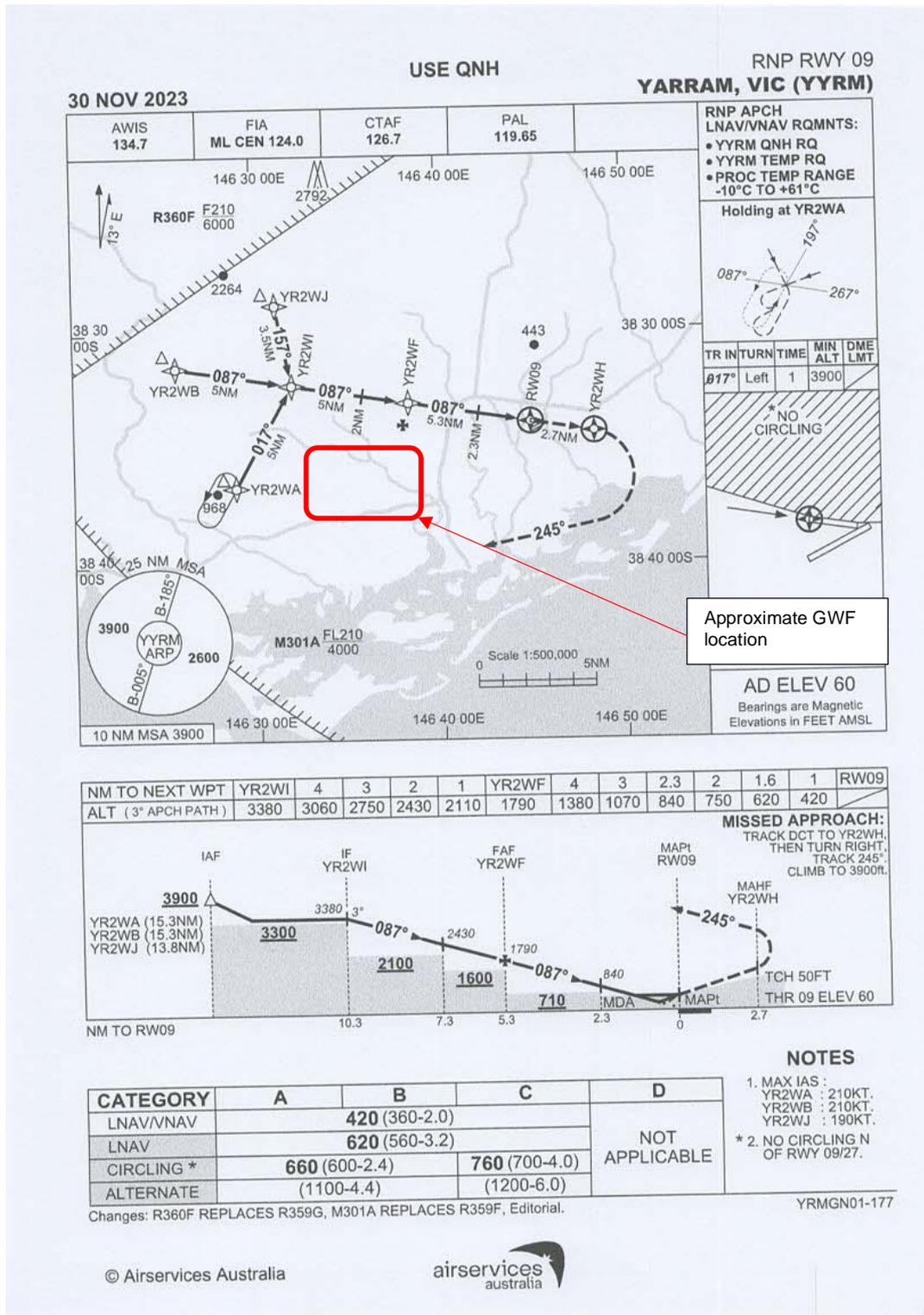


Figure 7 – YYRM RNP RWY09 Approach Plate<sup>6</sup>

<sup>6</sup> AIP DAP YRMGN01-177 dated 30 November 2023



The RWY09 approach plate shows a Segment MSA of 2100ft from YR2WI to 7.3nm from RWY09. From 7.3nm to YR2WF the Segment MSA is 1600ft.

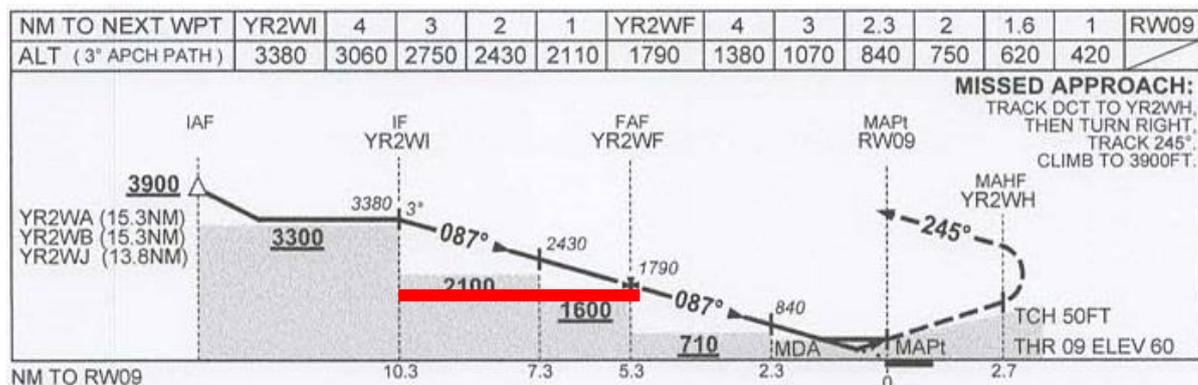


Figure 8 – YYRM RNP RWY09 IAP elevation with distance to threshold.  
 Red line is approximate location of GWF.

Turbines GWT10 and GWT09 are 3.62nm and 3.77nm respectively, south of the RWY09 path and therefore are outside the 2.5nm buffer applied to the Segment MSA between 7.3nm and YR2WF. The turbines do not impact the RWY09 IAP.

Turbine GWT09 is 5.31nm southwest of YR2EH, with an LSALT of 1800ft. This is sufficiently distant from the RWY27 missed approach path to facilitate the required turn and climb to the 10nm MSA of 3900ft.

The GWF will not impact on operations at YYRM.

#### 4.5 Significant Certified and Military aerodromes beyond 30nm

##### 4.5.1 West Sale (YWSL)

West Sale is a certified aerodrome with three runways. It is located 35.19nm (65.17km) north northeast of turbine GWT10.

The primary runway, RWY 09/27 is 1803m in length and equipped with PAL. The Wellington Shire Council operate the aerodrome.

West Sale has published instrument approach procedures for RWY 27 and RWY 09. The 25nm Minimum Safe Altitude (MSA) is 3900ft in the relevant sector.

The GWF is beyond the Procedures for Air Navigation Services . Aircraft Operations (PANS-OPS) protected airspace for the YWSL IAP.

The GWF will not impact the operations at YWSL.

##### 4.5.2 RAAF Base East Sale (YMES)

East Sale is a Military aerodrome and training facility operated by the RAAF. It is located



39.65nm (73.42km) north northeast of turbine GWT11.

As noted elsewhere, the GWF sits below the Military Operating Airspace associated with RAAF East Sale.

The GWF will not impact the operations at YMES.

#### **4.5.3 Longford Heliport (YUOF)**

The Longford heliport is an uncertified helicopter landing area operated by ESSO Australia. It is the base for helicopter operations supporting the Bass Strait oil fields and is located 34.83nm (64.50km) northeast of turbine GWT03. YUOF has an RNAV (GNSS) non-precision instrument approach procedure for helicopter use only.

The GWF will not impact the operations at YUOF.

### **4.6 Other aerodromes and airstrips**

#### **4.6.1 Leongatha (YLEG)**

Leongatha is an uncertified aerodrome listed in ERSA and shown on the Visual Navigation Chart (VNC) Melbourne and the World Aeronautical Chart (WAC) Melbourne (3470). It is located 32.88nm (60.89km) west northwest of turbine GWT01.

The GWF will not impact the operations at YLEG.

#### **4.6.2 Inverloch (YIVE)**

Inverloch is an uncertified aerodrome shown on the Visual Navigation Chart (VNC) Melbourne and the World Aeronautical Chart (WAC) Melbourne (3470). It is listed in the DAH as a verified ALA not listed in ERSA. It is located 37.60nm (69.63km) west of turbine GWT01.

The GWF will not impact the operations at YIVE.

#### **4.6.3 Fish Creek ALA**

An aeroplane landing area (ALA) is shown on the Visual Navigation Chart (VNC) Melbourne and the World Aeronautical Chart (WAC) Melbourne (3470). It is not listed in ERSA or the DAH. The ALA does not show up on Google Earth or *Mapshare Vic*. From the charts it is located to the southwest of the Fish Creek town. This places it sufficiently distant from the GWF for there to be no impact on operations at the ALA.



#### 4.7 Air Routes and Lowest Safe Altitudes

The Lowest Safe Altitude over the GWF is 1800ft and sits below the GRID LSALT of 3900ft.

The published air routes are shown in Figure 2 in section 1.4.

Route	Segment	LSALT (ft)
Grid		3900
W219	ELMOR . LTV (northbound)	6500
W219	LTV . ELMOR (southbound)	3900

Table 2 – Lowest Safe Altitudes (AIP DAH section 23 13 June 2024)

The W219 segment from LTV to ELMOR passes overhead the GWF.

The GWF does not impact the LSALT of any published air route.

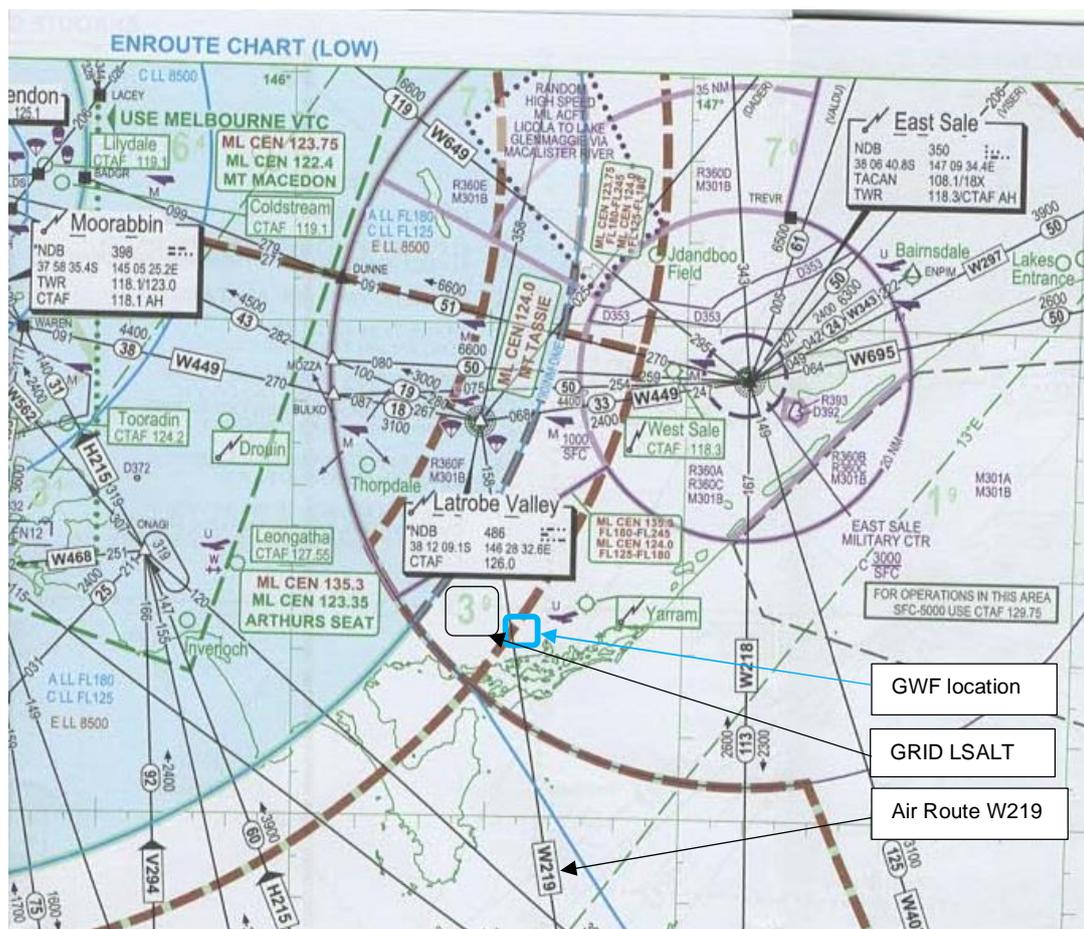


Figure 9 – Air Routes over GWF (AIP Charts ERC L1 13 June 2024)



## 4.8 Airspace

As shown in section 1.5, the GWF is in Class G airspace below the RAAF East Sale Military Operating Airspace M301A and M301B. The GWF is below M301A which has a lower limit of 4000ft. This is above the GWF LSALT of 1800ft.

## 4.9 Communications, Navigation and Surveillance (CNS)

Wind turbines by their size and construction may cause interference to air traffic control communications, navigation and surveillance (CNS) facilities. Airservices Australia (AsA) recommends the use of the *EuroControl Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors*<sup>7</sup>.

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

### 4.9.1 Communications

There is an Airservices Australia ATC communications facility at Mt Tassie 13.28nm (24.59km) to the north of the GWF at turbine GWT10. The Mt Tassie site is at an elevation of 736m AHD. The tallest GWF turbine is GWT03 at 220.6m AHD.

The GWF will have no impact on the operations of these facilities.

### 4.9.2 Navigation

The nearest ground based navigation aid is the Non Directional Beacon (NDB) (486kHz) at YLTV, 25.43nm (47.09km) north of turbine GWT10. This NDB has a range of 30nm.

An NDB is a low frequency radio transmitter and will not be affected by the GWF turbines.

There is an NDB (350kHz) at YMES, 39.66nm (73.45km) north northeast of turbine GWT03. This NDB has a daytime range of 120nm and a night time range of 90nm.

YMES has a TACAN navigation aid as well as an Instrument Landing System (ILS). These are VHF/UHF facilities and are sufficiently distant to be unaffected by the GWF.

### 4.9.3 Surveillance

The nearest civil aviation surveillance facility is a Secondary Surveillance Radar (SSR) at Mt Macedon 221.67km (119.69nm) northwest. The Primary Surveillance Radar (PSR) at Gellibrand Hill (Tullamarine airport) is 182.42km (98.5nm) northwest.

The applicable document, as referred to in the Airservices letter, is the Eurocontrol

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<sup>7</sup> Available at <http://www.eurocontrol.int/sites/default/files/publication/files/20140909-impact-wind-turbines-sur-sensors-guid-v1.2.pdf>



Guidelines “How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors” edition 1.2, September 2014 (EUROCONTROL-GUID-130).

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

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

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

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

*Note: There is no Zone 3 for SSR*

The Mt Macedon SSR, at 221.67km (119.69nm) southeast is well beyond the 16km distance, therefore no assessment is required.

The Primary Surveillance Radar (PSR) at Gellibrand Hill (Tullamarine airport) is 182.42km (98.5nm) northwest. The antenna height is 228m AHD. The maximum tip height of the GWF is 220.6m AHD, however there is high ground of approximately 460m AHD between the PSR site and the GWF turbines. This will put the GWF outside the line of site of the Gellibrand Hill PSR, therefore **no assessment is required**.

The GWF is beyond the line of site of both the Mt. Macedon and Gellibrand Hill radars and will not affect their operation.

There are satellite based surveillance facilities at Mt. Tassie. The GWF is sufficiently distant, and below, these facilities and should not affect their operation.

There is PSR and SSR surveillance facilities at RAAF East Sale located 39.66nm (73.45km) north northeast of turbine GWT03. The GWF should have no impact on the SSR, however it is in PSR Zone 3 and will require a simple assessment. The aerodrome elevation at YMES is 7m (23ft) with high ground, approximately 185m, between YMES and the GWF. The high ground penetrates the line of sight from the PSR to the turbines.



The author has no knowledge of the East Sale PSR capabilities, therefore cannot comment on any likely impact from the GWF. The Department of Defence will assess any impact.

#### 4.10 AIS Conclusions

The GWF will: -

- Not impact on the LSALT of any published air route
- Not impact on the GRID LSALT
- Not impact on any civil aviation CNS.
- Not impact on any PANS . OPS airspace
- Not impact the OLS for YYRM

#### 4.11 Airservices Australia Response

Airservices Australia response is summarised below.

Based on the above assessment, our view is that the proposed Gelliondale Wind Farm would not have an impact on any Airservices designed instrument procedures, CNS facilities or ATC operations at Yarram and Latrobe Valley aerodromes.

The full response is at Appendix B.

#### 4.12 Department of Defence Response

The Department of Defence response is summarised below.

Defence has no objection to the proposed wind farm provided that the project complies with the above conditions. These conditions refer to reporting tall structures.

The full response is at Appendix C.



## 5. QUALITATIVE RISK ASSESSMENT

The expression 'in the vicinity of the aerodrome' is considered by CASA to mean within the boundaries of either the OLS or the PANS-OPS surfaces for a certified aerodrome. CASA Advisory Circular AC130.E-05 v1.0 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome*, refers to the vicinity of an aerodrome as being within the limits of the Obstacle Limitation Surface<sup>8</sup>.

The NASF Guideline D considers 30km (16.2nm) from a certified or registered aerodrome to be 'in the vicinity'.

Within Victoria, the Planning Authority refers to aerodromes within 30km (16.2nm) of a wind farm for consideration.

For an AIS and this assessment, the impact on any certified aerodrome within 56km (30nm) of a wind farm is considered. This ensures the 25nm (46km) prescribed airspace associated with any published aerodrome instrument approach procedure is captured in the analysis.

### 5.1 Certified Aerodromes

Refer to section 4.4 for details of the certified aerodromes, Yarram (YYRM) and LaTrobe Valley (YLTV). YYRM is located 6.7nm (12.41km) north northeast of turbine GWT11 and YLTV is located 25.29nm (46.84km) north of turbine GWT10. These are the only certified aerodromes within 30nm (56km) of the GWF.

#### 5.1.1 Significant aerodromes beyond 30nm

There are three significant aerodromes just outside 30nm from the GWF boundary.

These are: -

- West Sale (YWSL) certified aerodrome 35.19nm NNE
- East Sale RAAF Base (YMES) military aerodrome 39.64nm NNE
- Longford Heliport (YUOF) 34.83nm NE

Details of these aerodromes is shown in section 4.5.

The GWF will not impact on operations at these aerodromes.

### 5.2 Uncertified Aerodromes

Refer to section 4.6 for details of the known uncertified aerodromes, Leongatha (YLEG),

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<sup>8</sup> CASA AC139.E-05 v1.0 Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome, May 2021.



Inverloch (YIVE) and Fish Creek ALA. These aerodromes are considered sufficiently distant from the GWF for it to have no impact on operations at these aerodromes.

### 5.3 Airspace

As described in section 1.4, the GWF is in Class G airspace with Class E airspace above having a lower limit of FL125 (12,500ft).

The GWF sits below East Sale Military Operating Areas M301A and M301B. These areas are used for military flying training associated with RAAF Base East Sale.

M301A has a lower limit of 4000ft and M301B has a lower limit of FL210 (21,000ft) and are part of a suite of restricted airspace extending to a 50nm (92.6km) radius from the East Sale aerodrome. The M301 Military Operating Areas are activated by NOTAM.

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

### 5.4 Relevant Air Routes

The relevant air routes are described in section 4.7. The GWF does not affect any overlying air routes.

### 5.5 Night Flying

Aircraft flying at night under either IFR or VFR are protected by published or calculated LSALT. Descent below the LSALT for a VFR at Night flight is restricted to within 3nm (5.4km) of the aerodrome and with it in sight. Where an IFR aircraft is using a published instrument approach it is protected by PANS-OPS surfaces.

Both YLTV and YYRM are equipped with Pilot Activated Lighting (PAL) and non-precision RNP Instrument Approach Procedures and therefore are available for night operations by aircraft in accordance with both IFR and VFR at Night flights.

Night operations into YYRM and YLTV are not affected by the GWF.

### 5.6 General Aviation Flying Training

Flying training is conducted at LaTrobe Valley and Leongatha aerodromes. The GWF is sufficiently distant from these aerodromes to not impact on flying training.

### 5.7 Recreational and Sport Aviation

Yarram Aeroclub are an active group regularly flying light aircraft, ultralight and sport



aircraft from YYRM and in the surrounding area. The aeroclub advises that the GWF will not impact on their activities.

## 5.8 Approved Low Flying Activities

There are no published flying training areas in the vicinity of the GWF. As noted in section 5.3 there are Military Operating Areas above the GWF used for flying training. The Military Operating Area M301A is the low level flying training area for RAAF East Sale. M301A boundary is 19.58nm (36.26km) northeast of the GWF.

## 5.9 Aerial Application Activity

The Aerial Application Association of Australia opposes wind farm developments unless the developer has (inter alia):

- Consulted in detail with local operators;
- Received independent expert advice on safety and economic impacts; and
- Considered the impacts on the aerial application industry.<sup>9</sup>

An aerial application operator made the comment that *“the decision to host wind turbines is one made by the landholder who must accept that there will most probably be limitations to any aerial applications on the property”*<sup>10</sup>.

There is some aerial applications activity in the general area, dependent on seasons, crops and pests.

Another operator made the comment that *“wind farms are becoming common, they’re a fact of life, we know more about them and can operate safely in their vicinity.”*<sup>11</sup>

The operators interviewed all consider meteorological monitoring masts to be killers+ because they are very difficult to see. The agreement amongst them was that as a minimum they should be marked in accordance with the NASF Guideline D and that the base around the outer guy wires should be marked in a contrasting colour to the ground.



## 5.10 Known Highly Trafficked Areas

There are no known highly trafficked areas within the immediate vicinity of the GWF.

<sup>9</sup> <https://aaaa.org.au/policies/>

<sup>10</sup> Expert opinion obtained by the author during previous QRA work

<sup>11</sup> Stakeholder interview with aerial agricultural applications operator for Border Air.



There is flying training activity from YLTV, YYRM and YLEG that operates in the general area of those aerodromes. There is some general aviation transiting along the coast to avoid high ground and the RAAF East Sale Military Operating Areas.

## 5.11 Emergency Services Flying

All Emergency Services flying is subject to ongoing dynamic risk assessment throughout the flight. The safety of the aircraft and its crew is paramount.

### 5.11.1 Police Air Wing

The Police Air Wing helicopters are capable of IFR flight and flown by suitably IFR rated pilots who are also qualified for low level flight, for example, search and rescue operations.

From previous work done by the author for other wind farms in Victoria the Police Air Wing utilise dynamic risk assessment for all operations and the pilot in command has the final say as to whether the operation is aborted because of the risk to the aircraft and crew. For low level night operations, the aircraft are equipped with Night Vision Imaging Systems (NVIS) enabling the pilot to see in reduced light conditions.

### 5.11.2 Helicopter Emergency Medical Services

The Helicopter Emergency Medical Service (HEMS) utilise helicopters capable of IFR flight. For low level night operations, the aircraft are equipped with NVIS enabling the pilot to see in reduced light conditions. All HEMS operations are subject to a dynamic risk assessment and the pilot in command has the final say as to whether the operation is aborted due to the risk to the aircraft and crew. *“There are lots of them (wind farms) around and we are conscious of their locations. The presence of a wind farm will not stop our operations, we know they are there and fly accordingly.”*<sup>12</sup> The presence of tall obstacles influences the available cruising levels of the helicopters in known aircraft icing conditions due to the capabilities of the airframe anti-icing equipment.

### 5.11.3 Fixed Wing Air Ambulance

Fixed wing Air Ambulance operations in Victoria are undertaken in twin engine turbo-prop aircraft in accordance with IFR. The aircraft are usually Beechcraft Super Kingair (BE200) which have a MTOW of 5700kg and use suitable aerodromes. The primary use of these aircraft is for patient transfer from regional to major city hospitals. The GWF will not affect fixed wing Air Ambulance operations due to the nature of the operations and the aircraft size. *“The wind farm does not need lights. In solid IMC (Instrument Meteorological Conditions) you can’t see them (the lights).”*<sup>13</sup>

<sup>12</sup> Stakeholder interview Senior Base Pilot, HEMS Victoria.

<sup>13</sup> Stakeholder interview Senior Base Pilot, Pelair, Fixed Wing Air Ambulance Victoria



## 5.12 Fire Fighting

Firefighting is a multi-faceted operation utilising multiple resources and equipment appropriate to the circumstances. A fire ground is a dynamic place where resources are continually being reassigned to have the best effect. Aerial firefighting is just one of the resources available and its use may or may not be appropriate to the current fire ground situation. There will be times when aerial firefighting is not possible due to turbulence, smoke, strong wind or erratic fire behaviour.

### 5.12.1 Aerial Firefighting

At all times, the pilot in command has the ultimate responsibility for the safety of the aircraft.<sup>14</sup>

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

***“It is important to remember that aircraft alone do not extinguish fires.”<sup>15</sup>***



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

The State rural firefighting agencies made submissions to the Senate Select Committee on Wind Turbines. These submissions attached the Australian Fire and Emergency Service Authorities Council (AFAC) *Wind Farms and Bushfire Operations Position Paper 30 October 2014* document. See Appendix E for a copy of this paper.

The AFAC paper states:

***“Aerial firefighting operations will treat the turbine towers similar to other tall obstacles. Pilots and Air Operations Managers will assess these risks as part of routine procedures. Risks due to wake turbulence and the moving blades should also be considered. Wind turbines are not expected to pose unacceptable risks.”<sup>16</sup>***

<sup>14</sup> A point reiterated in an interview by the author with a Victorian Forest Fire Management Fire Ground Manager, 6 August 2019. This is part of the Civil Aviation Safety Regulations 1998.

<sup>15</sup> NSW Rural Fire Service submission to the Senate Select Committee on Wind Turbines, 6 March 2015, page 2

<sup>16</sup> AFAC *Wind Farms and Bushfire Operations Position version 2.0 30 October 2014*, page 2



All these agencies make the point that firefighting aircraft operate to the Visual Flight Rules so can only operate during daylight hours and must remain clear of smoke in order to maintain the required visibility of the ground and obstacles such as trees, power lines, radio masts, houses and ground based fire fighters. The Victorian Country Fire Authority (CFA) recommends:

*“... .. a minimum distance between turbines of 300 metres. This provides adequate distance for aircraft to operate around a wind energy facility given the appropriate weather and terrain conditions. Fire suppression aircraft operate under the ‘Visual Flight Rules.’ As such, fire suppression aircraft only operate in areas where there is no smoke and can operate during the day or night.”<sup>17</sup>*

There are a very limited number of operators approved by CASA to conduct aerial firefighting at night. These organisations utilise specific helicopters equipped for night flight that are flown as a two-pilot operation who are both appropriately rated. Night aerial firefighting is not currently undertaken by fixed wing aircraft. The Large Air Tankers (Boeing 737 and Bombardier Dash 8) have undertaken some night operations. These aircraft are registered in either Canada or the United States of America and are equipped for night flight. Single engine air tankers, usually aerial agricultural applications aircraft, are limited to VFR flight by day.

The South Australian Country Fire Service has published a fact sheet titled *Aerial Firefighting* which explains the use and limitations of aircraft in firefighting. The major point made is that:

*“Although aircraft are often the most visible part of the response to fire, and therefore believed to be the most important, almost all fires are still extinguished by ground crews.”<sup>18</sup>*

A further point made by the CFS is that firefighting aircraft:

*“... may not be able to fly if wind speeds are too high, dust or smoke covers the fire, or when daylight is fading. and*

*Firefighting aircraft will be grounded if Remotely Piloted Aircraft (drones) are flown without permission over the fireground.”*

### **5.12.2 Ground Based Firefighting**

Firefighting is a dynamic undertaking relying on multiple resources including aircraft.

The bushfire report for the GWF will have the detail of firefighting operations and restrictions.

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<sup>17</sup> CFA Guidelines for Renewable Energy Facilities, March 2022 section 5

<sup>18</sup> SA CFS Fact Sheet *Aerial Firefighting*, 2021



### 5.13 Topographical and Marginal Weather Conditions

The LaTrobe Valley region of Victoria is known for having morning fog, low cloud and reduced visibility during the winter. This creates marginal to Non-Visual Meteorological Conditions (Non-VMC). VMC are the weather conditions required for VFR flight at or below either 3000ft AMSL or 1000ft AGL, namely: -

- Clear of cloud;
- In sight of the ground or water; and
- With a forward visibility of 5000m<sup>19</sup>.

The rules governing VFR flight require that pilots remain clear of cloud and not get into such situations by turning away from the low cloud and terminating the flight at the nearest suitable aerodrome.

Aircraft operating under Instrument Flight Rules (IFR) can operate in poor weather conditions and in cloud which precludes visual acquisition of obstacles and terrain. These operations are protected by PANS OPS surfaces and LSALTs that are designed to keep the aircraft clear of obstacles and terrain.

Otherwise CASR 91.267 states (in part) that an aircraft operating under VFR must not fly lower than 152m/500ft over a non-populated area being terrain or obstacles on that terrain and within 300m horizontally, unless:

- Due stress of weather or any other unavoidable cause it is essential that a lower height be maintained; or
- It is engaged in approved low flying private or aerial work; or
- It is engaged in flying training and flies over part of a flying training area in respect of which low flying is authorised by CASA under sub regulation 141(1); or
- It is undertaking a baulked approach; or
- It is flying in the course of actually taking-off or landing at an aerodrome.

In regard to the first bullet point above it is possible that due to lowering cloud base, and if through poor airmanship the aircraft had pressed on to the point that it was unable to execute a turn and fly away from the weather, an aircraft could find itself lower than 152m/500ft above the terrain or obstacles. The operative word is unavoidable. Flying into marginal or non VMC weather is entirely avoidable. It should be noted that a non-instrument rated pilot endeavouring to fly in cloud almost always has a fatal outcome<sup>20</sup>.

Marginal VMC in the LaTrobe Valley, is an issue that local operators are very aware of and flight plan accordingly.

<sup>19</sup> AIP ENROUTE, page ENR 1.2 . 1 date 23 March 2023

<sup>20</sup> Accidents involving Visual Flight Rules pilots in Instrument Meteorological Conditions, Australian Transport Safety Bureau, 22 August 2019



## 5.14 Advisory Circular AC139.E-05v1.0

CASA Advisory Circular, AC139.E-05 v1.0 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome* was published in May 2021 to provide advice to wind farm proponents and planning authorities.

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

The GWF is outside the OLS for YYRM and YLTV. It is also outside the PANS-OPS surfaces protecting the non-precision instrument approaches at YYRM and YLTV.

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

## 5.15 NASF Guidelines

The National Airports Safeguarding Framework . Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* provides guidance for the siting and marking of the turbines and meteorological monitoring towers associated with wind farms.

### 5.15.1 Notification to Authorities

Paragraph 20 of Guideline D advises that:

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

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

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

### 5.15.2 Qualitative Risk Assessment

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

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



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

*27. The risk assessment should address the merits of installing obstacle marking or lighting. The risk assessment should determine whether or not a proposed structure will be a hazardous object. CASA may determine, and subsequently advise a proponent and relevant planning authorities that the structures have been determined as:*

- (a) Hazardous but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or*
- (b) Hazardous and should not be built, either in the location and/or to the height proposed as an unacceptable risk to aircraft safety will be created; or*
- (c) Not a hazard to aircraft safety.*

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

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

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

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

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

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



There is no civil or known military CNS infrastructure that will be impacted by the GWF.

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

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

### **5.15.3 Lighting of Wind Turbines**

*33 Where a wind turbine 150m or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment.*

*34. The risk assessment, to be conducted by a suitably qualified person(s), should examine the effect of the proposed wind turbines on the operation of aircraft. The study must be submitted to CASA to enable an assessment of any potential risk to aviation safety. CASA may determine that the proposal is:*

*(a) hazardous, but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or*

*(b) not a hazard to aircraft safety.*

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

- In %solid IMC+they cannot be seen; and
- In light cloud or light fog, they %are+and distract the pilot.<sup>21</sup>

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

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<sup>21</sup> Stakeholder interviews with experienced IFR pilots.



## 5.16 QRA Findings

Risk Element	Assessed Level of Risk	Comment
Airport Operations	LOW	
Aircraft Landing Area Operations	LOW	Suitability for use is a pilot responsibility.
Known Highly Trafficked Routes	LOW	None identified
Published Air Routes	LOW	Nil impact
Restricted Airspace	LOW	Below and clear of R359F
Promulgated Flying Training Areas	LOW	Nil exist in the area
GA Flying	LOW	
Night Flying	LOW	
Emergency Services Flying	LOW	
Commercial Flying	LOW	
Recreational and Sport Aviation	LOW	
Recreational Pilot Training (RA-AUS)	LOW	
GA Pilot Training	LOW	
Weather and Topographical Issues	LOW	

Table 2 – Risk Assessment Summary

## 6. WIND MONITORING TOWERS

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

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

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

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

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



*Figure 7 – A Meteorological Monitoring Mast photographed from the ground*

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

### **6.1 NASF Guidelines – Marking of Meteorological Monitoring Masts**

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

*Wind monitoring towers are very difficult to see from the air due to their slender construction and guy wires. This is a particular problem for low flying aircraft, particularly aerial agricultural and emergency services operations.*

*Measures to be considered to improve visibility include:*

- *The top one third of wind monitoring towers be painted in alternating contrasting bands of colour. Examples can be found in the CASA MOS 139 sections 8 and 9;*
- *Marker balls, high visibility flags or high visibility sleeves*



*placed on the outer guy wires;*

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

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

## 6.2 Reporting of Tall Structures

The turbines proposed for the GWF have a tip height of 210m (689ft) AGL; therefore, they must be reported as per CASR 175.480.

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

The procedure for reporting tall structures is contained in Advisory Circular AC139.E-01 v1.0 *Reporting of Tall Structures*<sup>22</sup>.

Meteorological Monitoring Masts for the GWF must also be reported as per AC139.E-01 and to the Aerial Agricultural Association of Australia ([admin@aaaa.org.au](mailto:admin@aaaa.org.au)).

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

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<sup>22</sup> Advisory Circular AC 139.E-01 v1.0 December 2021



*Figure 8 – A Meteorological Monitoring Mast*



### 6.3 Recommendations

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

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

## 7. REGULATORY FRAMEWORK – AVIATION AND WIND FARMS

### 7.1 Civil Aviation Safety Regulations (CASR)

CASR Part 139 . Aerodromes, is the relevant part dealing with the protection of certified and registered aerodromes.

Part 139 is applicable %within the vicinity,+ [considered to be within the Obstacle Limitation Surface (OLS)], of certified aerodromes.

The Gelliondale Wind Farm is beyond any Obstacle Limitation Surfaces. (See Sections 4 and 5).

CASR Part 175 . Aeronautical information management, covers the reporting requirements for aeronautical information, including objects and structures that affect aviation safety. CASR Part 175 requires the reporting of structures with a height of 100m or more above ground level (AGL) to Airservices Australia for inclusion in the vertical obstacle database (VOD). The RAAF has access to the VOD.

The Gelliondale Wind Farm will comply with Part 175 by reporting all tall structures in accordance with Advisory Circular AC139.E-01.

For certified aerodromes with published Instrument Approach Procedures (IAP) there is ICAO Annexe 14 PANS-OPS protected airspace protecting the procedures from obstacle penetration. (See Section 4)

The Gelliondale Wind Farm will not impact on the PANS-OPS airspace associated with Yarram or LaTrobe Valley airport.

### 7.2 National Airports Safeguarding Framework (NASF)

The Australian National Airports Safeguarding Advisory Group (NASAG) produced a set of guidelines called the National Airports Safeguarding Framework (NASF) in 2012.

The purpose of the National Airports Safeguarding Framework (the Safeguarding



Framework) is to enhance the current and future safety, viability, and growth of aviation operations at Australian airports, by supporting and enabling:

- 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 and
- the publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports.

Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations [Wind Farms] / Wind Monitoring Towers*<sup>23</sup> provides information regarding wind farms. This guideline provides the following information: -

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

*33 Where a wind turbine 150m or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment.*

*34. The risk assessment, to be conducted by a suitably qualified person(s), should examine the effect of the proposed wind turbines on the operation of aircraft. The study must be submitted to CASA to enable an assessment of any potential risk to aviation safety. CASA may determine that the proposal is:*

*(a) hazardous, but that the risks to aircraft safety would be reduced by the provision of approved lighting and/or marking; or*

*(b) not a hazard to aircraft safety.*

The risk assessment for the Gelliondale Wind Farm demonstrates it to be a LOW risk to aviation and is therefore not a hazard to aircraft safety. (See Sections 5 and 6).

The *Aviation Impact Statement* (See Section 4) has been submitted and assessed by Airservices Australia and the Department of Defence. CASA has received a copy accompanied by Airservices assessment.

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<sup>23</sup> Available at

[https://www.infrastructure.gov.au/aviation/environmental/airport\\_safeguarding/nasf/nasf\\_principles\\_guidelines.aspx](https://www.infrastructure.gov.au/aviation/environmental/airport_safeguarding/nasf/nasf_principles_guidelines.aspx)



## 7.3 Victorian Planning – Wind Energy Facilities

### 7.3.1 Victorian Planning Provisions

The Victorian Planning Provisions (VPP)<sup>24</sup>, at clause 52.32 *Wind Energy Facilities*, states in clause 52.32-6 *Decision Guidelines*, that:

*Before deciding on an application, in addition to the decision guidelines of Clause 65, the responsible authority must consider, as appropriate:*

- *The Municipal Planning Strategy and the Planning Policy Framework*
- *The effect of the proposal on the surrounding area in terms of noise, blade glint, shadow flicker and electromagnetic interference*
- *The impact of the development on significant views, including visual corridors and sightlines*
- *The impact of the facility on the natural environment and natural systems*
- *The impact of the facility on cultural heritage*
- *The impact of the facility on aircraft safety*
- *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria (Department of Environment, Land, Water and Planning, March 2019)*
- *The New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise,*

This report, *Gelliondale Wind Farm Aviation Impact Assessment*, assesses the impact of the facility on aircraft safety and demonstrates that it poses a LOW risk to aviation and is therefore not a hazard to aircraft safety.

### 7.3.2 Victorian Policy and Planning Guidelines

The Victorian Policy and Planning Guidelines for Wind Energy Facilities are in the document *Development of Wind Energy Facilities in Victoria – Policy Planning and Guidelines*<sup>25</sup>.

Section 4 of the policy guidelines *Planning permit applications – information for applicants* provides information at Section 4.3.6 regarding aircraft safety issues. The

<sup>24</sup> Available at <https://planning-schemes.app.planning.vic.gov.au/Victoria%20Planning%20Provisions/ordinance>

<sup>25</sup> Available at [https://www.planning.vic.gov.au/\\_data/assets/pdf\\_file/0024/95361/Development-of-Wind-Energy-Facilities-Mar2019.pdf](https://www.planning.vic.gov.au/_data/assets/pdf_file/0024/95361/Development-of-Wind-Energy-Facilities-Mar2019.pdf)



advice is that:

*Applicants should consult with the Civil Aviation Safety Authority (CASA) for wind energy proposals that:*

- *Are within 30km of a declared aerodrome or airfield*
- *Infringe the Obstacle Limitation Surface (OLS) around a declared aerodrome*
- *Include a building or structure the top of which will be 110 metres or more above natural ground level (height of a wind turbine is that reached by the tip of the turbine blade when vertical above ground level).*

*Early engagement with aviation safety organisations like CASA is encouraged as aviation safety is a complex area of wind energy facility assessment.*

*Operators of certified aerodromes are required to notify CASA if they become aware of any development or proposed construction near the aerodrome that is likely to create an obstacle to aviation, or if an object will infringe the Obstacle Limitation Surfaces (OLS) or Procedures for Air Navigation Services –Operations (PANS-OPS) surfaces of an aerodrome. Operators of registered aerodromes should advise CASA if the proposal will infringe the OLS; CASA will ask Airservices to determine if there is an impact on published flight procedures for the aerodrome.*

The Aeronautical Impact Assessment [this report] undertaken by Chiron Aviation Consultants on behalf of the Gelliondale Wind Farm applicant addresses the air safety issues raised in this section. Airservices Australia has assessed the Aviation Impact Statement (section 4) of this report regarding OLS and PANS-OPS protected airspace.

Section 5 of the policy guidelines, *Information for responsible authorities assessing a wind energy facility*, at section 5.1.5 refers to *aircraft safety*. The advice in this section is that:

*Although the Civil Aviation Safety Authority (CASA) is not a formal referral authority for wind energy facility permit applications, a responsible authority should nevertheless consult with CASA in relation to aircraft safety impacts of a wind energy facility proposal, particularly proposals that:*

- *are within 30 kilometres of a declared aerodrome or airfield*
- *infringe the obstacle limitation surface around a declared aerodrome*
- *include a building or structure the top of which will be 110*



*metres or more above natural ground level (height of a wind turbine is that reached by the tip of the turbine blade when vertical above ground level).*

Further advice is that

*Other private airstrips may not be identified by consultation with CASA. These may be identified using aerial photographs, discussions with the relevant council, or consultation with local authorities.*

*A responsible authority should ensure that the proponent has consulted appropriately with CASA in relation to aircraft safety and navigation issues. It is recommended that the proponent consults and receives approval from CASA prior to lodging their application for ease of process. Refer to Section 4.3.6 of these guidelines for more detail.*

*CASA may recommend appropriate safeguards to ensure aviation safety. These may include changes to turbine locations, turbine heights and/or the provision of aviation safety lighting. A responsible authority should ensure that any concerns raised by CASA are appropriately reflected in permit conditions.*

#### 7.4 Consultation with CASA

All the requirements raised in the VPP and Guidelines under the heading *consultation with CASA* have been addressed in the AIA.

The AIA assesses the impact of the facility on aircraft safety and demonstrates that it poses **a LOW risk to aviation and is therefore not a hazard to aircraft safety**. This addresses the impact of the facility on aircraft safety.

As noted above CASA is not a formal referral authority. CASA can only make recommendations, not determinations/directions mandating that wind turbines are obstacles when the turbines are beyond the OLS [not in the vicinity] of a certified or registered [declared] aerodrome. Penetration of PANS-OPS airspace is not permitted.

At the Senate Select Committee on Wind Turbines (2015) CASA provided evidence to the Committee about the limited role it plays in regulating airspace around wind farms.

*We know our responsibilities and the power of our legislation, which is very limited. For the most part, wind turbines are built away from aerodromes and certainly away from federally leased aerodromes. So the only power we have is to make a recommendation to the planning authority about whether the turbine is going to be an obstacle and, if we decide it is an obstacle, we can make a recommendation as to whether it should be lighted and marked.*



*This is the extent of our power.*<sup>26</sup>

It is the author's experience<sup>27</sup>, that CASA does not provide approval regarding wind farms and provides no comment on risk assessment reports prepared by Applicants. CASA has emphasised to the author that *“it is a matter for the appropriate Land Use Planning Authority to consider the implementation of our recommendations”* regarding wind farms.

The Clean Energy Council held discussions with CASA and the Wind Farm Commissioner in 2019 where CASA reiterated that they were not a referral authority and did not provide approval for wind farms. At these discussions they stated that, to have a single point of contact, they preferred to deal with the relevant State Planning Authority and not each individual proponent and their consultants.

The AIA uses 30nm (56km) from any declared aerodrome to the wind farm boundary, as requested by Airservices Australia, when assessing the *aircraft safety impacts of a wind energy facility*. The 30nm encompasses the PANS-OPS airspace of 25nm plus buffer associated with any published Instrument Approach Procedures at the declared aerodrome as well as the OLS of 15km from the runway threshold.

The requirements raised in the Policy and Guidelines, sections 4 and 5 *Consultation with CASA*: -

- Aircraft safety
- Infringement of OLS
- Infringement of PANS-OPS
- Tall structures . 110m or taller
- Approval from CASA
- Identification of private airstrips

have been addressed.

Consequently, CASA has not been consulted with respect to this risk assessment.

## 7.5 Private Airstrips

Section 4.4 of this report details the aerodromes and airstrips identified within 30nm (56km) of the wind energy facility. The official register of aerodromes and airstrips, published in the public domain, is held in the Aeronautical Information Publication (AIP).

CASA do not hold any other register of private airstrips. Relevant council and local authorities often do not know the locations of airstrips, particularly those used

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<sup>26</sup> Senate Select Committee on Wind Turbines, Final Report, August 2015, paragraph 5.38

<sup>27</sup> The author has conducted Aeronautical Impact Assessments for more than 25 wind farms Australia wide and over the last decade has had extensive consultation and discussion with CASA.



infrequently for aerial agricultural applications activity.

Section 1.1 of this report notes that the identification of aerodromes and airstrips not listed in the Aeronautical Information Publication is a difficult process.

## 7.6 Additional Comment

The NASF Guideline D and Victorian Policy and Planning Guidelines use 30km from a declared aerodrome as the reference distance when considering wind farms.

It is the author's opinion that this distance needs to be amended to 30nm (56km) to ensure consideration of any published instrument approach procedures. The associated PANS-OPS protected airspace extends to 30nm (56km), that is 25nm Minimum Safe Altitude (MSA) plus buffer zone. An OLS extends to 15km from the runway threshold and is therefore encompassed in the 30nm distance.

Additionally, the Policy and Planning Guidelines and NASF Guideline D, advise that tall structures, above 30m AGL within 30km of an aerodrome and 45m AGL elsewhere, should be notified to RAAF AIS for inclusion in the database of tall structures.

CASA Advisory Circular AC139.E-01 v1.0 . *Reporting of tall structures* advises that the *Vertical Obstacles Database* is maintained by Airservices Australia and has been since at least 2016. The RAAF has access to this database.



## 8. CONCLUSIONS – AERONAUTICAL IMPACT ASSESSMENT

### 8.1 Aviation Impact Statement

The GWF will: -

- Not impact on the LSALT of any published air route
- Not impact on the GRID LSALT
- Not impact on any civil aviation CNS.
- Not impact on any PANS . OPS airspace
- Not impact the OLS for YYRM

Both Airservices Australia and Department of Defence have assessed the AIS and advise that it will have no impact on instrument approach procedures, CNS facilities, ATC operations or military facilities.

### 8.2 Risk Assessment

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

### 8.3 Obstacle Lighting

The GWF does not require aviation obstacle lighting.

### 8.4 Met Masts

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

### 8.5 Reporting Tall Structures

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



## ***APPENDIX A***

### ***Gelliondale Wind Farm***

#### ***Turbine Locations***



## APPENDIX A

### Gelliondale Wind Turbines 2022-06

WTG ID	Loc X GDA	Loc Y GDA	Lat WGS	Long WGS	Elev (m)	Tip Hgt AGL (m)	Tip Hgt AHD (m)	Tip Hgt AHD (ft)	Add MOC 1000ft	LSALT
GWT01	459100	5721210	38° 39' 24.18" S	146° 31' 47.78" E	5.4	210	215.4	706.512	1706.512	1800
GWT02	459315	5721622	38° 39' 10.88" S	146° 31' 56.75" E	5.8	210	215.8	707.824	1707.824	1800
GWT03	459649	5722922	38° 38' 28.74" S	146° 32' 10.85" E	10.6	210	220.6	723.568	1723.568	1800
GWT04	462359	5723610	38° 38' 06.85" S	146° 34' 03.09" E	10	210	220	721.6	1721.6	1800
GWT05	462850	5723361	38° 38' 15.05" S	146° 34' 23.34" E	10.1	210	220.1	721.928	1721.928	1800
GWT06	463560	5723252	38° 38' 18.68" S	146° 34' 52.68" E	10.2	210	220.2	722.256	1722.256	1800
GWT07	464422	5723400	38° 38' 13.98" S	146° 35' 28.36" E	7	210	217	711.76	1711.76	1800
GWT08	464965	5723088	38° 38' 24.17" S	146° 35' 50.79" E	8.1	210	218.1	715.368	1715.368	1800
GWT09	465167	5723719	38° 38' 03.71" S	146° 35' 59.26" E	7.1	210	217.1	712.088	1712.088	1800
GWT10	466839	5726260	38° 36' 41.52" S	146° 37' 08.84" E	10.3	210	220.3	722.584	1722.584	1800
GWT11	467329	5725912	38° 36' 52.88" S	146° 37' 29.03" E	9.4	210	219.4	719.632	1719.632	1800
GWT12	467499	5724918	38° 37' 25.15" S	146° 37' 35.89" E	7.2	210	217.2	712.416	1712.416	1800
GWT13	467573	5724240	38° 37' 47.15" S	146° 37' 38.86" E	5.6	210	215.6	707.168	1707.168	1800

Gelliondale Wind Farm Turbine locations and heights.



## ***APPENDIX B***

### ***Airservices Australia***

#### ***AIS Response***



## APPENDIX B

**ian\_jennings@netspace.net.au**

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**From:** Airport Developments <Airport.Developments@AirservicesAustralia.com>  
**Sent:** Tuesday, 11 October 2022 11:32 AM  
**To:** ian\_jennings@netspace.net.au  
**Cc:** Airspace.Protection@casa.gov.au  
**Subject:** AIRSERVICES RESPONSE: VIC-WF-058 - Gelliondale Wind Farm

OFFICIAL

Hi Ian,

I refer to your request for an Airservices assessment of the proposed Gelliondale Wind Farm.

**Airspace Procedures**  
With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a height of 220.6m (724ft) AHD the Gelliondale Wind Farm will not affect any sector or circling altitude, nor any instrument approach or departure procedures at Yarram and Latrobe Valley aerodromes.

Note: procedures not designed by Airservices at Yarram and Latrobe Valley aerodromes were not considered in this assessment.

**Communications/Navigation/Surveillance (CNS) Facilities**  
We have assessed the proposal to a maximum height of 220.6m (724ft) AHD for any impacts to Airservices Precision/Non-Precision Navigation Aids, Anemometers, HF/VHF/UHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links and have no objections to it proceeding.

**Air Traffic Control (ATC) Operations**  
There are no additional instructions or concerns from our ATC.

**Summary - no impact**  
Based on the above assessment, our view is that the proposed Gelliondale Wind Farm would not have an impact on any Airservices designed instrument procedures, CNS facilities or ATC operations at Yarram and Latrobe Valley aerodromes.

If you have any further queries, please let me know.

Kind regards,

**Richard Tomlinson**  
Airport Development & Engagement Advisor  
w: (02) 6268 4460

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**From:** ian\_jennings@netspace.net.au <ian\_jennings@netspace.net.au>  
**Sent:** Wednesday, 24 August 2022 3:20 PM  
**To:** Airport Developments <Airport.Developments@AirservicesAustralia.com>  
**Cc:** 'Adam Gray' <adam.gray@exceed-energy.com.au>  
**Subject:** Gelliondale Wind Farm - Aviation Impact Statement

Team,  
Please find attached the Aviation Impact Statement for the Gelliondale Wind Farm southwest of Yarram Victoria. This wind farm will not affect the PANS-OPS or OLS for YYRM or YLTV.  
Ian

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## ***APPENDIX C***

***Department of Defence***

***AIS Response***



## APPENDIX C

OFFICIAL



Australian Government  
Defence

ID-EP-DLP&R/OUT/2022/BS35746649

**Mr Ian Jennings**  
Chiron Aviation Consultants  
27 Hilda St  
Essedon VIC 3040

Dear Mr Jennings

### RE: GELLIONDALE WIND FARM - AVIATION IMPACT STATEMENT

Thank you for referring the abovementioned wind farm proposal to the Department of Defence (Defence) for comment. Defence understands that this is a proposal for the construction and operation of a wind farm including up to 13 turbines with a maximum blade tip height of 210m Above Ground Level (AGL). The site is approximately 7.5km southwest of Yarram, 3km west of Alberton and 8km east of Welshpool in Victoria.

As tall structures, wind farms can have the potential to pose a number of concerns for Defence, particularly with regard to aircraft safety, military low flying and radar interference. Defence has conducted an assessment of the proposal for potential impacts on the safety of Defence flying operations.

There is an ongoing need to obtain and maintain accurate information about tall structures so that this information can be marked on aeronautical charts. Marking tall structures on aeronautical charts assists pilot navigation and enhances flight safety. AirServices Australia (AsA) is responsible for recording the location and height of tall structures. The information is held in a central database managed by ASA and relates to the erection, extension, or dismantling of tall structures, the top of which is above:

- a. 30 metres AGL, that are within 30 kilometres of an aerodrome; and
- b. 45 metres AGL elsewhere.

The proposed 210 metres AGL turbines meet the requirements for reporting of tall structures. Defence therefore requests that the applicant provide ASA with "as constructed" details. The details can be emailed to ASA at [vod@airservicesaustralia.com](mailto:vod@airservicesaustralia.com).

OFFICIAL



OFFICIAL

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Defence has no objection to the proposed wind farm provided that the project complies with the above conditions.

Yours sincerely,

**Timothy HOGAN 2**

Digitally signed by Timothy  
HOGAN 2

Date: 2022.11.07 15:56:39 +11'00'

**Timothy Hogan**  
Ag/Director Land Planning and Regulation

Brindabella Business Park (BP26-1-A053)  
PO BOX 7925  
CANBERRA BC ACT 2610  
02 5109 5177  
[Timothy.hogan2@defence.gov.au](mailto:Timothy.hogan2@defence.gov.au)

7 November 2022

OFFICIAL



## ***APPENDIX D***

### ***Glossary of Terms and Abbreviations***



## APPENDIX D

### Glossary of Terms and Abbreviations

#### AERONAUTICAL STUDY GLOSSARY

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies. A full list of terms and abbreviations used in this report is included as an Appendix.

**AC** (Advisory Circulars) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

**Aeronautical study** is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

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

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

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

**Airservices Australia** is the Australian government-owned corporation providing safe and environmentally sound air traffic management and related airside services to the aviation industry.

**Altitude** is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

**AMSL** (Above Mean Sea Level) is the elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level datum. In aviation, the ellipsoid known as World Geodetic System 84 (WGS 84) is the datum used to define mean sea level.

**ATC** (Air Traffic Control) service is a service provided for the purpose of:

- a. preventing collisions:
  1. between aircraft; and
  2. on the maneuvering area between aircraft, vehicles and obstructions; and
- b. expediting and maintaining an orderly flow of air traffic.

**CASA** (Civil Aviation Safety Authority) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation



safety standards. As Australia is a signatory to the ICAO *Chicago Convention*, CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

**CASR** (Civil Aviation Safety Regulations) are promulgated by CASA and establish the regulatory framework (*Regulations*) within which all service providers must operate.

**Civil Aviation Act 1988** (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

**ICAO** (International Civil Aviation Organization) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention*.

**IFR** (Instrument Flight Rules) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not safe. IFR flight depends upon flying by reference to instruments in the flight deck, and navigation is accomplished by reference to electronic signals. It is also referred to as, ~~the~~ term used by pilots and controllers to indicate the type of flight plan an aircraft is flying, such as an IFR or VFR flight plan.

**IMC** (Instrument Meteorological Conditions) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, less than the minimum specified for visual meteorological conditions.

**LSALT** (Lowest Safe Altitudes) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

**MOS** (Manual of Standards) comprises specifications (*Standards*) prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation.

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

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

**NOTAMs** (Notices to Airmen) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service,



procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

**Obstacles.** All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

**OLS (Obstacle Limitation Surfaces)** are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

**PANS-OPS (Procedures for Air Navigation Services - Aircraft Operations)** is an Air Traffic Control term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) or Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS-OPS may vary from country to country.

**PANS OPS Surfaces.** Similar to an Obstacle Limitation Surface, the PANS-OPS protection surfaces are imaginary surfaces in space which guarantee the aircraft a certain minimum obstacle clearance. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to penetrate the OLS, they cannot be permitted to penetrate any PANS-OPS surface, because the purpose of these surfaces is to guarantee pilots operating under IMC an obstacle free descent path for a given approach.

**Prescribed airspace** is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

#### **Regulations (Civil Aviation Safety Regulations)**

**VFR (Visual Flight Rules)** are rules applicable to the conduct of flight under VMC. VFR allow a pilot to operate an aircraft in weather conditions generally clear enough to allow the pilot to maintain visual contact with the terrain and to see where the aircraft is going. Specifically, the weather must be better than basic VFR weather minima. If the weather is worse than VFR minima, pilots are required to use instrument flight rules.

**VMC (Visual Meteorological Conditions)** are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima.



## ABBREVIATIONS

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

Abbreviation	Meaning
AC	Advisory Circular (document support CASR 1998)
ACFT	Aircraft
AD	Aerodrome
AHD	Australian Height Datum
AHT	Aircraft height
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALA	Aircraft Landing Area
Alt	Altitude
AMSL	Above Minimum Sea Level
A(PofA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DEVELMT	Development
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DITCRD	Department of Infrastructure, Transport, Cities and Regional Development
DIRDC	Department of Infrastructure, Regional Development and Cities See DITCRD above
DIRD	Department of Infrastructure and Regional Development. (Formerly Department of Infrastructure and Transport) See DIRDC above
DoIT	Department of Infrastructure and Transport. Also called %nfrastructure+ (Formerly Department of Infrastructure, Transport, Regional Development and Local Government (DITRD LG) and previously the Department of Transport and Regional Services (DoTARS)) See DIRD above.
DITRD LG	See DoIT above
DOTARS	See DITRD LG above
ELEV	Elevation (above mean sea level)



Abbreviation	Meaning
ENE	East Northeast
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
ft	feet
GA	General Aviation
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LSALT	Lowest Safe Altitude
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
SSR	Monopulse Secondary Surveillance Radar
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NDB	Non Directional Beacon
NE	Northeast
NM or nm	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	North Northeast
NOTAM	NOtice To AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface



Abbreviation	Meaning
PANS-OPS	Procedures for Air Navigation Services . Aircraft Operations, ICAO Doc 8168
PRM	Precision Runway Monitor
PROC	Procedure
PSR	Primary Surveillance Radar
QNH	An altimeter setting relative to height above mean sea level
Rnnn	Restricted Airspace . promulgated in AIP as R with 3 numbers
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes . replaced by the MOS Part 139 . Aerodromes
RPT	Regular Public Transport
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
SSR	Secondary Surveillance Radar
STAR	Standard ARrival
TAR	Terminal Area Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
VFR	Visual Flight Rules
V <sub>n</sub>	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart
YLTV	LaTrobe Valley aerodrome
YMES	East Sale RAAF Base
YWSL	West Sale aerodrome
YYRM	Yarram aerodrome