November 2019

AVIATION IMPACT ASSESSMENT

FOREST WIND

Prepared for Forest Wind Holdings Pty Ltd

AVIATION PROJECTS

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Revision History

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1.1	Final Report – DoD response	26 November 2019		

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ACRONYMS

AGL	above ground level
AHD	Australian Height Datum
AIP	Aeronautical Information Package
ALARP	as low as reasonably practicable
AMSL	above mean sea level
ARP	Aerodrome Reference Point
CAR	Civil Aviation Regulation (1988)
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation (1998)
CFIT	controlled flight into terrain
ERSA	En Route Supplement Australia
FCRC	Fraser Coast Regional Council
FWH	Forest Wind Holdings Pty Limited
GRC	Gympie Regional Council
HF	high frequency
ICAO	International Civil Aviation Organization
IFR	instrument flight rules
IMC	instrument meteorological conditions
LSALT	Lowest Safe Altitude
MOC	minimum obstacle clearance
MOS	Manual of Standards
MSA	minimum sector altitude
NASF	National Airports Safeguarding Framework
OLS	obstacle limitation surface
PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
RPT	regular public transport
VFR	visual flight rules
VMC	visual meteorological conditions

WBTA	Wide Bay Training Area
WMT	wind monitoring towers
WTA	wind turbine area
WTG	wind turbine generator

UNITS OF MEASUREMENT

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

NOTE

The turbine symbol used for this report is for illustration purposes only and should not be interpreted as the actual ratio between a rotor diameter and land size area.

EXECUTIVE SUMMARY

Introduction

Forest Wind Holdings Pty Ltd (FWH) proposes to develop and construct a wind farm called Forest Wind in State forests, situated between Gympie and Maryborough in the Wide Bay Region of Queensland. Specifically, the Project comprises a wind farm with up to 226 wind turbines and ancillary infrastructure (Wind Turbine Area (WTA)) and a transmission line corridor in which a high voltage transmission line (the Transmission Line) will be located in a corridor (Overhead Line Corridor) to transfer the generated electricity to an existing substation located at Woolooga to the northwest of Gympie.

The proposed WTA is located south east of Maryborough Airport and west of and adjacent to the military training area at Tin Can Bay known as Wide Bay Training Area (WBTA).

FWH proposes that the wind turbines will be up to 295 m above ground level (AGL) and located within a series of corridors.

Aviation Projects undertook an initial preliminary aviation assessment in August 2015 for a prospective site in the area, followed by a specific preliminary aviation assessment on 22 September 2016.

Furthermore, Aviation Projects prepared an aviation impact assessment (version v0.3) for CleanSight Pty Ltd in August 2017. The aviation impact assessment (AIA) reviewed potential impacts of the Project on aviation safety in respect of relevant requirements of air safety regulations and procedures and in respect of consultation with relevant regulators.

FWH has engaged Aviation Projects to review and reassess the original AIA (version v0.3) and provide an updated report that takes into consideration the current design of the proposed wind farm.

Conclusions

Project description

- The WTA will accommodate up to 226 wind turbine generators (WTG) in total, with a tip height of up to 295 m (968 ft) AGL located within the exotic pine plantation located adjacent to existing forestry tracks. Electrical distribution lines will be installed within the WTA to connect the wind turbines to the substations and will be installed underground along forestry tracks or overhead within the Overhead Line Corridor. Site entrances, substations and operations compounds will be constructed within the WTA. Temporary construction compounds and concrete batching plants will be required through the construction phase, as well as any relevant manufacturing and assembly facilities; and
- Three temporary and up to six permanent wind monitoring towers (WMT) are proposed to be built within the WTA with a hub height up to 180 m (590.6 ft) AGL.

Regulatory requirements

- For WTGs or WMTs more than 150 m in height, State Code 23 requires written endorsement by Airservices Australia and CASA stating they have no objection to the proposed development.
- With respect to Manual of Standards (MOS) 139 7.1.5.1, the proposed WTGs and WMTs must be reported to CASA if they will be higher than 110 m AGL.

- With respect to MOS 139 7.1.5.2, the WTGs or WMTs must be regarded as an obstacle if they are higher than 150 m AGL, unless CASA assesses otherwise. Obstacle monitoring includes the Procedures for Air Navigation Services - Aircraft Operations (PANS OPS) surface which extends beyond the OLS of the aerodrome.
- With respect to MOS 139 9.4.1.2 (b), the WTGs or WMTs will need to be lit if they are outside the obstacle limitation surface (OLS) and above 110 m AGL, unless an aeronautical study assesses they are of no operational significance.

Planning considerations

The Project as proposed satisfies the following Outcomes of State Code 23:

Performance outcomes	*Acceptable outcomes - Compliance*
Aviation safety, integrity and efficiency	
PO1 The safety, operational integrity and efficiency of air services and aircraft operations are not adversely affected by the location, siting, design and operation of the development.	AO1.1 - Not applicable as WTG and WMT are more than 150 m in height AO1.2 (1) – [TBA pending CASA written endorsement] (2) – Not applicable as the WTA is outside 30 km of a military aerodrome, or a certified aerodrome or registered aerodrome jointly used as a military aerodrome,
PO2 Development includes lighting and marking measures to ensure the safety, operational integrity and efficiency of air services and aircraft operations.	AO2.1 – Complies, the WTG will be marked AO2.2 – Complies, the top one-third of the WMT will be painted in alternating bands of contrasting colour AO2.3 – [TBA pending CASA written endorsement] AO2.4 In areas where low flying aircraft occur: (1) – Complies, marker balls will be placed on the guy wires (2) – Complies, the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation (3) – Complies - ICAO compliant medium intensity flashing white for day, low intensity steady red for night AO2.5 – N/A as LED lighting is not proposed

The Project as proposed satisfies all Performance Criteria and Acceptable Outcomes of the Fraser Coast Airport Environs Overlay Code and does not conflict with provisions of the Gympie Regional Council Planning Scheme as outlined in Section 3 of this report.

Consultation

An appropriate and justified level of consultation is being undertaken with relevant parties.

Aviation Impact Statement

Based on the proposed WTA layout and overall turbine blade tip height limit of 295 m AGL, the blade tip elevation of the highest WTG, which is WTG 2_199, will not exceed 408.7 m AHD (1341.1 ft AMSL) and:

- will not penetrate any OLS surfaces;
- will penetrate the following:
    - Maryborough Airport 10 nm MSA MOC 1700 ft AMSL by approximately 468.3 ft (142.7 m);
    - Maryborough Airport 25 nm MSA MOC 2000 ft AMSL in the sector between bearings 110°and 340° by approximately 341.1 ft (104 m), and
    - Hervey Bay Airport 25 nm MSA MOC 2100 ft AMSL by approximately 147 ft (44.8 m).

  Therefore, the following is required:
    - the 10 nm MSA for Maryborough Airport will need to be increased by 500 ft to 2200 ft;
    - the 25 nm MSA for Maryborough Airport in the sector between bearings 110°and 340° will need to be increased by 400 ft to 2400 ft; and
    - the 25 nm MSA for Hervey Bay Airport will need to be increased by 200 ft to 2300 ft.
- will not impact Maryborough Airport circling areas;
- will likely restrict circuit operations at the Unnamed ALA (to the west of the WTA);
- will partially impact Danger Area D688;
- will not have an impact on nearby designated air routes;
- is wholly contained within Class G airspace; and
- is outside the clearance zones associated with aviation navigation aids and communication facilities.

Airservices Australia response:

> *With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a maximum height of 408.7 m (1341 ft) AHD, the wind farm will affect the 25 NM and 10 NM minimum sector altitude (MSA) of Maryborough Airport and the 25 NM minimum sector altitude (MSA) of Hervey Bay Airport.*
>
> *In order to accommodate the proposal, the MSA is required to be amended for Hervey Bay and Maryborough as follows:*

- *The existing Maryborough 3100 ft 25 NM MSA sector will need to be expanded to cover B-260° to B-110°. The Maryborough 10 nm MSA will need to be raised by 500 ft from 1700 ft to 2200 ft.*
- *The Hervey Bay 25NM MSA will need to be revised to include a new 2300 ft sector between B-340° and B-025°.*
- *The missed approach termination altitude of the YMYB RNAV-Z (GNSS) RWY 17 procedure will need to be increased to 3100 ft.*

Airservices requires that the operator of Hervey Bay and Maryborough Airport (included in this email response) to be consulted and confirm that the proposed permanent change to MSA will not adversely impact on their operations before any change (temporary or permanent) can be supported by Airservices.

Fraser Coast Regional Council's response:

Mr James Cockburn, Executive Manager Planning and Growth at FCRC, in his email dated 13 September 2019 advised that council has no objection to the proposal subject to ongoing compliance with all CASA, Airservices and relevant aviation regulatory requirements.

Aircraft operator characteristics

- Aircraft will be required to navigate around the Project site in low cloud conditions where aircraft need to fly at 500 ft AGL.
- The Proponent will engage with local aerial agricultural and aerial firefighting operators in relation to forestry operations to develop procedures, which may include, for example, stopping the rotation of the wind turbine rotor blades, prior to the commencement of the subject aircraft operations within the WTA.
- Wind turbines are generally not a safety concern to aerial agricultural operators. WMTs remain the primary safety concern to aerial agricultural operators, who have expressed a general desire for these towers to be more visible.
- Mr Anthony Hooper, Manager Line Operations at RFDS, in his email dated 02 August 2019 advised that the Project will not impact on the RRDS' operations at both Maryborough and Hervey Bay airports.
- In the email response dated 2 August 2019, Ms Logan - Flight Operations Engineering Manager at Virgin Australia advised that Virgin Australia does not operate to Maryborough Airport. With respect to Hervey Bay Airport, Ms Logan advised that Virgin Australia flying operations will not be significantly impacted by the proposed MSA changes.
- During email consultation for the final project layout, QantasLink was informed of the Project. Captain Adrian Young (Head of Flying Operations and Chief Pilot) in his email dated 2 August 2019 advised that after reviewing the aviation impact assessment (version 0.6), QantasLink will have no issue with the Projects development.

Hazard lighting and marking

- With respect to MOS 139 7.1.5.1, the proposed wind turbines must be reported to CASA if they are higher than 110 m AGL. With respect to MOS 139 7.1.5.2, the proposed 295 m wind turbine overall

blade tip height must be regarded as obstacles since they are higher than 150 m AGL, unless CASA assesses otherwise.

- With respect to MOS 139 9.4.1.2 (b), the wind turbines and WMTs will need to be lit if they are higher than 110 m AGL, unless an aeronautical study assesses they are of no operational significance.
- **Aviation Projects assesses that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines of the Project.**
- CASA has recently advised that it will only review assessments referred to it by a planning authority or agency.
- Consultation with Department of Defence regarding lighting has been undertaken during the preparation of the aviation impact assessment. Defence has no objection to the proposed wind farm provided that the project complies with the conditions outlined in **Annexure 2.**
- With respect to marking of turbines, a shade of white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.
- There will be three temporary and up to six permanent WMTs at a height of up to 180 m (590.6 ft) AGL. The proposed towers will be reported to Airservices Australia.
- Consideration should be given to marking any WMT according to the requirements set out in MOS 139 Section 8.10 Obstacle Markings (as modified by the guidance in NASF Guideline D).
- The route of the electrical reticulation will follow the existing forestry tracks. Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators and marked in accordance with MOS 139 Section 8.10 Obstacle Markings; specifically:

> *8.10.2.8 Wires or cable obstacles must be marked using three-dimensional coloured objects such as spheres and pyramids, etc; of a size equivalent to a cube with 600 mm sides, spaced 30 m apart.*

Risk Assessment

A summary of the level of risk associated with the proposed Project, under the proposed treatment regime, is provided in Table E1. Note: A risk level below 8 is considered tolerable.

Table E1 Risk assessment summary

Risk Element	*Consequence*	*Likelihood*	*Risk*	*Actions Required*
Aircraft collision with wind turbine	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Aircraft collision with monitoring tower	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Consider marking the wind monitoring towers according to the requirements set out in MOS 139 Section 8.10 Obstacle Markings, specifically 8.10.2.6 and 8.10.2.8. Any WMT that exceeds a height of 150 m AGL should be lit with a high intensity white flashing obstacle light during the day and a low intensity steady red light at night, until such time as a wind turbine is constructed within close proximity to the WMT (nominally 900 m). Communicate details of wind monitoring towers to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes following construction.
Avoidance manoeuvring leads to ground collision	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Effect on crew	Minor	Possible	5	Acceptable without obstacle lighting (ALARP) Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Visual impact from obstacle lights	Moderate	Likely	7	Acceptable without obstacle lighting (zero risk of visual impact from obstacle lighting). If lights are installed, design to minimise impact.

Recommendations

Planning considerations

1. If all the recommendations contained herein are implemented, the Project will not adversely affect the safety, operational integrity and efficiency of air services as:
    a. The Project will comply with the Acceptable Outcomes and Performance Outcomes of State Code 23; and
    b. The Project will comply with the Fraser Coast Airport Environs Overlay Code and does not conflict with provisions of the Gympie Regional Council Planning Scheme.

Notification and reporting

2. 'As constructed' details of wind turbine and WMT coordinates and elevations should be provided to Airservices Australia, using the following email address: vod@airservicesaustralia.com.
3. Department of Defence should be consulted if there is any subsequent modification in the wind turbine height or scale of development.
4. Any obstacles above 110 m AGL (including temporary construction equipment) should be reported to Airservices Australia NOTAM office until they are incorporated in published operational documents. With respect to crane operations during the construction of the Project, a notification to the NOTAM office may include, for example, the following details:
    a. The planned operational timeframe and maximum height of the crane; and
    b. Either the general area within which the crane will operate and/or the planned route with timelines that crane operations will follow.
5. Details of the wind farm should be provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm on their operations. Specifically, details should be provided to the South Queensland Regional Airspace and Procedures Advisory Committee for consideration by its members in relation to VFR transit routes in the vicinity of the wind farm.

Operation

6. The Proponent should consider engaging with local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project. The Proponent may consider developing procedures such as, for example, stopping the rotation of the wind turbine rotor blades, prior to the commencement of the subject aircraft operations within the Project area.

Marking of turbines

7. The rotor blades, nacelle and the wind turbines towers should be painted a shade of white.

Lighting of turbines

8. **Aviation Projects has assessed that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft based on the following conclusions:**

a. outcomes of the Aeronautical Impact Statement (once the MSAs of the 10 nm and 25 nm of Maryborough Airport and the 25 nm of Hervey Airport are increased); and

b. conclusions of the risk assessment.

Marking of wind monitoring towers

9. Consideration should be given to marking the WMTs according to the requirements set out in MOS 139 Section 8.10 (as modified by the guidance in NASF Guideline D).

Lighting of wind monitoring towers

10. The proposed permanent and temporary WMTs should be lit with ICAO compliant medium intensity flashing white for day, low intensity steady red for night.

Marking of overhead transmission lines and poles

11. Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators and marked in accordance with MOS 139 Section 8.10.2.8.

Micrositing

12. The potential micrositing of the turbines and WMTs have been taken into account. The proposed WTGs and WMTs will be within the proposed WTA. The micrositing of the turbines and WMTs is unlikely to result in a change in the maximum overall blade tip height of the Project. This is based on the information provided by the proponent noting 295 m AGL wind turbine is the highest impact scenario possible and current layout has WTGs on the highest area of site.

Triggers for review

13. Triggers for review of this risk assessment are provided for consideration:

a. prior to construction to ensure the regulatory framework has not changed;

b. following any significant changes to the context in which the assessment was prepared, including the regulatory framework; and

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

1. INTRODUCTION

1.1. Situation

Forest Wind Holdings Pty Ltd (FWH) is currently preparing a development application to obtain planning approval for Forest Wind (the Project).

The proposed development requires an aviation risk assessment to be undertaken in accordance with the Queensland State Code 23: Wind farm development (State Code 23) and State Code 23 Planning Guideline (June 2018).

The Aviation Impact Assessment will review potential impacts of the proposed Project on aviation safety in respect of relevant requirements of air safety regulations and procedures and in respect of consultation with relevant regulators.

Aviation Projects prepared an AIA (version v0.3) for CleanSight in August 2017.

FWH has now progressed the design and updated the layout of the wind turbines and identified a corridor for the high voltage transmission line to the Woolooga substation.

1.2. Background

The WTA is approximately 53 km (29 nm) from the northern extent to the southern extent, and approximately 16 km (8.5 nm) from the eastern extent to the western extent.

The Project is located approximately 14.5 km (7.8 nm) from Maryborough Airport and is located west of and adjacent to the military training area at Tin Can Bay known as Wide Bay Training Area (WBTA).

FWH has indicated the wind turbines will be up to a maximum tip height of 295 m (968 ft) AGL and will be located within a series of corridors.

The Project is proposed to be built in a series of stages, comprising of up to 226 wind turbines, three temporary and up to six permanent WMTs and associated infrastructure.

1.3. Purpose and Scope

The scope of work for this assessment relates to State Code 23: Wind farm development (State Code 23) of the State Development Assessment Provisions – version 2.5 effective 01 July 2019, specifically Performance Outcomes PO1 and PO2 and their associated acceptable outcomes.

Assistance will be provided in support of stakeholder consultation including Airservices Australia, Department of Defence, state and local government authorities, aerodrome operators, aircraft operators, Aerial Agriculture Association of Australia and landowners/leaseholders. Included preparation of correspondence, telephone consultation as applicable and consolidation of responses.

1.4. Methodology

The preparation of the aviation impact assessment was performed according to the steps outlined below:

1. confirm the scope and deliverables;
2. review client material;
3. review relevant regulatory requirements and information sources;
4. prepare an updated aviation impact assessment and supporting technical data that provides evidence and analysis for the development approval application to demonstrate that appropriate risk mitigation strategies have been identified. The aviation impact assessment report will include an updated Aviation Impact Statement (AIS) and a qualitative risk assessment to determine whether or not obstacle lighting is required. The risk assessment will be completed following the guidelines in Standards Australia AS/NZS ISO 31000:2018 Risk Management – Guidelines;
5. consult with relevant stakeholders as necessary dependent upon the implications of the updated Project (e.g. Airservices Australia, Department of Defence, aerodrome operators and aircraft operators), including preparation of correspondence, telephone consultation as applicable and consolidation of responses;
6. finalise the aviation impact assessment report for client acceptance when responses received from relevant stakeholders for client review; and
7. send a final report to client for acceptance.

1.5. Aviation Impact Statement

The Aviation Impact Statement includes the following specific requirements as advised by Airservices Australia:

Aerodromes:

- Specify all registered/certified aerodromes that are located within 30 nm (55.56 km) of the Site;
- Nominate all instrument approach and landing procedures at these aerodromes;
- Review the potential effect of the Project operations on the operational airspace of the aerodrome(s);

Air Routes:

- Nominate air routes published in ERC-L & ERC-H which are located near/over the Site and review potential impacts of Project operations on aircraft using those air routes;
- Specify two waypoint names located on the routes which are located before and after the obstacles;

Airspace:

- Nominate the airspace classification – A, B, C, D, E, G etc where the Site is located; and

Navigation/Radar:

- Nominate radar navigation systems with coverage overlapping the site.

1.6. Report structure

This report is structured around the following areas of consideration:

- Introduction;
- Background;
- External context
- Internal context;
- Consultation;
- Aviation Impact Statement;
- Aircraft operator characteristics;
- Hazard lighting and marking;
- Accident statistics;
- Risk assessment;
- Conclusions; and
- Recommendations.

1.7. Stakeholders

Aviation Projects consulted or considered the needs of the following parties in the preparation of this report:

- aerodrome operators;
- airline operators;
- Airservices Australia;
- Civil Aviation Safety Authority;
- Department of Defence;
- Fraser Coast Regional Council regarding Maryborough and Hervey Bay Airports; and
- Royal Flying Doctor Service.

1.8. Material reviewed

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

- FWH, Preliminary Draft Forest Wind Project description, pdf file, version 0.03, dated 12 June 2019;
- FWH, Forest Wind project layout Stage 1A, kmz file, WTG_Layout 024 R02 Stage 1A_190607, received 12 June 2019;

- FWH, Forest Wind project layout Stage 1B, kmz file, WTG_Layout 025 R03 Stage 1B_190607, received 12 June 2019;
- FWH, Forest Wind project layout Stage 2, kmz file, WTG_Layout 026 R04 Stage 2_1900610, received 12 June 2019;
- FWH, Forest Wind project layout Stage 3, kmz file, WTG_Layout 027 R02 Stage 3_1900607, received 12 June 2019;
- FWH, Forest Wind project layout Stage 4, kmz file, WTG_Layout 028 R03 Stage 4_190607, received 12 June 2019;
- FWH, Forest Wind, Wind Farm Area, kmz file LAND_Wind Farm Area_190529, received 29 May 2019;
- FWH, Forest Wind project constraint west ALA, shp file, CONSTRAINT_P_AVI_Con_WestALA_LicenceArea_190514, received 12 June 2019;
- FWH, Forest Wind, Wind Mast Locations, kmz file WIND_Mast locations ground truthed_190508, received 29 May 2019;
- FWH, Forest Wind Layout Coordinates 226 WTGs All Stages, Excel file, FW_Layout Coordinates 226 WTGs_All Stages_190610, received 12 June 2019; and
- FWH, Forest Wind Wind Farm Boundary, LAND_Project Lot Area_BOUNDARY revised Plantation only_190823, received 30 August 2019.

1.9. References

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

- Aerial Agricultural Association of Australia, National Windfarm Operating Protocols, May 2014;
- Aerial Agricultural Association of Australia, Powerlines Policy, dated March 2011;
- Aerial Agricultural Association of Australia, Windfarm Policy, dated March 2011;
- Airservices Australia, Aeronautical Information Package; including AIP Book, Departure and Approach Procedures and En Route Supplement Australia dated 23 May 2019;
- Airservices Australia, Designated Airspace Handbook, effective 23 May 2019;
- Aircraft Owners and Pilots Association of Australia (AOPA), National Airfield Directory 2012, 15th ed;
- Aviation Projects, Proposed Wind Farm 'Forest Wind' (Phase 1) – Preliminary Aviation Assessment, dated 22 September 2016;
- Clean Energy Council, Best Practice Guidelines – For Implementation of Wind Energy Projects in Australia, 2013, Aircraft Safety;
- Civil Aviation Safety Authority, Civil Aviation Regulations 1998 (CAR);
- Civil Aviation Safety Authority, Civil Aviation Safety Regulations 1998 (CASR;

- Civil Aviation Safety Authority, Civil Aviation Advisory Publication (CAAP) 92-1(1): Guidelines for aeroplane landing areas, dated July 1992;
- Civil Aviation Safety Authority, Civil Aviation Advisory Publication (CAAP) 166-01 v4.2: Operations in the vicinity of non-controlled aerodromes, File Ref D17/368894 dated February 2019;
- Civil Aviation Safety Authority, Manual of Standards Part 173 – Standards Applicable to Instrument Flight Procedure Design, version 1.5, dated March 2016;
- Civil Aviation Safety Authority, Manual of Standards Part 139 – Aerodromes, version 1.14: dated January 2017;
- Civil Aviation Safety Authority, Advisory Circular (AC) 139-08 v2.0: Reporting of Tall Structures, dated March 2018;
- Department of State Development, Manufacturing, Infrastructure and Planning, QLD State Government, Development Assessment mapping system and State Planning Policy Planning interactive mapping system;
- Department of Infrastructure, Local Government and Planning, QLD State Government, State Development Assessment Provisions (SDAP), State Code 23: Wind Farm Development and State Code 23: Wind farm development Planning Guideline (June 2018), SDAP version 2.5, date of commencement 01 July 2019;
- Department of Infrastructure, Local Government and Planning, QLD State Government, State Planning Policy, dated 3 July 2017, Part E, State interest policies and assessment benchmarks, Strategic airports and aviation facilities;
- Department of Infrastructure and Regional Development, Australian Government, National Airport Safeguarding Framework, Guideline D Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation, dated June 2013;
- Fraser Coast Regional Council, Fraser Coast Planning Scheme, version 10.0.2 effective 24 January 2014;
- Gympie Regional Council, Gympie Regional Planning Scheme 2013, commenced on 1 July 2013, version 1.3;
- International Civil Aviation Organization (ICAO) Doc 8168 Procedures for Air Navigation Services—Aircraft Operations (PANS-OPS);
- ICAO Standards and Recommended Practices, Annex 14—Aerodromes;
- OzRunways, aeronautical navigation charts extracts, dated 22 May 2019;
- Standards Australia, AS/NZS ISO 31000:2018 Risk management - Guidelines; and
- other references as noted.

2. BACKGROUND

2.1. Project description

The WTA will accommodate up to 226 wind turbine generators (WTG) in total, with a tip height of up to 295 m (968 ft) AGL located within the exotic pine plantation located adjacent to existing forestry tracks. Electrical distribution lines will be installed within the WTA to connect the wind turbines to the substations and will be installed underground along forestry tracks or overhead within the Overhead Line Corridor. Site entrances, substations and operations compounds will be constructed within the WTA. Temporary construction compounds and concrete batching plants will be required through the construction phase, as well as any relevant manufacturing and assembly facilities.

Three temporary and up to six permanent WMTs are proposed to be built within the WTA up to hub height of 180 m (590.6 ft) AGL.

2.2. Project chronology

Aviation Projects undertook an initial preliminary aviation assessment in August 2015 for a prospective site in the area, followed by a specific preliminary aviation assessment on 22 September 2016.

Furthermore, Aviation Projects prepared an aviation impact assessment (version v0.3) for CleanSight Pty Ltd in August 2017. The AIA reviewed potential impacts of the Project on aviation safety in respect of relevant requirements of air safety regulations and procedures and in respect of consultation with relevant regulators.

The outcomes of the AIA (version v0.3) were consulted in 2017 with CASA, Airservices Australia, Department of Defence, FCRC, airlines and the Plantation Licensee.

FWH has engaged Aviation Projects to review and reassess the original AIA (version v0.3) and provide an updated report that takes into consideration the current design of the proposed wind farm.

2.3. Stakeholder engagement

Airservices Australia was informed of the proposed project in August 2017. In the email response received on 06 September 2017, AsA advised limiting the height of turbines 1 and 2 so not to affect Maryborough Airport circling procedures.

AsA was also advised of the proposed mitigation actions to accommodate the wind farm.

During email consultation with CASA in August 2017, CASA was informed of the Project and advised of the affects to the Hervey Bay 25 nm MSA and Maryborough 10 nm MSA. CASA advised that mitigations suggested by Airservices Australia should be implemented prior to the construction of the proposed wind farm.

FCRC had no objection to the proposed changes to the Hervey Bay 25 nm MSA and Maryborough 10 nm MSA and inbound tracks.

Qantas reviewed the proposal and the increase to the 25 nm MSA at Hervey Bay and confirmed that these changes would not affect their procedures.

Virgin Australia confirmed that their operations to Hervey Bay Airport would not be significantly impacted by the wind farm development.

RFDS reviewed the material for the proposed Forest Wind Project and concluded that it would not impact their operations at both Maryborough and Hervey Bay Airports.

2.4. Project layout modification

Following Airservices Australia assessment and CASA's recommendation in 2017, FWH revised the WTA so that no wind turbines are located within the circling areas of Maryborough Airport.

FWH advised that the final WTA and wind turbine number will likely be reduced following further assessments and changes in technology.

2.5. Micrositing

The potential micrositing of the turbines and WMTs have been taken into account. The proposed WTGs and WMTs will be within the proposed WTA. The micrositing of the turbines and WMTs is unlikely to result in a change in the maximum overall blade tip height of the Project. This is based on the information provided by the proponent noting 295 m AGL wind turbine is the highest impact scenario possible and current layout has WTGs on the highest area of site.

Figure 1 shows the potential micrositing of the turbines within the WTA. The proposed turbine locations are indicated in pumpkin colour and the potential micrositing of the turbine locations are shown in a blue-coloured dots line.

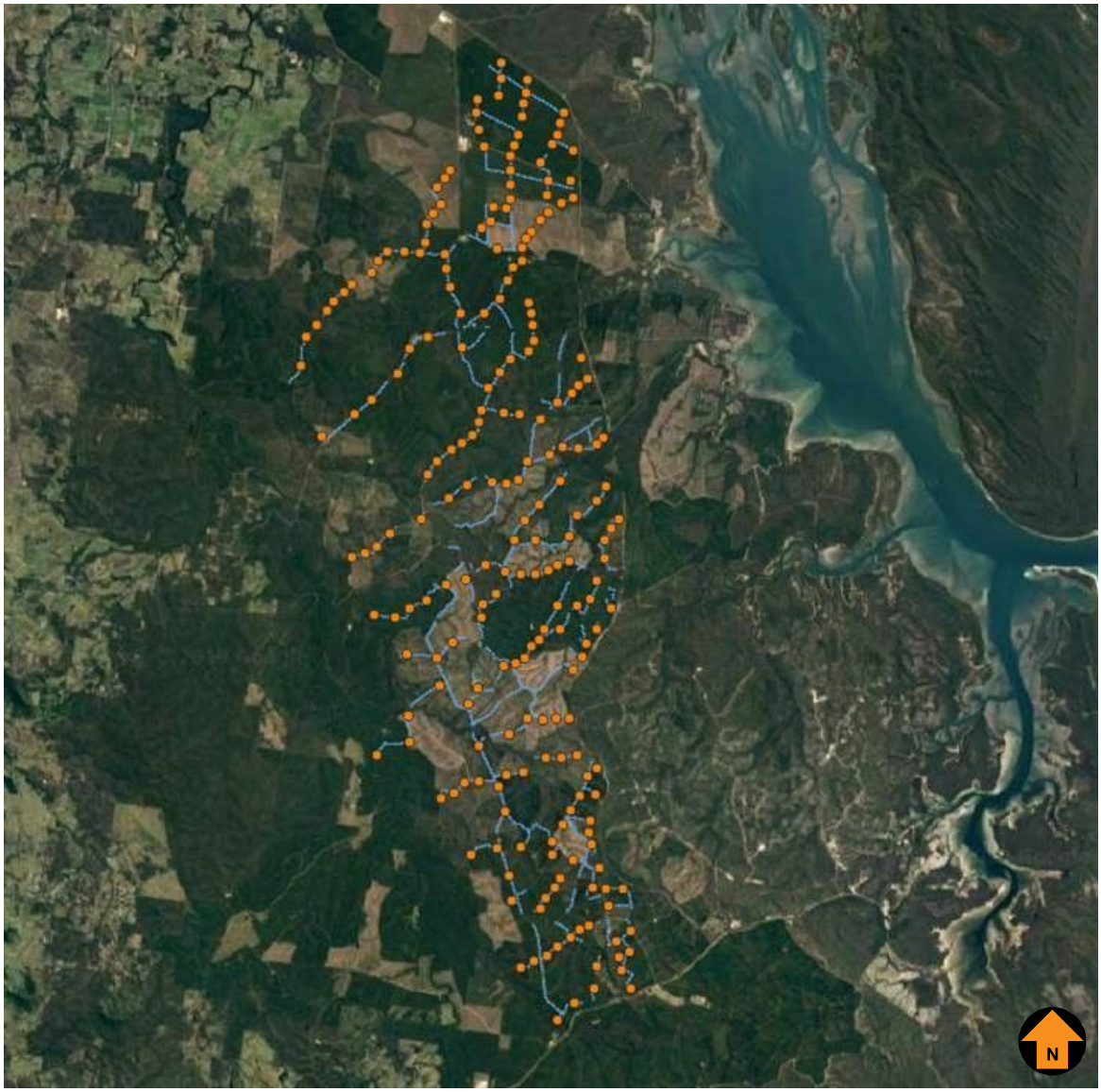

Figure 1 Project micrositing

The coordinates and ground elevations of the Project wind turbines are listed in **Annexure 1**.

3. EXTERNAL CONTEXT

3.1. Department of State Development, Manufacturing, Infrastructure and Planning

The Department of State Development, Manufacturing, Infrastructure and Planning released the State Development Assessment Provisions (SDAP), version 2.5, commencing on 1 July 2019.

SDAP sets out the matters of interest to the state for development assessment, where the Director-General of the department is responsible for assessing or deciding development applications. State Code 23 addresses wind farm development.

The code applies to a material change of use for a new or expanding wind farm. The purpose of State Code 23 is:

> *to protect individuals, communities and the environment from adverse impacts as a result of the construction, operation and decommissioning of wind farm development.*
>
> *Wind farms should be appropriately located, sited, designed and operated to ensure:*
>
> *(1) the safety, operational integrity and efficiency of air services and aircraft operations.*

State Code 23 contains Performance Outcomes (PO) and Acceptable Outcomes (AO). PO1 and PO2 and associated Acceptable Outcomes address aviation safety, integrity and efficiency and are provided in Table 1.

Table 1 State Code 23 - Aviation safety, integrity and efficiency for Material Change of Use

Performance outcomes	*Acceptable outcomes*
Aviation safety, integrity and efficiency	
PO1 The safety, operational integrity and efficiency ***of air services*** and aircraft operations are not adversely affected by the location, siting, design and operation of the development.	AO1.1 Wind turbines or wind monitoring towers are 150 metres or less in height and do not infringe on the obstacle limitation surfaces (OLS), procedures for air navigation services – aircraft operations (PANS-OPS) surface, restricted airspace and low flying areas of a certified aerodrome, registered aerodrome or military aerodrome. OR AO1.2 For development involving wind turbines or wind monitoring towers more than 150 metres in height: (1) written endorsement by the Civil Aviation Safety Authority (CASA), Airservices Australia and the district aerodrome supervisor is provided stating they have no objection to the propose development, or (2) where within 30 kilometres of a military aerodrome, or a certified aerodrome or registered

Performance outcomes	*Acceptable outcomes*
	aerodrome jointly used as a military aerodrome, written endorsement by the federal Department of Defence, Civil Aviation Safety Authority (CASA), Airservices Australia and the district aerodrome supervisor is provided stating they have no objection to the proposed development.
PO2 Development includes lighting and marking measures to ensure the safety, operational integrity and efficiency of air services and aircraft operations.	AO2.1 Marking of wind turbines is provided so that rotor blades, the nacelle and the upper two thirds of the supporting mast of wind turbines are painted white. AND AO2.2 The top one third of wind monitoring towers is painted in alternating bands of contrasting colour. AND AO2.3 For development involving the lighting of wind turbines or wind monitoring towers more than 150 metres in height or within 30 kilometres of a certified aerodrome or registered aerodrome, written endorsement by the Civil Aviation Safety Authority (CASA) and Airservices Australia is provided stating they have no objection to the proposed development and lighting measures. AND AO2.4 In areas where low flying aircraft occur: (1) marker balls or high visibility sleeves are placed on the outside guy wires or wind monitoring towers (2) the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation (3) a flashing strobe light is installed to operate on wind monitoring towers during daylight hours. AND AO2.5 Where LED obstruction lighting is proposed, they frequency range of the LED light emitted falls within the range of wavelengths 655 to 930 nanometres.

On the basis of performance outcomes PO1 and PO2 and associated Acceptable Outcomes, the following actions will support an application in demonstrating compliance with State Code 23 addressing aviation safety, integrity and efficiency:

- Demonstrate all potential risks to air services have been identified; and
- Provide evidence from a suitably qualified aerodrome consultant / specialist that the development will not adversely affect the safety, operational integrity and efficiency of air services.

The methodology for preparing the risk assessment is contained in the National Airports Safeguarding Framework (NASF) – *Guideline D Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation.*

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

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

3.2. Fraser Coast Regional Council

Fraser Coast Planning Scheme 2014 incorporates an Airport and aviation facilities overlay code. The purpose of this code is:

> *to protect and maintain the safety, efficiency and operational integrity of Hervey Bay Airport, Maryborough Airport and Aviation facilities; and*
>
> *The purpose of the code will be achieved through the following outcomes:*
>
> *(a) the safety of aircraft operating within an Airport's operational airspace is maintained and enhanced;*
>
> *(Note – operational airspace includes the areas and vertical dimensions of an Airport's obstacle limitation surface (OLS).*
>
> *(b) sensitive land uses and other incompatible activities are appropriately located and designed to ensure that these uses and activities:*
>
> *i) do not adversely impact on Airport operations*
>
> *(c) The risk of public safety being compromised by incidents in the take-off and landing phases of aircraft operations is minimised.*

A copy of the Airport and aviation facilities overlay code's performance outcomes and acceptable outcomes relevant to the Project is provided in Table 2.

Table 2 Fraser Coast Planning Scheme Airport and aviation facilities overlay code

Performance outcomes	*Acceptable outcomes*
Obstructions and hazards	
PO1 Development does not cause an obstruction or hazard to the safe movement of aircraft through the temporary or permanent intrusion of physical structures into an Airport's operational airspace, particularly take-off and approach flight paths.	AO1 Buildings, structures (both freestanding and attached to buildings, including signs, masts or antennae) do not penetrate the obstacle limitation surface (OLS) of an Airport and Aviation facilities overlay map unless the intrusion is approved in accordance with the relevant federal legislation.
PO3 Development does not cause an obstruction or hazard to the safe movement of aircraft within an Airport's operational airspace through the installation of external lighting that could distract or interfere with a pilot's vision, or confuse the visual identification of runway, approach or navigational lighting from the air.	AO3.1 Outdoor lighting (including street lighting and security lighting) located within 6km of Airport runways, as identified on an Airport environs overlay map, does not involve: (a) lighting that shines, projects or reflects above a horizontal plane; (b) coloured, flashing or sodium lighting; (c) flare plumes; (d) configurations of lights in straight parallel lines 500m to 1,000m in length; and (e) reflective surfaces. AO3.2 Development located within a light restriction zone is not permitted to emit light that will exceed the maximum light intensity specified for the zone • lighting Zone A - 0 candela • Zone B - 50 candela • Zone C - 150 candela • Zone D - 450 candela Note - Light intensity measured from the light source at 3 degrees above its horizontal plane.

Performance outcomes	*Acceptable outcomes*
PO6 Development does not interfere with the function of Aviation facilities.	AO6.1 Development located within the building restricted area for an aviation facility does not create: (a) permanent or temporary physical obstructions in the line of sight between antennas; (b) an electrical or electromagnetic field that will interfere with signals transmitted by the facility; or (c) reflective surfaces that could deflect or interfere with signals transmitted by the facility. AO6.2 Development located within the building restricted area for an aviation facility (zone boundary of Zone A relevant to the aviation facility type) is designed and constructed to mitigate adverse impact on the function of the facility. AO6.3 Development located within the building restricted area (Zone B relevant to the aviation facility type) does not cross the zone boundary.

3.3. Gympie Regional Council

Gympie Regional Council Planning Scheme 2013 incorporates an Aerodrome Precinct. This precinct facilitates opportunities for the expansion of aviation related uses, adjacent to the Gympie Aerodrome at Kybong. Gympie Regional Council Planning scheme has no Airports Environs Overlay Code. Therefore, the project does not conflict with provisions of the Gympie Regional Council Planning Scheme.

3.4. Aircraft operations at non-controlled aerodromes

Civil Aviation Advisory Publications (CAAP) provide guidance, interpretation and explanation on complying with the Civil Aviation Regulations 1988 (CAR) or Civil Aviation Orders (CAO). CAAP 166-01 v4.2 – *Operations in the vicinity of non-controlled aerodromes* – provides guidance with respect to CAR 166. The purpose of this CAAP is to support Common Traffic Advisory Frequency (CTAF) procedures. It provides guidance on a code of conduct (good airmanship) to allow flexibility for pilots when flying at, or in the vicinity of, non-controlled aerodromes.

CAAP 166-01 v4.2 paragraph 2.1.4 states the following:

> *3.4 CASA strongly recommends the use of 'standard' traffic circuit and radio broadcast procedures by radio-equipped aircraft at all non-controlled aerodromes. These procedures are described in the Aeronautical Information Publication (AIP) and Visual Flight Rules Guide (VFRG),and discussed in Section 5 of this CAAP (Standard traffic circuit procedures) and Section 7 (Radio broadcasts).*

The standard circuit consists of a series of flight paths known as *legs* when departing, arrival or when conducting circuit practice. Illustrations of the standard aerodrome traffic circuit procedures are provided in Figure 2 and Figure 3.

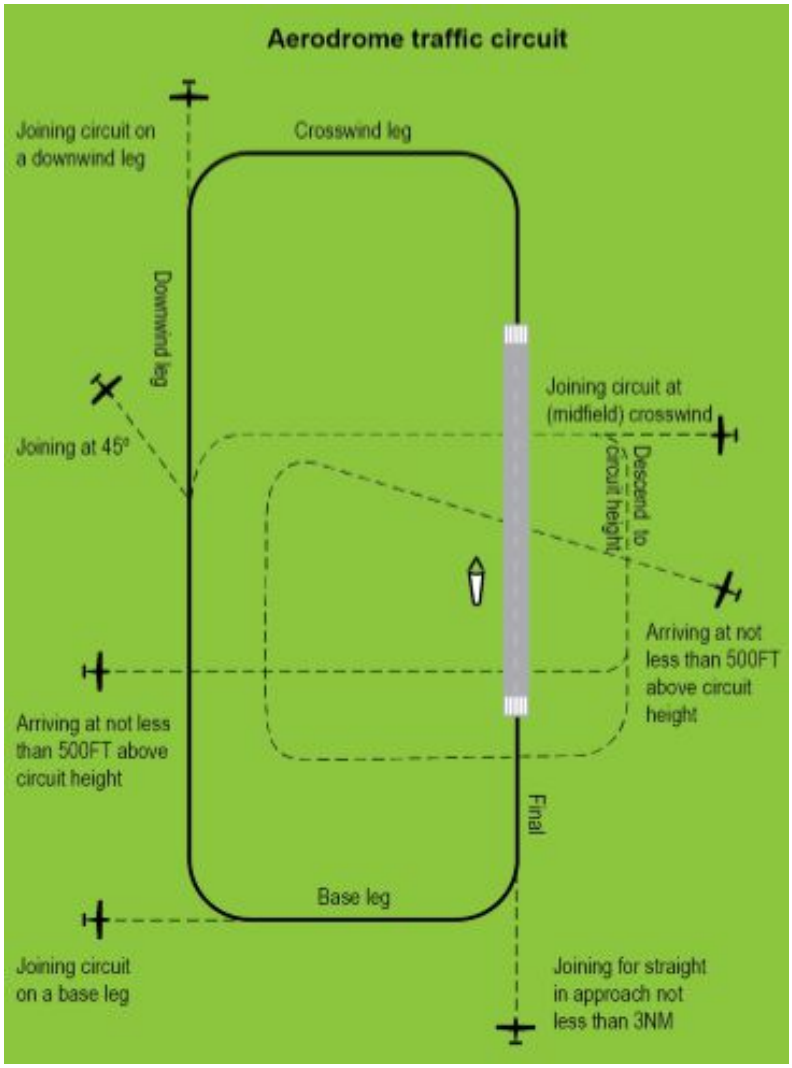

Figure 2 Aerodrome standard traffic circuit, showing arrival and joining procedures

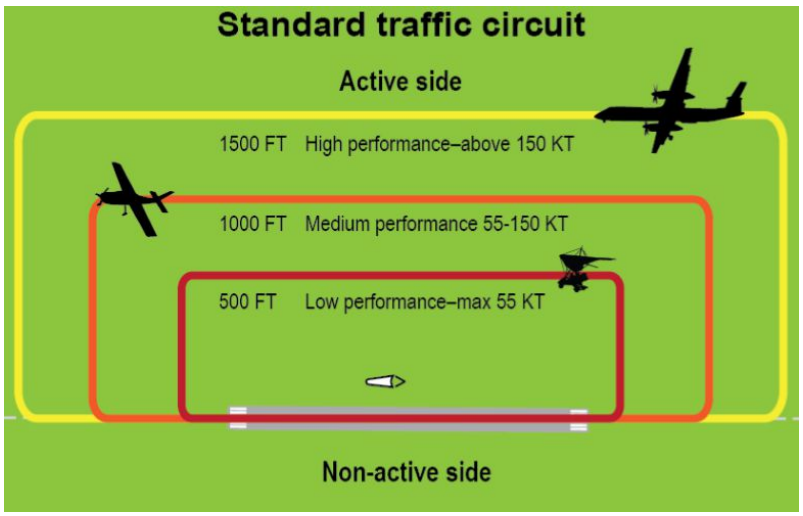

Figure 3 Lateral and vertical separation in the standard aerodrome traffic circuit

CAAP 166-01 v4.2 paragraph 5.4.1 makes reference to a distance that is "normally" well outside the circuit area and where no traffic conflict exists, which is at least 3 nm (5556 m). The paragraph is copied below:

> *5.4 Departing the circuit area*
>
> *5.4.1 Aircraft should depart the aerodrome circuit area by extending one of the standard circuit legs or climbing to depart overhead. However, the aircraft should not execute a turn to fly against the circuit direction unless the aircraft is well outside the circuit area and no traffic conflict exists. This will normally be at least 3 NM from the departure end of the runway, but may be less for aircraft with high climb performance. In all cases, the distance should be based on the pilot's awareness of traffic and the ability of the aircraft to climb above and clear of the circuit area.*

3.5. Rules of flight

3.5.1. Flight under Day Visual Flight Rules (VFR)

According to Aeronautical Information Publication (AIP) the meteorological conditions required for visual flight in the applicable (class G) airspace at or below 3000 ft AMSL or 1000 ft AGL whichever is the higher are: 5000 m visibility, clear of clouds and in sight of ground or water.

Civil Aviation Regulation (1988) 157 (Low flying) prescribes the minimum height for flight. Generally speaking aircraft are restricted to a minimum height of 500 ft AGL above the highest point of the terrain and any object on it within a radius of 600 m (or 300 m for helicopters) in visual flight during the day when not in the vicinity of built up areas, and 1000 ft AGL over built up areas.

These height restrictions do not apply if through stress of weather or any other unavoidable cause it is essential that a lower height be maintained.

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

3.5.2. Night VFR

With respect to flight under the VFR at night, Civil Aviation Regulations (1988) 174B states as follows:

> *The pilot in command of an aircraft must not fly the aircraft at night under the V.F.R. at a height of less than 1000 feet above the highest obstacle located within 10 miles of the aircraft in flight if it is not necessary for take-off or landing.*

3.5.3. IFR (Day or night)

According to CAR 178, flight under the instrument flight rules (IFR) requires an aircraft to be operated at a height clear of obstacles that is calculated according to an approved method. Obstacle lights on structures not within the vicinity of an aerodrome are effectively redundant to an aircraft being operated under the IFR.

3.6. Aircraft operator characteristics

3.6.1. Passenger transport operations

Regular public transport (RPT) and passenger carrying charter operations are generally operated under the IFR.

3.6.2. Private operations

Private operations are generally conducted under day or night VFR, with some IFR. Flight under day VFR is conducted above 500 ft AGL.

3.6.3. Aerial agricultural operations

Aerial agricultural operations including such activities as fertiliser, pest and crop spraying are generally conducted under day VFR below 500 ft AGL; usually between 60 ft (18.3 m) and 100 ft (30.5 m) AGL.

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

The Aerial Agricultural Association of Australia (AAAA) has a formal risk management program which is recommended for use by its members.

3.6.4. Aerial fire fighting

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

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

3.6.5. Emergency services/RFDS

Aeromedical and other emergency services operations are generally conducted under the IFR, except when arriving/departing a destination that is not serviced by instrument approach aids or procedures.

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

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

4. INTERNAL CONTEXT

4.1. Wind Turbine Area

The proposed WTA is located approximately 14.5 km (7.9 nm) south east from Maryborough Airport and approximately 33.2 km (18 nm) south west from Hervey Bay Airport.

The WTA is approximately 53 km (29 nm) from the northern extent to the southern extent, and approximately 16 km (8.5 nm) from the eastern extent to the western extent and is located within the following land parcels:

- Lot 915 of Crown Plan FTY1775;
- Lot 1004 of Crown Plan FTY1659; and
- Lot 1419 of Crown Plan FTY1697.

Figure 4 shows the location of the proposed WTA (source: CleanSight).

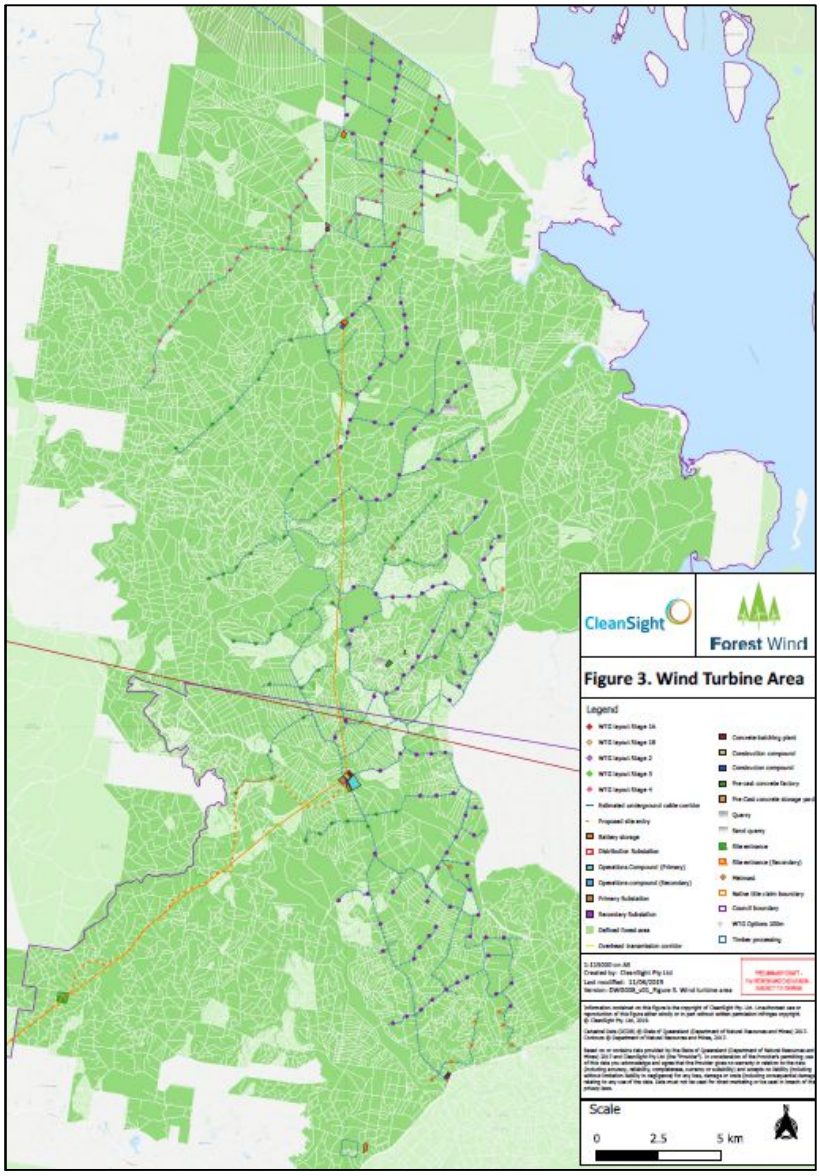

Figure 4 Proposed WTA

Figure 5 shows the location of the proposed Project including the WTA and the Project site area relative to Maryborough Airport (YMYB) and Hervey Bay Airport (YHBA) (source: Google Earth).

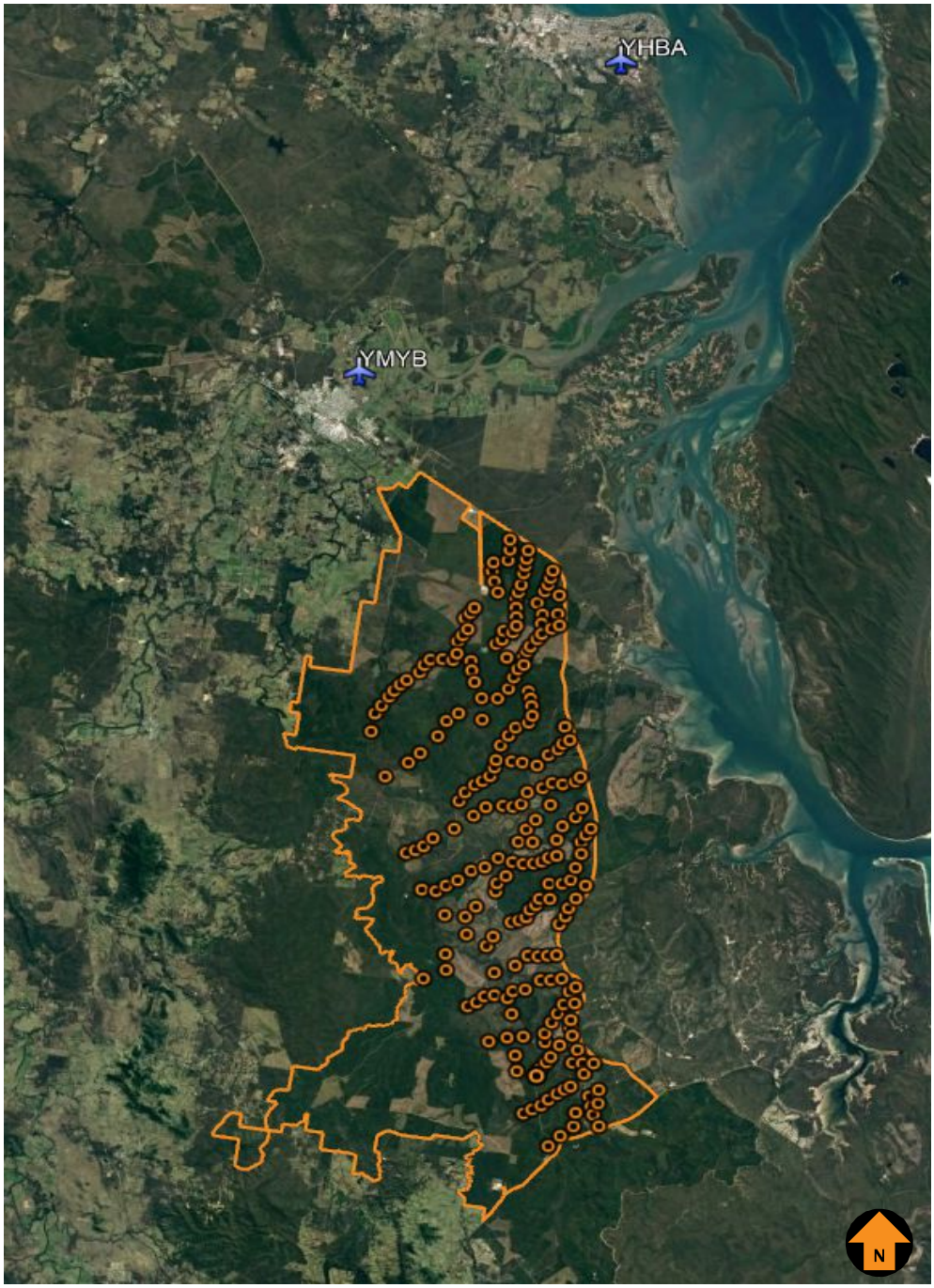

Figure 5 Proposed WTA and Project site area relative to nearby certified/registered airports

Figure 6 shows the location of the proposed Project site area relative to the local government areas boundaries (source: QLD Globe).

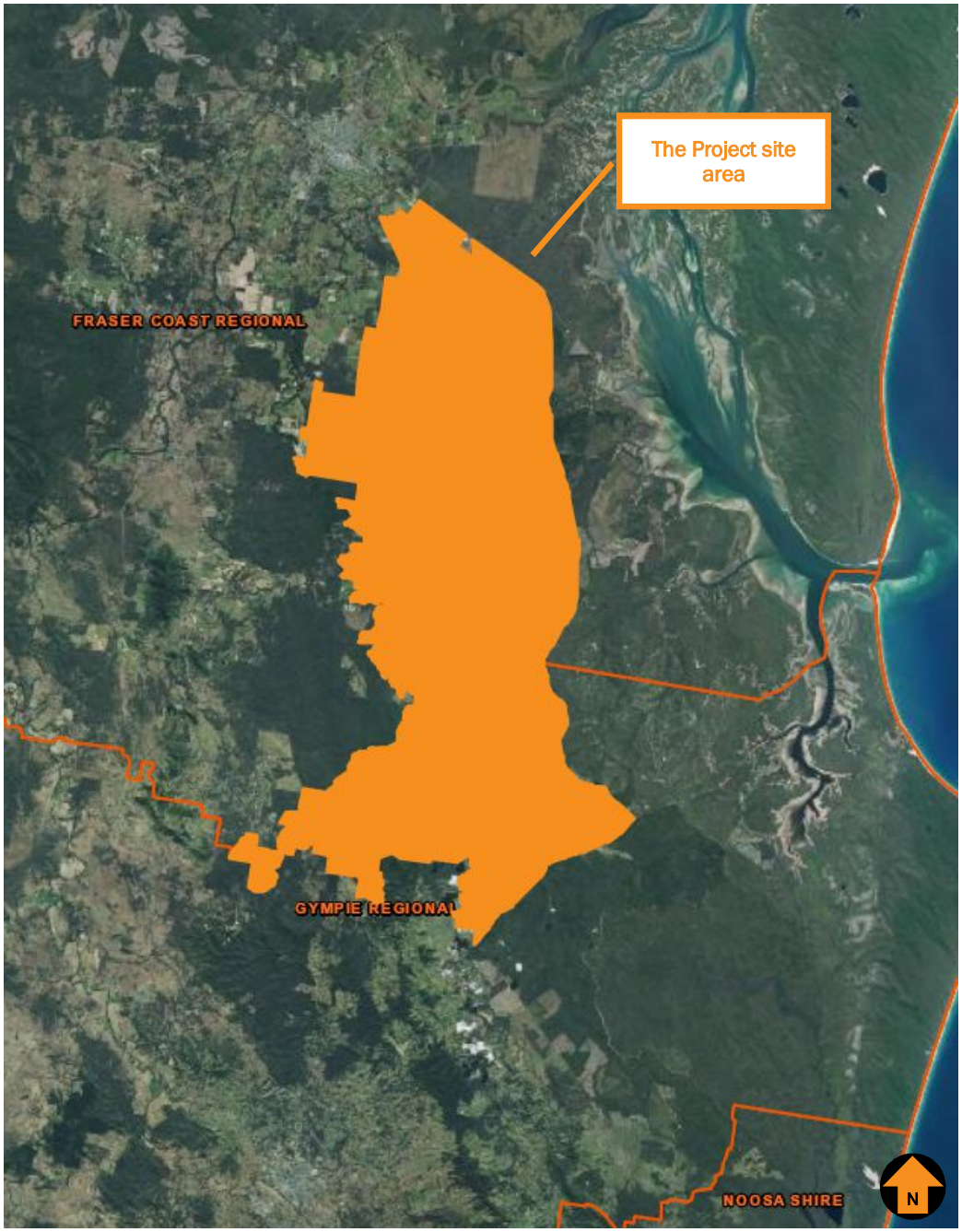

Figure 6 Location of the proposed Project site area relative to local government areas

4.2. Wind turbine description

The proposed Project will comprise of the following:

- up to 226 turbines;
- maximum overall height (tip height) of the wind turbines is up to 295 m AGL;
- highest wind turbine is WTG 2_119 with ground elevation of 108.7 m AHD and overall height of 408.7 m AHD (1341 ft AMSL); and
- lowest wind turbine is WTG 1A_1 with ground elevation of 8.9 m AHD and overall height of 309 m AHD (1013.4 ft AMSL).

The site is flat to undulating terrain with elevation ranging from 10 m to 150 m AHD.

Figure 7 provides the proposed WTA identifying the highest and the lowest wind turbines (source: CleanSight and Google Earth).

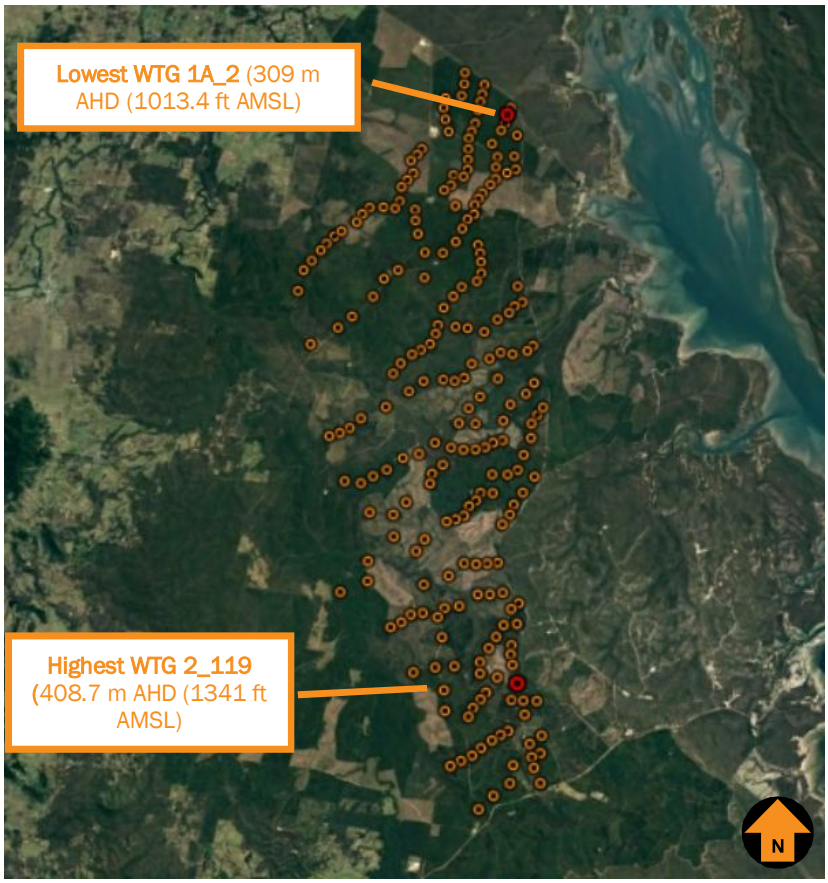

Figure 7 Proposed WTA identifying the highest and the lowest wind turbines

WTG 2_1 will be the closest to Maryborough runway centreline, which is approximately 14.4 km (7.8 nm) from the southern runway threshold. WTG 2_85 will be closest to the adjacent to the WBTA military training area at Tin Can Bay. Refer to Figure 8 (source: Google Earth).

Figure 8 Proposed WTA vs closest wind turbines to Maryborough runway centreline

4.3. Wind monitoring tower description

FWH has proposed to install three temporary and up to six permanent WMTs at the site location up to 180 m (590.6 ft) AGL in height, which will be reported to Airservices Australia.

Figure 9 shows the proposed locations of temporary WMTs (source: Google Earth).

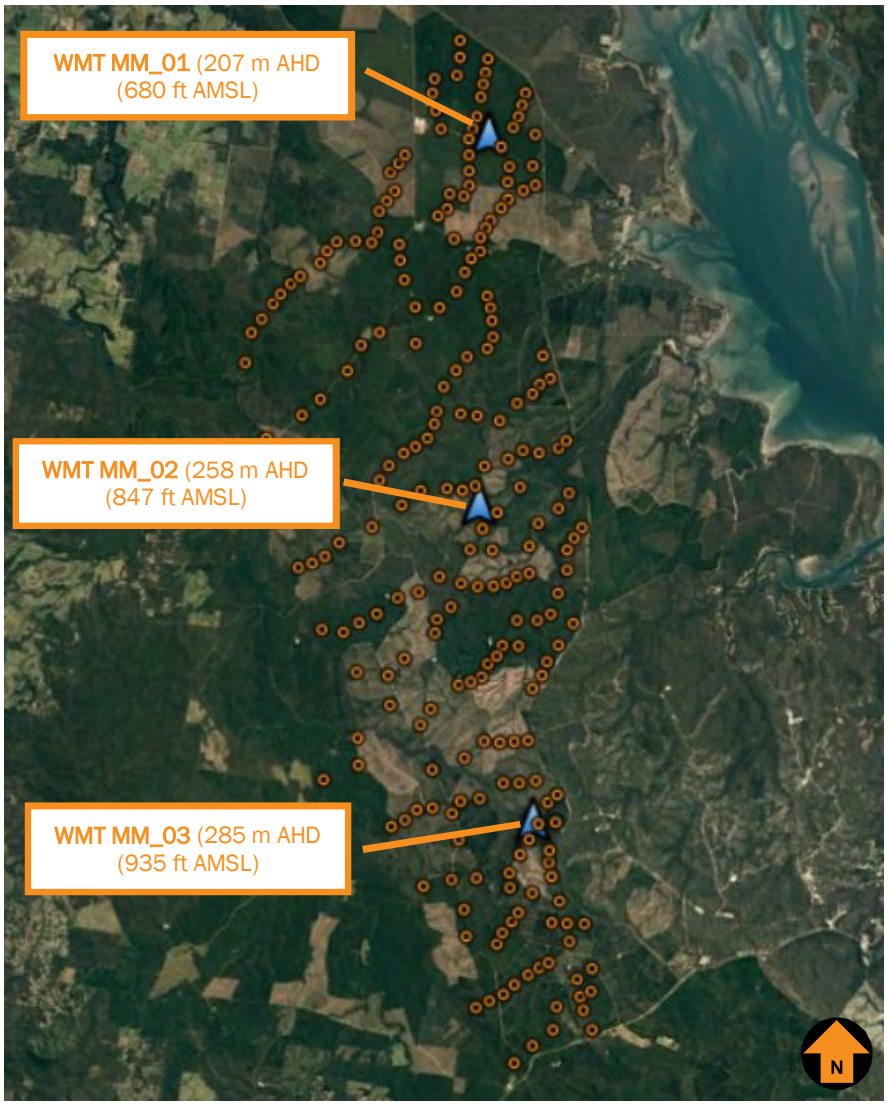

Figure 9 Proposed location of temporary wind monitoring towers

The details of the proposed temporary WMTs are provided in Table 3.

Table 3 Temporary wind monitoring tower description

Detail	*WMT MM_01*	*WMT MM_02*	*WMT MM_03*
Location (Lat, Lon)	-25.65598438°S 152.8227873°E	-25.793082°S 152.8194991°E	-25.90993265°S 152.8422136°E
Ground elevation at site (approximate)	22 m	73 m	100 m
Error budget (m)	± 5 m AHD	± 5 m AHD	± 5 m AHD
Height of tower AGL	Up to 180 m	Up to 180 m	Up to 180 m
WMT tip height AHD	207 m AHD (680 ft AMSL)	258 m AHD (847 ft AMSL)	285 m AHD (935 ft AMSL)
Lighting	ICAO compliant medium intensity flashing white for day, low intensity steady red for night	ICAO compliant medium intensity flashing white for day, low intensity steady red for night	ICAO compliant medium intensity flashing white for day, low intensity steady red for night
Marking	• Top 1/3 of mast structure painted in red and white alternating bands • Aviation marker balls on outside guys • Contrasting colour markings at guy wire ground attachments	• Top 1/3 of mast structure painted in red and white alternating bands • Aviation marker balls on outside guys • Contrasting colour markings at guy wire ground attachments	• Top 1/3 of mast structure painted in red and white alternating bands • Aviation marker balls on outside guys • Contrasting colour markings at guy wire ground attachments
Design	Up to 180 m AGL guyed lattice tower	Up to 180 m AGL guyed lattice tower	Up to 180 m AGL guyed lattice tower
Construction date	Target date late August 2019	Target date late August 2019	Target date late August 2019
Reported to Airservices Australia	Will be reported to AsA	Will be reported to AsA	Will be reported to AsA

FWH advised that up to six permanent WMTs are also to be installed during the construction phase within 500 m of the external perimeter of the WTA.

Alternatively, the Project proposes to use remote sensing devices for permanent wind resource monitoring.

5. CONSULTATION

The following stakeholders were consulted:

- aerodrome operators (Fraser Coast Regional Council regarding Maryborough and Hervey Bay Airports)
- airline operators;
- Airservices Australia;
- Department of Defence; and
- Royal Flying Doctor Service.

Stakeholder consultation details are provided in Table 4.

Note: All consultation was undertaken according to items 27-29, 32 and 34 of the NASF Guideline D.

Table 4 Stakeholder consultation details

Agency/Contact	*Activity/Date*	*Response/ Date*	*Issues Raised During Consultation*	*Action Proposed*
Virgin Australia	15 November 2017 Email to Flight Operations Engineering Manager Ms Robyn Logan (Robyn.Logan@virginaustralia.com)	21 November 2017 Email from Ms Robyn Logan	During email consultation on for the initial project layout, Virgin Australia was informed of the Project. In the email response, Ms Logan advised that Virgin Australia does not operate to Maryborough Airport. In terms of Hervey Bay Airport, Ms Logan advised that Virgin Australia operations to HVB will not be significantly impacted by the wind farm development.	No further actions required.
Virgin Australia	02 August 2019 Email to Flight Operations Engineering Manager Ms Robyn Logan (Robyn.Logan@virginaustralia.com)	07 August 2019 Email from Ms Robyn Logan	During email consultation for the final project layout, Virgin Australia was advised on the updated Project. In the email response, Ms Logan confirmed that Virgin Australia still do not operate to Maryborough Airport. With respect to Hervey Bay Airport, Ms Logan advised that Virgin Australia flying operations will not be significantly impacted by the proposed MSA changes.	No further actions required.

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			Virgin Australia would be interested in receiving information of any additional Airservices Australia assessment outcomes for information purposes.	
QantasLink	02 August 2019 Email to Head of Flying Operations and Chief Pilot QantasLink Captain Adrian Young (adrianyoung@qantas.com.au)	13 August 2019 Email from Captain Adrian Young	During email consultation for the final project layout, QantasLink was informed of the Project. In the email response, Captain Adrian Young advised that after reviewing the aviation impact assessment (version 0.6), QantasLink will have no issue with the Projects development.	No further actions required.
Airservices Australia (Airport Developments)	07 August 2017 Email to Airport Developments	06 September 2017 Email from William Zhao (Advisor Airport Development)	During initial email consultation, Airservices Australia was provided with a copy of the initial aviation impact assessment (version v0.3) from CleanSight Pty Ltd in August 2017. Airservices Australia agreed with the proposed appropriate mitigation measures, which have been reflected throughout this version v0.5 of the aviation impact assessment.	The proposed WTA layout has been updated to reflect the requested Airservices Australia mitigation measures from 2017 consultation.

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
Airservices Australia (Airport Developments)	02 August 2019 Email to Airport Developments	01 October 2019 Email from William Zhao (Advisor Airport Development)	During email consultation for the final project layout, Airservices Australia was informed of the Project. In the email response, William Zhao advised that, Airservices requires that the operator of Hervey Bay and Maryborough Airport are to be consulted and confirm that the proposed permanent change to MSA will not adversely impact on their operations before any change (temporary or permanent) can be supported by Airservices.	Consult the operator of Hervey Bay and Maryborough Airport – completed. Airservices work associated with amending the flight procedures will be undertaken on a commercial basis and require further consultation with Airservices – not completed.
Civil Aviation Safety Authority (CASA)	07 August 2017 Email to Aerodrome Engineer Mr Matthew Windebank	06 October 2017 Letter from Mr Andrew Tiede (Manager)	During initial email consultation in August 2017, CASA was informed of the Project and advised on the affects to the Hervey Bay 25 nm MSA and Maryborough 10 nm MSA. The project layout has been updated to include the mitigation strategies as recommended by CASA, which are detailed in the initial aviation impact assessment (version v0.3).	The proposed WTA layout has been updated to reflect the requested CASA mitigation measures from 2017 consultation.

Agency/Contact	*Activity/Date*	*Response/ Date*	*Issues Raised During Consultation*	*Action Proposed*
Department of Defence **Estate Planning QVT**	Email to Estate Planning Land Planning and Regulation Infrastructure Division (DSRGIDEP) ExecutiveSupport@ defence.gov.au	8 December 2017 Letter from Sonya Dare (Director Land Planning and Regulation, Estate Planning Branch) Department of Defence	During initial email consultation in August 2017, the Department of Defence was provided with a copy of the initial aviation impact assessment (version v0.3). The Project has been reassessed with appropriate mitigation strategies as recommended during the initial consultation response from the Department of Defence.	The proposed project layout has been updated to reflect the requested Defence mitigation measures from 2017 consultation.
Department of Defence **Estate Planning QVT**	2 August 2019 Email to DSRGIDEP ExecutiveSupport@ defence.gov.au	19 November 2019 Letter from (Director Land Planning and Regulation) Department of Defence	During email consultation in August 2019, the Department of Defence was provided with a copy of the revised aviation impact assessment (version v0.6). Defence has conducted an assessment of the amended proposal for potential impacts on the safety of Defence flying operations. Defence has no objection to the proposed wind farm provided that the project complies with the conditions outlined in the letter response (refer to **Annexure 2**). Defence advised that should the proposed wind farm have an adverse impact on Defence training capabilities, the operators of the wind farm would need to work with	No further action required uncles the wind farm to interfere with high frequency radio communications used within the Wide Bay Training Area when the operators of the wind farm would need to work with Defence to resolve the issue – Not applicable. Notify Airservices Australia of 'as-constructed' details.

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			Defence to resolve the issue by introducing measures to reduce levels of interference to acceptable levels. The proposed 295 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. A response is provided in **Annexure 2.**	
Fraser Coast Regional Council (FCRC)	07 August 2017 Email to Airport Technical Officer at Hervey Bay/Maryborough Airports Ms Karen Strange (karen.strange@frasercoast.qld.gov.au)	29 August 2017 Email from Ms Strange	During email consultation regarding the initial proposed layout in 2017, FCRC was informed of the Project and advised of the affects to the Hervey Bay 25 nm Minimum Sector Altitude and Maryborough 10 nm Minimum Sector Altitude. In the email response received on 29 August 2017 from Ms Karen Strange (Airport Technical Officer), Ms Strange advised that FCRC agreed that there would be no impact on either YHBA or YMYB in regard to OLS surfaces. Ms Strange noted that Fraser Coast Regional Council, as the	Receive CASA and AsA no objections –completed.

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
			Aerodrome Operator, have no concerns with the Project once CASA and Airservices would state no objections.	
Fraser Coast Regional Council (FCRC)	12 August 2019 Meeting with the Council	13 September 2019 Email from James Cockburn, Executive Manager Planning and Growth	During meeting regarding the revised project layout, FCRC discussed the Project. As operator of airports in both Maryborough and Hervey Bay, Council has no objection to the proposal subject to ongoing compliance with all CASA, Airservices and relevant aviation regulatory requirements. Furthermore, Council's position is on the condition that the proposed wind farm would not inhibit or be an impediment to the future growth of aviation activities and services at the Maryborough Airport.	Compliance with all CASA, Airservices and relevant aviation regulatory requirements – completed.
Royal Flying Doctor Service (RFDS)	02 August 2019 Email to Manager Line Operations Anthony Hooper (ahooper@rfdsqld.com.au)	02 August 2019 Email from Mr Hooper	During email consultation for the final project layout, RFDS was informed of the Project. In the email response, Mr Hooper advised that the Project will not impact on the RRDS' operations at both Maryborough and Hervey Bay airports.	No further actions required.

6. AVIATION IMPACT STATEMENT

The Aviation Impact Statement (AIS) was prepared in accordance with Airservices Australia requirements.

6.1. Nearby registered/certified aerodromes

There are two registered/certified aerodromes with instrument approach procedures (IAPs) or Obstacle Limitation Surfaces (OLS) within 30 nm (55.6 km) of the boundary of the proposed Project.

The nearby registered/certified aerodromes are listed in Table 5.

Table 5 Nearby registered/certified aerodromes

Aerodrome	*Operator*	*Location from the Project*
Maryborough (YMYB) (Registered)	Fraser Coast Regional Council	North west of proposed WTA. Closest proposed turbine is WTG 2_1 located approximately 14.4 km (7.8 nm) from Maryborough Aerodrome Reference Point (ARP)
Hervey Bay (YHBA) (Certified)	Fraser Coast Regional Council	North east of the proposed WTA. Closest proposed turbine is WTG 2_1 located approximately 33 km (17.8 nm) from Hervey Bay Airport ARP.

The northern side of the WTA is located within the 30 nm from the Hervey Bay Airport ARP and wholly within the 30 nm from the Maryborough Airport ARP.

Figure 10 illustrates nearby Maryborough Airport (YMYB) and Hervey Bay Airports (YHBA) with 30 nm buffer areas (source: Google Earth).

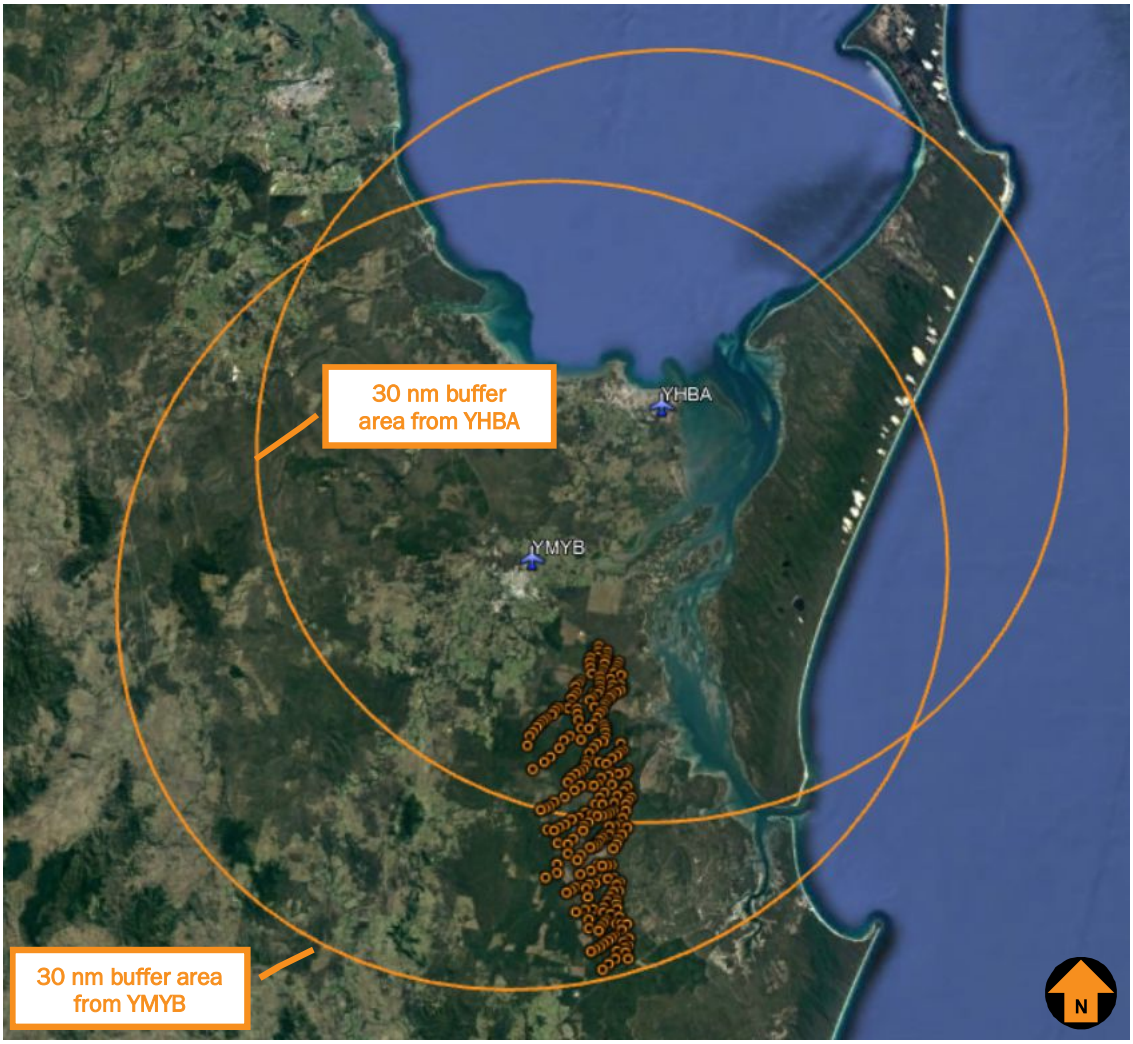

Figure 10 WTA in relation to registered/certified aerodromes

6.2. Maryborough Airport

Maryborough Airport is the closest registered aerodrome to the WTA. Maryborough Airport is located north of Maryborough town and approximately 14.4 km (7.8 nm) to the north west of the WTA.

The airport is owned and operated by the Fraser Coast Regional Council.

A check of Airservices Australia's Aeronautical Information Package shows that Maryborough Airport (YMYB) has two runways:

- a main sealed runway 17/35 that is 1587 m in length; and
- a cross grass runway 12/30 that is 885 m in length.

Maryborough Airport's aerodrome elevation is 38 ft AMSL (11.6 m AHD). Maryborough Airport's ARP coordinates published in Airservices Australia's Designated Airspace Handbook are Latitude 25°30'48"S and Longitude 152°42'54"E.

6.3. Maryborough Airport – obstacle limitation surfaces

Runway 17/35 at Maryborough Airport is an instrument, non-precision Code 3 approach runway. According to MOS 139 Chapter 7, the critical obstacle limitation surfaces for an instrument, non-precision Code 3 approach runway are as follows:

- Inner horizontal surface 4000 m in radius and up to 45 m in height;
- Approach and take-off surface total length – 15 000 m; and
- Transitional surface – at 14.3% slope from the edge of a runway strip.

The maximum horizontal distance that an OLS may extend for an aerodrome in Australia is 15 km (8.1 nm) from the edge of a runway strip.

The closest wind turbine (WTG 2_1) is located approximately 14.4 km (7.8 nm) south east of Maryborough Airport ARP, which is outside the maximum extent of the inner horizontal surface for a Code 3 non-precision approach runway.

The southern approach and take-off surfaces of runway 17/35 do not overlay the proposed WTA.

The proposed Project's turbine locations are outside the horizontal extent of, and will not impact, Maryborough Airport OLS.

An indicative representation of the approach surface for runway 35 is shown in Figure 11. It can be seen that the wind turbines are well clear of this surface, which has the greatest horizontal extent of any of the surfaces of the OLS.

Figure 11 Maryborough Airport runway 35 approach surface

6.4. Maryborough Airport - instrument procedures

A check of the AIP via the Airservices Australia website showed that Maryborough Airport is served by non-precision terminal instrument flight procedures, as per Table 6 (source: Airservices Australia, 23 May 2019).

Table 6 Maryborough Airport (YMYB) aerodrome and procedure charts

Chart name (Procedure Designer)	*Effective date*
AERODROME CHART (AsA)	23 May 2019 (MYBAD01-159)
RNAV-Z (GNSS) RWY 17 (AsA)	23 May 2019 (MYBGN01-159)
RNAV-Z (GNSS) RWY 35 (AsA)	23 May 2019 (MYBGN02-159)

The minimum safe altitude (MSA) is applicable for each instrument approach procedure at Maryborough Airport. An image of the MSA published for the aerodrome is shown in Figure 12.

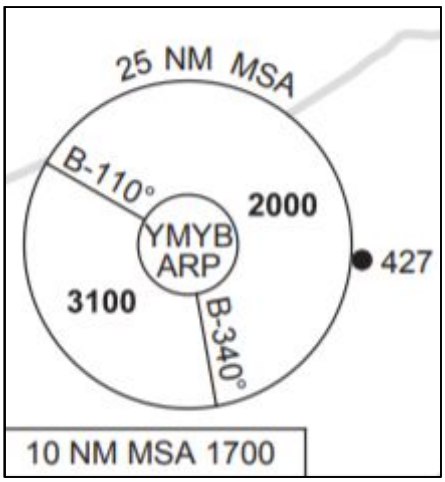

Figure 12 MSA at Maryborough Airport

The *Manual of Standards 173 Standards Applicable to Instrument Flight Procedure Design* (MOS 173), requires that a minimum obstacle clearance (MOC) of 1000 ft below the published MSA is maintained.

Figure 13 shows Maryborough Airport with 10 nm and 25 nm MSAs with associated 5 nm buffer areas (source: Google Earth).

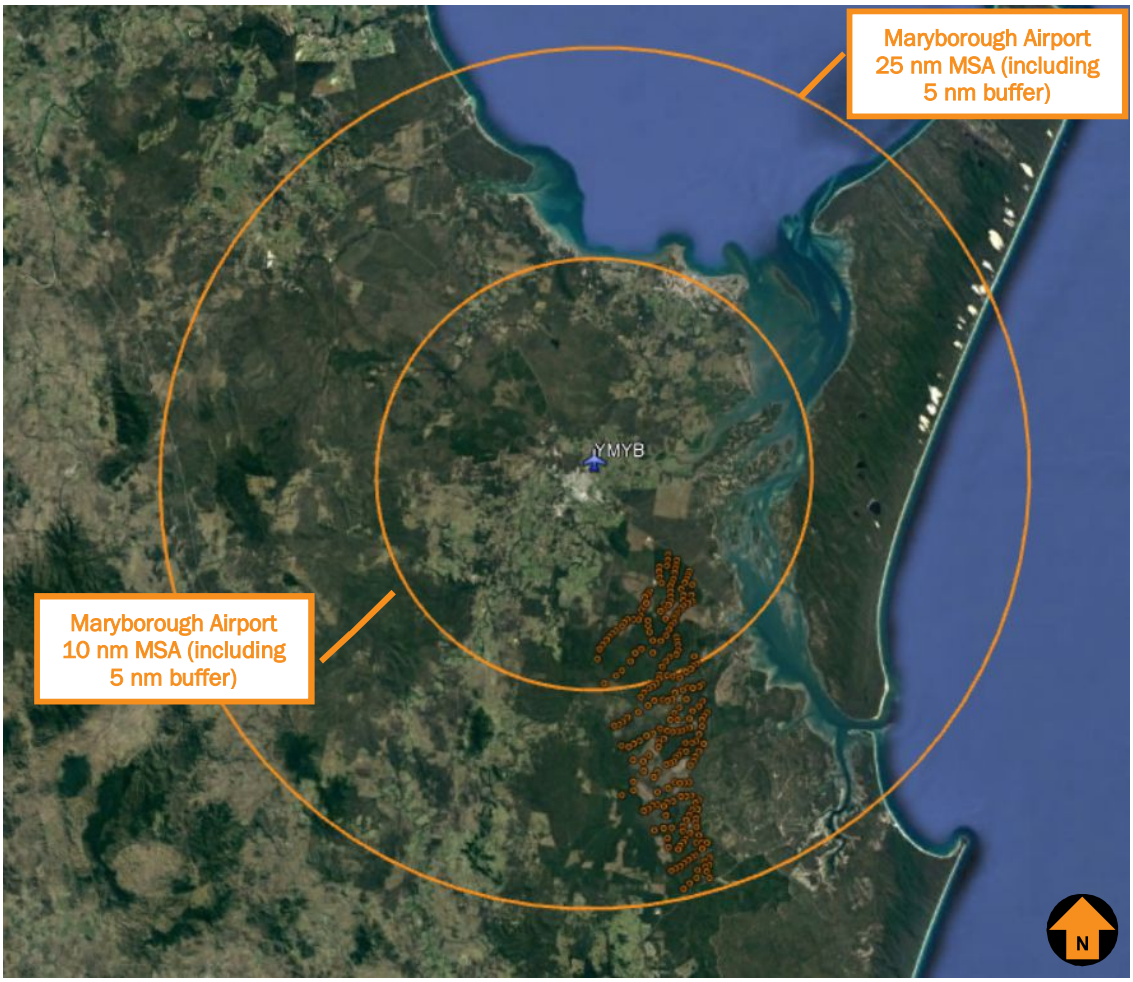

Figure 13 Maryborough Airport's 10 nm and 25 nm MSAs including 5 nm buffer areas

Within 15 nm (10 nm MSA + 5 nm buffer) of Maryborough Airport ARP, aircraft are subject to a minimum altitude of 1700 ft AMSL. The MOC for the 10 nm MSA is 700 ft AMSL.

The highest wind turbine located inside the horizontal extent of the 15 nm MSA of Maryborough Airport (10 nm MSA + 5 nm buffer) is WTG 3_7. At a maximum overall height of approximately 356.1 m AHD (1168.3 ft AMSL) for WTG 3_7 the Maryborough Airport 10 nm MSA MOC will be impacted by approximately 468.3 ft (142.7 m).

The 10 nm MSA for Maryborough Airport will need to be increased by 500 ft to 2200 ft for a 295 m AGL wind turbine model.

A close up illustration of wind turbines located inside the horizontal extent of the 10 nm MSA (including 5 nm buffer) of Maryborough Airport is shown in Figure 14 (source: Google Earth).

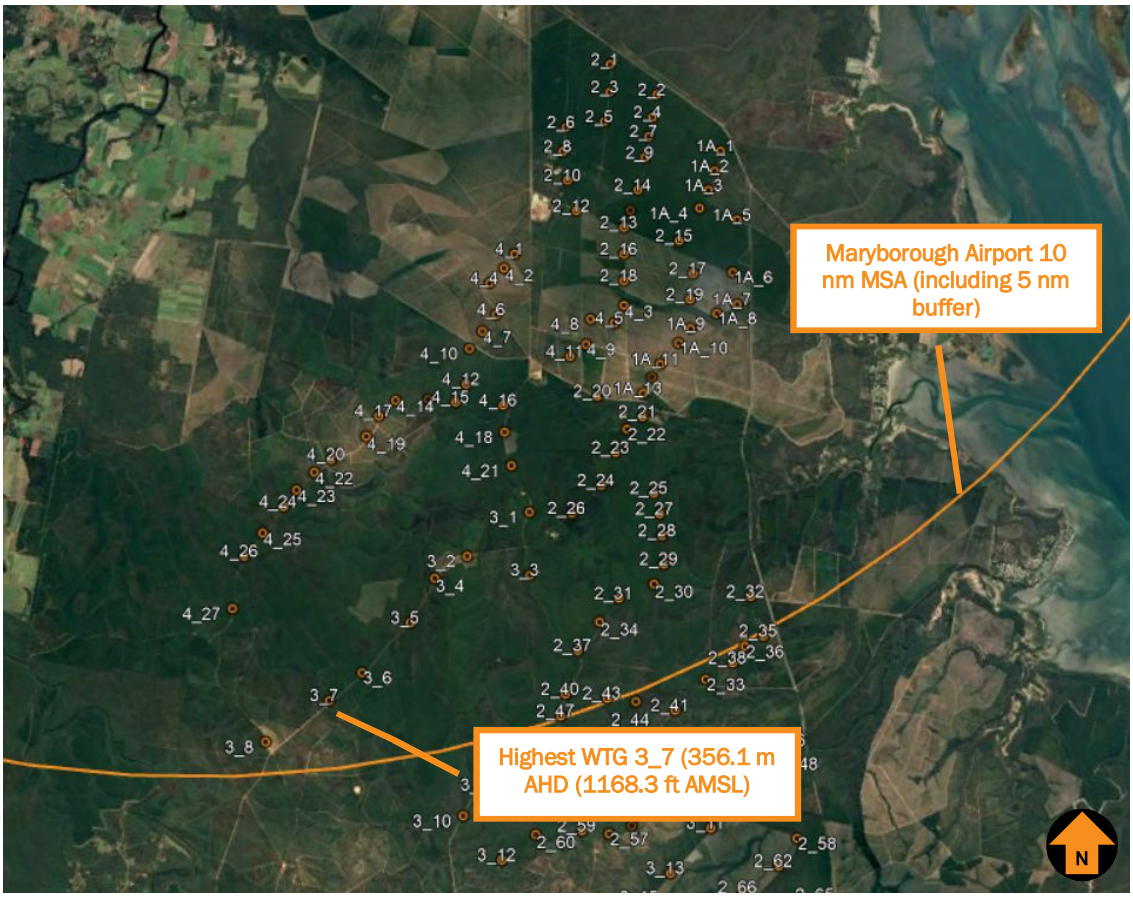

Figure 14 Maryborough Airport's 10 nm MSA

Within 30 nm (25 nm MSA + 5 nm buffer) of Maryborough Airport ARP, aircraft are subject to the following minimum altitudes:

- 2000 ft AMSL - in the sector between bearings 110°and 340°; and
- 3100 ft AMSL - in the sector between bearings 340°and 110°.

The MOC for the 25 nm MSA are respectively 1000 ft AMSL and 2100 ft AMSL.

Figure 15 shows the proposed wind turbine locations relative to the horizontal extent of the 25 nm MSA (including 5 nm buffer) of Maryborough Airport (source: Google Earth).

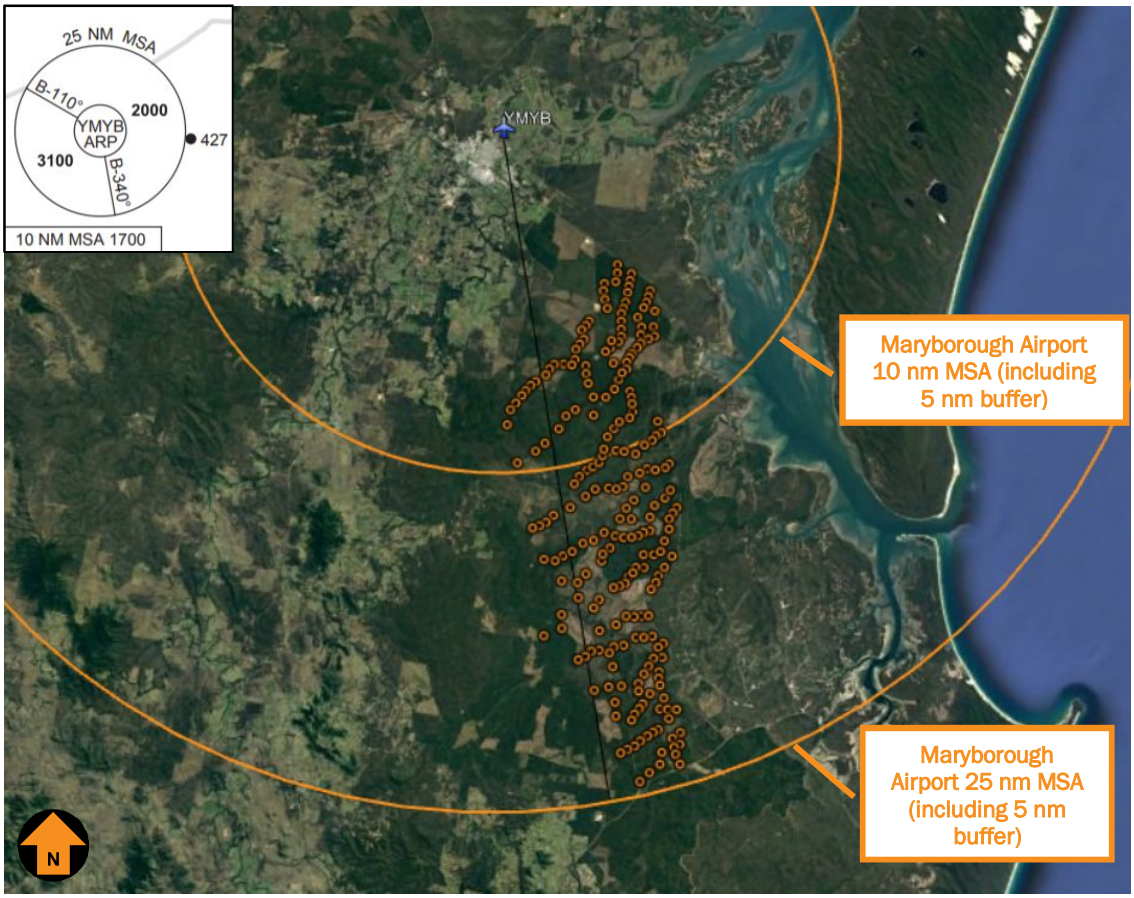

Figure 15 Proposed Project relative to 25 nm MSA (including 5 nm buffer) of Maryborough Airport

Two sectors of the 25 nm MSA (including 5 nm buffer) of Maryborough Airport are shown in Figure 16 (source: Google Earth).

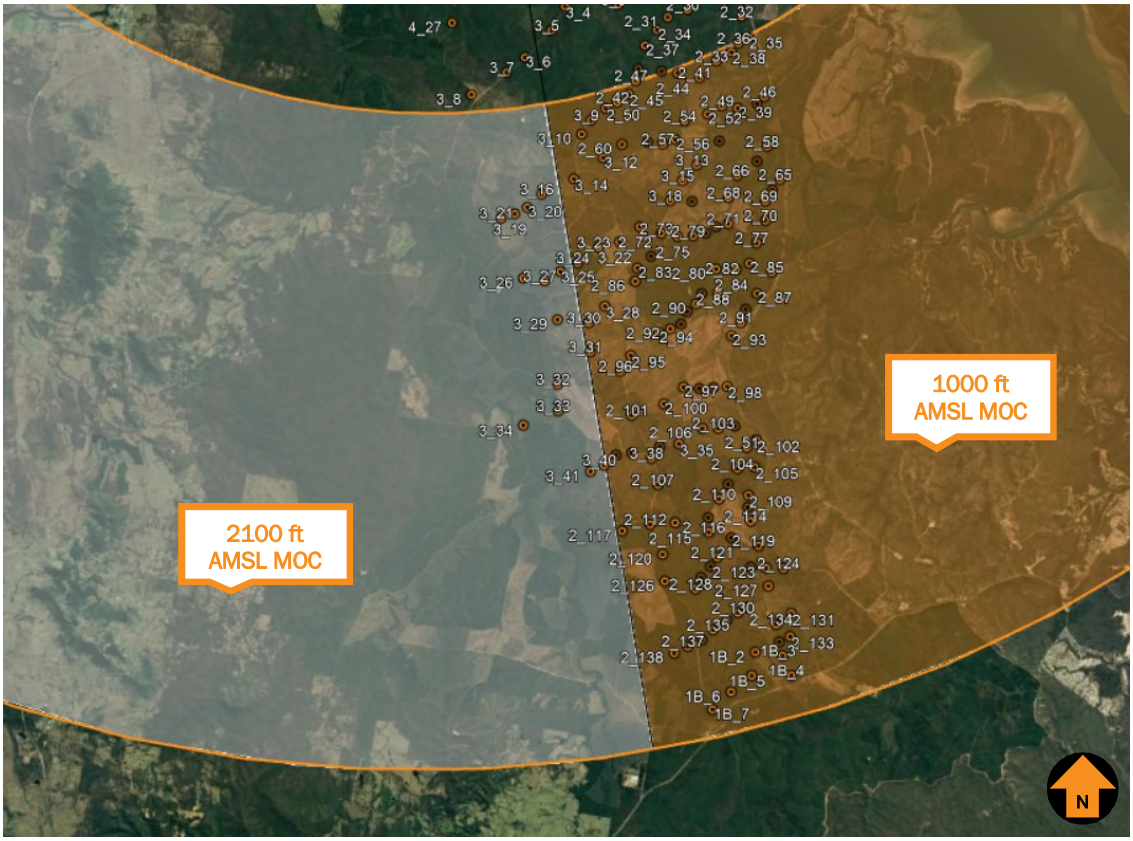

Figure 16 Maryborough Airport's 25 nm MSA

The highest wind turbine located inside the horizontal extent of the 25 nm MSA of Maryborough Airport (including 5 nm buffer area) in the sector between bearings 110° and 340° is WTG 2_119.

At a maximum overall height of approximately 408.7 m AHD (1341.1 ft AMSL) for WTG 2_119 the Maryborough Airport 25 nm MSA MOC in this sector will be impacted by approximately 341.1 ft (104 m).

The 25 nm MSA for Maryborough Airport in the sector between bearings 110° and 340° will need to be increased by 400 ft to 2400 ft for a 295 m AGL wind turbine model.

The highest wind turbine located inside the horizontal extent of the 25 nm MSA of Maryborough Airport (including 5 nm buffer area) in the sector between bearings 340° and 110° is WTG 3_20.

At a maximum overall height of approximately 352.5 m AHD (1156.4 ft AMSL) the WTG 3_20 will be below the Maryborough Airport 25 nm MSA MOC in this sector by approximately 943.6 ft (287.6 m). Therefore, the Maryborough Airport 25 nm MSA MOC in this sector will not be affected by the proposed WTA. In any case, this sector MOC will be higher than the highest proposed WTG 2_199 which has a maximum overall height of approximately 408.7 m AHD (1341.1 ft AMSL).

6.5. Maryborough Airport - circling areas

Maryborough Airport has published circling areas for category A, category B, category C and category D aircraft.

Figure 17 provides details of published circling areas at Maryborough Airport (source: AsA, 23 May 2019).

CATEGORY	A	B	C	D
LNAV/VNAV	**350** (320-1.8)			
LNAV	**600** (570-3.2)			
CIRCLING	**710** (672-2.4)		**810** (772-4.0)	**830** (792-5.0)
ALTERNATE	(1172-4.4)		(1272-6.0)	(1292-7.0)

Figure 17 Maryborough Airport circling areas

The published altitude of category A and B circling areas is 610 ft AMSL. The category C and category D circling areas have published altitudes of 710 ft AMSL and 730 ft AMSL respectively. The noted published altitudes are allowed with accurate QNH setting, without accurate QHN published altitudes increase by 100 ft.

It was previously noted by Airservices Australia in 2017 that Maryborough Airport category D circling would be impacted by the proposed WTA, but it was based on the layout of 2017 which has been revised multiple times.

All turbines are now located beyond the horizontal extent of all circling areas at Maryborough Airport.

6.6. Hervey Bay Airport

Hervey Bay Airport is the closest certified aerodrome to the Project site. Hervey Bay Airport is located approximately 33 km (17.8 nm) to the north east of the closest wind turbine WTG 2_1.

The airport is owned and operated by the Fraser Coast Regional Council.

A check of Airservices Australia's Aeronautical Information Package shows that Hervey Bay Airport (YHBA) has one grooved runway (runway 11/29) 2000 m long and 30 m wide.

Hervey Bay Airport's aerodrome elevation is 60 ft AMSL (18.2 m AHD). Hervey Bay Airport's ARP coordinates published in Airservices Australia's Designated Airspace Handbook are Latitude 25°19'08"S and Longitude 152°52'49"E.

6.7. Hervey Bay Airport – obstacle limitation surfaces

Runway 11/29 at Hervey Bay Airport is an instrument, non-precision Code 3 approach runway.

The maximum horizontal distance that an OLS may extend for a Code 3 runway is 15 km (8.1 nm) from the edge of a runway strip.

The proposed Project is located approximately 33 km (17.8 nm) to the north east of the closest wind turbine WTG 2_1 and will not have an impact on the Hervey Bay Airport's OLS.

6.8. Hervey Bay Airport - instrument procedures

RNAV GNSS approach procedure for runway 29 initiates at Fraser Island. The initial approach fix (IAF) for runway 11 RNAV GNSS approach procedure starts at Burrum Heads. Both flight procedures are located at distant (at least 25 nm (82 km)) from the proposed Project and will not be impacted by the Project.

The MSA is applicable for each instrument approach procedure at Hervey Bay Airport. An image of the MSA published for the aerodrome is shown in Figure 18 (source: AsA 2019).

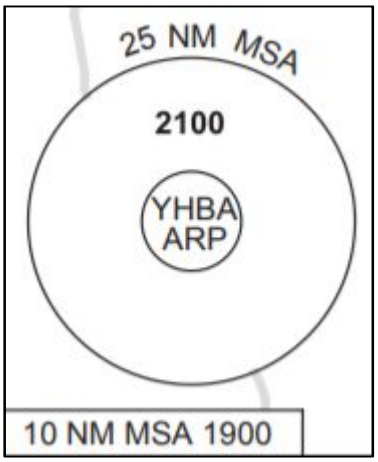

Figure 18 MSA at Hervey Bay Airport

Figure 19 shows the horizontal extents of 10 nm and 25 nm MSA of Hervey Bay Airport (including 5 nm buffer areas) (source: Google Earth).

Figure 19 Hervey Bay Airport's 10 nm and 25 nm MSA (including 5 nm buffer areas)

The WTA is outside the horizontal extent of the 10 nm MSA of Hervey Bay Airport (including 5 nm buffer area).

Within 30 nm (25 nm MSA + 5 nm buffer) of Hervey Bay Airport ARP, aircraft are subject to a minimum altitude of 2100 ft AMSL. The MOC for the 25 nm MSA is 1100 ft AMSL.

The highest wind turbine located inside the horizontal extent of the 25 nm MSA of Hervey Bay Airport (including 5 nm buffer area) is WTG 3_14.

At a maximum overall height of approximately 380.1 m AHD (1247 ft AMSL) for WTG 3_14 the Hervey Bay Airport 25 nm MSA MOC will be impacted by approximately 147 ft (44.8 m).

The 25 nm MSA for Hervey Bay Airport will need to be increased by 200 ft to 2300 ft for a 295 m AGL wind turbine model.

6.9. Nearby aircraft landing areas

There are a number of privately-owned aircraft landing areas (ALAs), which are uncontrolled aerodromes, in close proximity to the proposed WTA.

ALA name	*ICAO Code*	*Closest WTG*	*Distance*	*Location from the Project*
Unnamed (Western) ALA	No name ID	3_8	3.1 km (1.7 nm)	west
Cooloola Cove Airpark	YCXA	1B_4	13.9 km (7.5 nm)	east
Wide Bay	YWDY	2_124	10.4 km (5.6 nm)	east
Rainbow Beach	YRBB	2_74	19.1 km (10.3 nm)	east
Tobys Gap	YTBP	1A_1	23.5 km (12.7 nm)	north east
Eurong	YEUG	1A_1	31.8 km (17.2 nm)	north east
Hangaroo (Gunalda) ALA	No name ID	2_138	25.7 km (13.9 nm)	south west
Gympie ALA	YGYM	1B_7	35.6 km (19.2 nm)	south

A search on OzRunways, which sources its data from Airservices Australia (AIP) and AOPA National Airfield Directory datasets, returned no further nearby non-regulated aerodromes. The aeronautical data provided by OzRunways is approved by CASA under Civil Aviation Regulation 233(1)(h).

The general location of the WTA in relation to surrounding aerodromes is provided in Figure 20 (source: World Aeronautical Chart, OzRunways, dated 22 May 2019).

Figure 20 General location of the proposed WTA and surrounding aerodromes

As a guide, an area of interest within a 3 nm radius of an ALA is used to assess potential impacts of proposed developments on aircraft operations at or within the vicinity of the ALA.

Figure 21 shows indicative areas of interest within a 3 nm radius of surrounding ALAs (source: Google Earth).

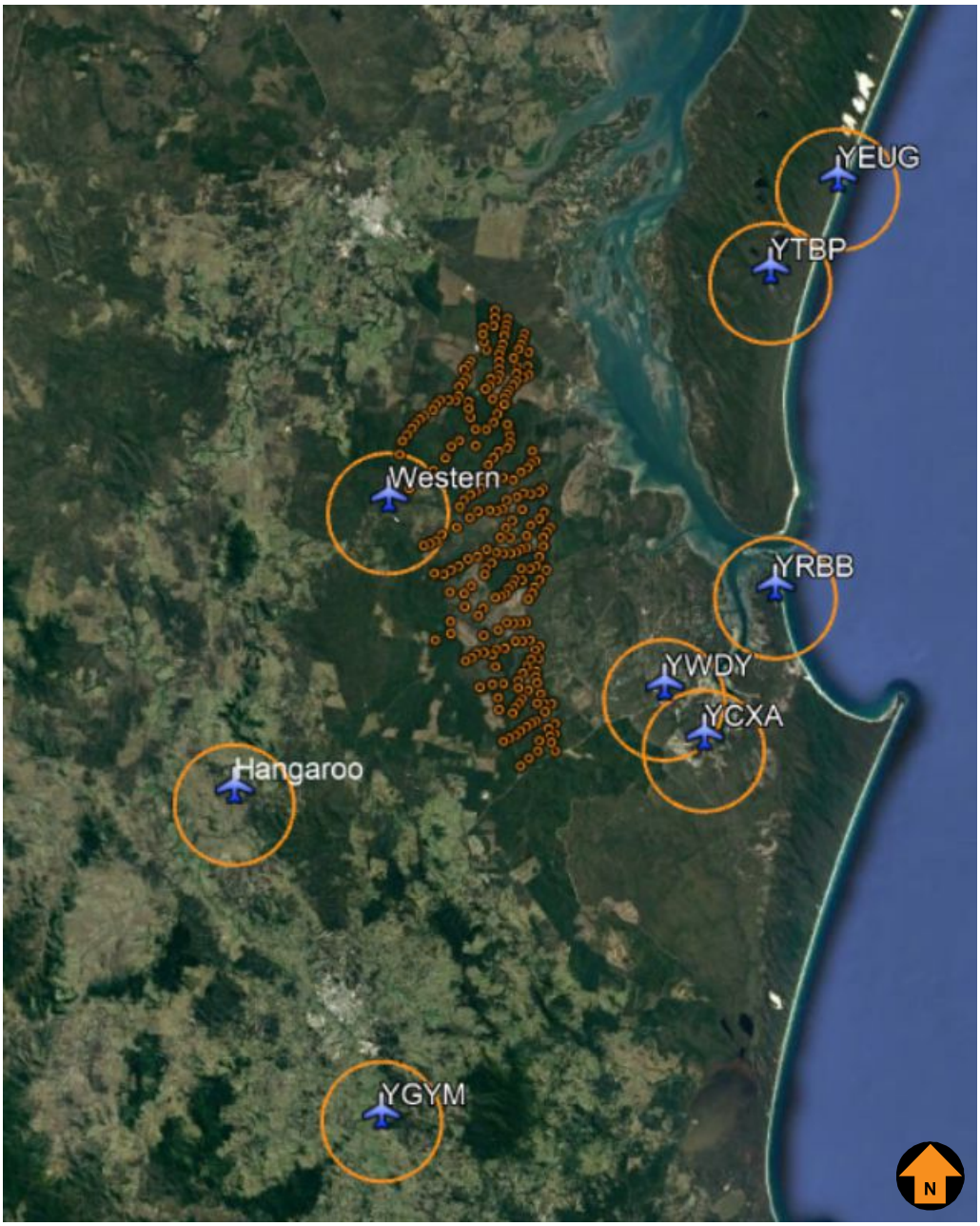

Figure 21 Proposed Project site area relative to ALAs

Western ALA is located approximately 3.1 km (1.7 nm) west of WTG 3_8 and is the closest ALA to the Project site.

Western ALA is located north east of Talegalla Drive and its runway is approximately 600 m long and 25 m wide.

WTG 3_7 and 3_8 are located abeam and approximately 4.8 km (2.6 nm) and 3.1 km (1.7 nm) from the Western ALA's runway.

Wind turbines 3_16, 3_19, 3_20 and 3_21 are located south east of the Western ALA south eastern runway end but outside the maximum horizontal extent of the approach and take-off surfaces and indicative flight circuits. These turbines will unlikely impact aircraft operations at the Western ALA.

The analysis of the approach and take-off surfaces and flight circuits is based on the recommendations provided in the CASA Advisory Publications (CAAP) 92-1(1) and (CAAP) 166-01 v4.2.

For the purposes of the flight circuit analysis, the following design parameters have been adopted:

- 1 nm upwind to achieve at least 500 ft AGL;
- 1 nm abeam the runway for downwind spacing;
- 45° relative position from the threshold for the turn from downwind onto the base leg; and
- Roll out at 1 nm final, not below 500 ft AGL.

Figure 22 shows a close up of the nearest wind turbines relative to the Western ALA showing the horizontal extent of the approach and take-off surfaces, indicative flight circuits and a 3 nm radius of this ALA.

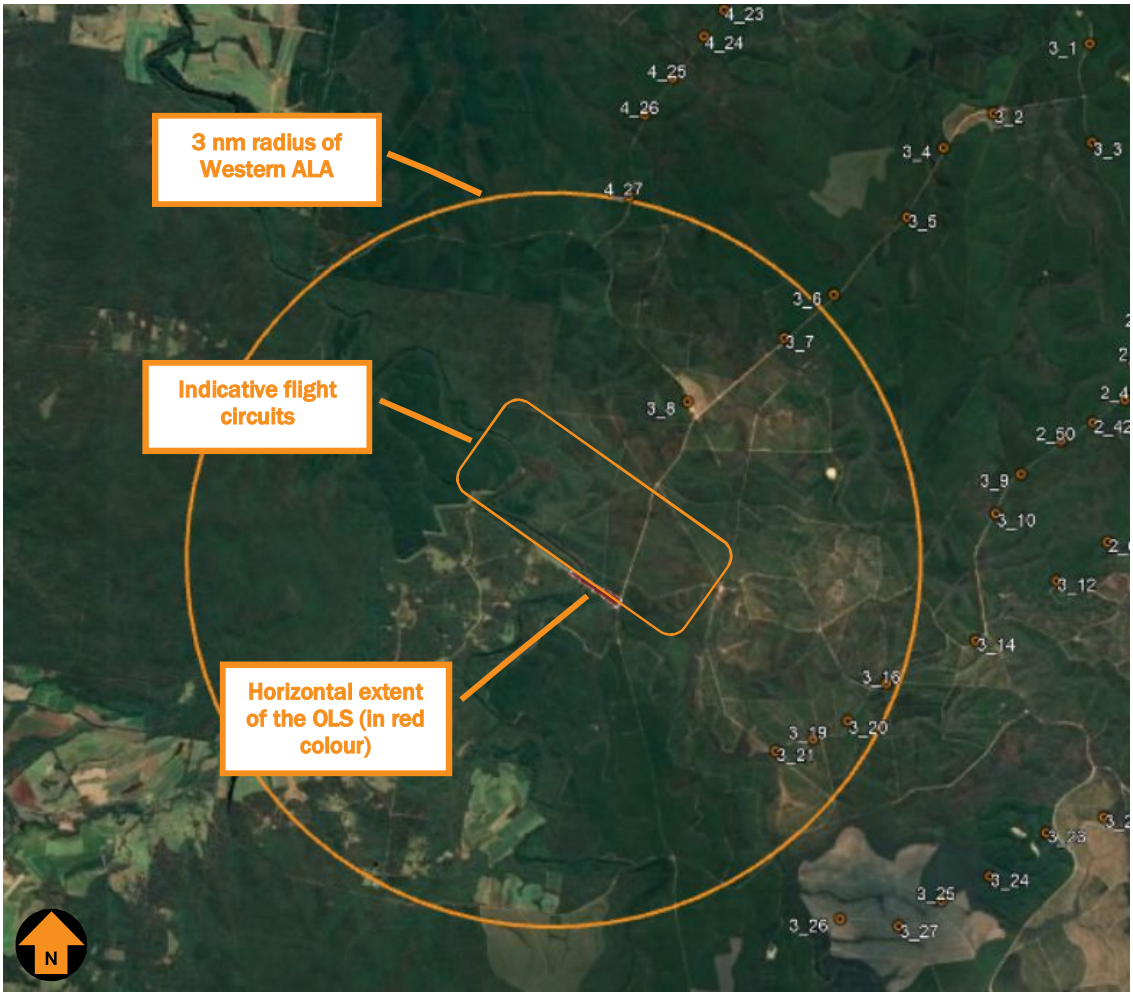

Figure 22 Western ALA relative to the proposed WTA showing the OLS and flight circuits

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

Guidance regarding wind turbine wake turbulence is provided in paragraph 43, which states:

> *Wind farm operators should be aware that wind turbines may create turbulence which noticeable up to 16 rotor diameters from the turbine. In the case of one of the larger wind turbines with a diameter of 125 metres, turbulence may be present two kilometres downstream. At this time, the effect of this level of turbulence on aircraft in the vicinity is not known with certainty. However, wind farm operators should be conscious of their duty of care to communicate this risk to aviation operators in the vicinity of the wind farm…*

While a rotor diameter is not yet specified for the Project, for the purpose of impact assessment, based on a 295 m tip height, a logical conservative assumed scenario 190 m rotor diameter has been used.

Based on this scenario, the effects of wake turbulence could be noticeable at a distance of 3040 m from the proposed wind turbines. The image in Figure 23 shows 3040 m rings around wind turbines located within a 3 nm radius of the Western ALA (WTGs 3_7, 3_8, 3_16, 3_19, 3_20 and 3_21).

For this scenario, it can be seen that the the effects of wake turbulence would extend into the nominal circuit pattern whenever there is a wind from the north, north east through to south east.

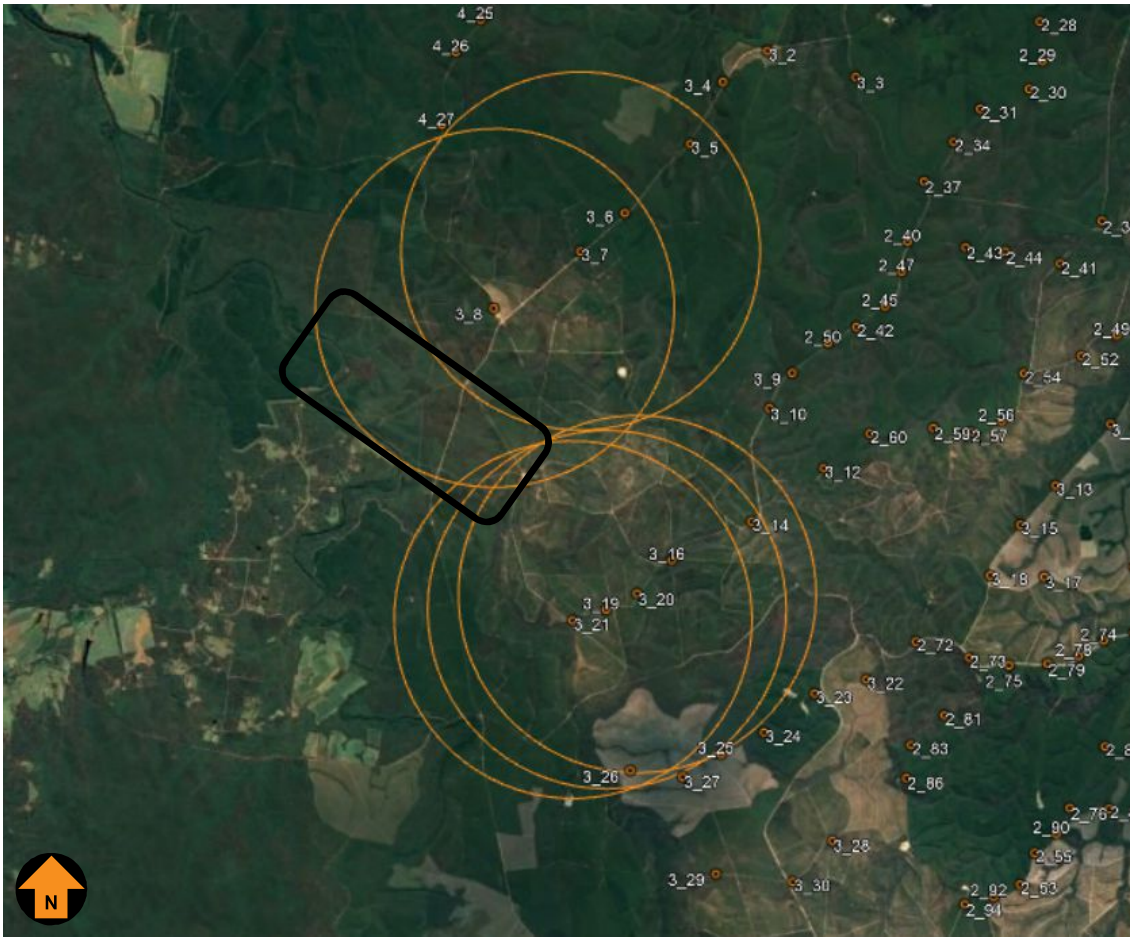

Figure 23 Potential extent of downstream wake turbulence

Figure 24 shows wind turbines which, based on this scenario, are likely to be subject to the potential extent of downstream wake turbulence to circuit operations at the Western ALA.

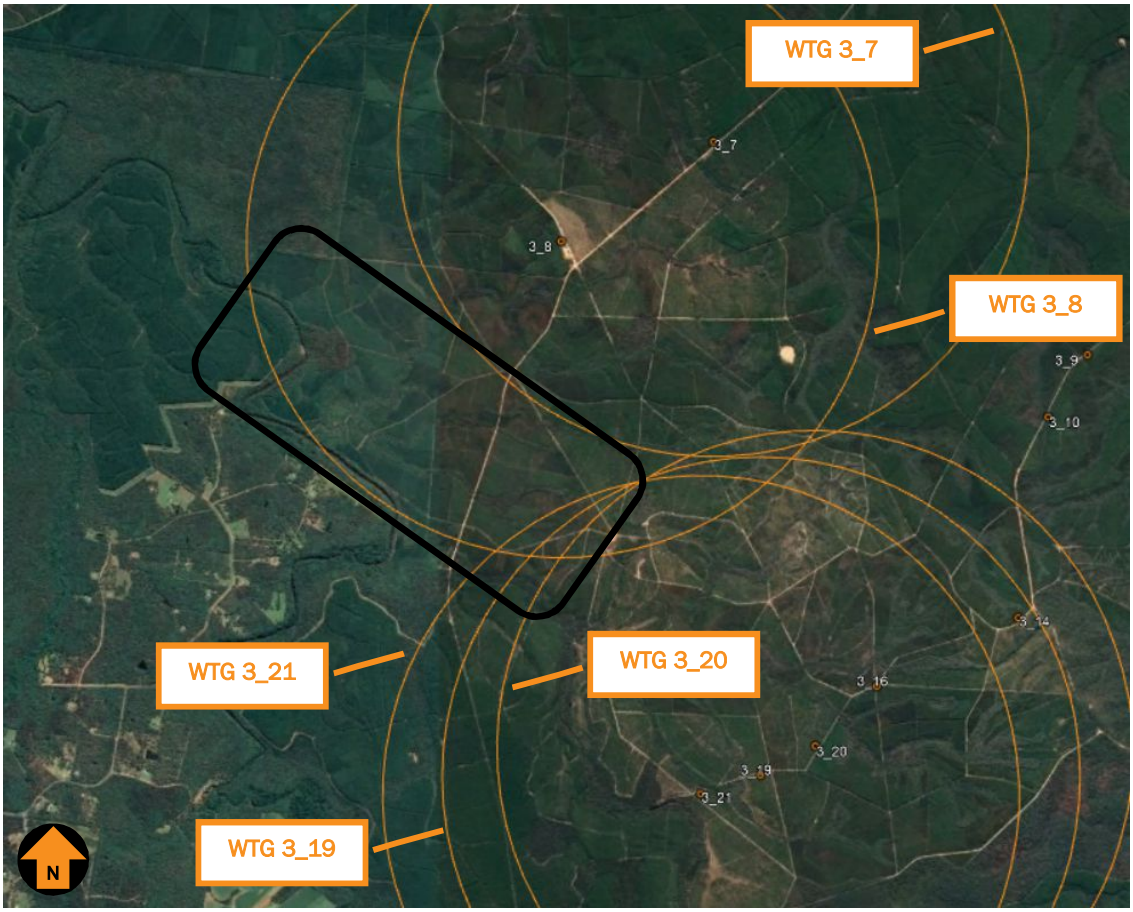

Figure 24 Close up of potential extent of downstream wake turbulence

Dependent on the wind direction and wind speed at the time, if a wind turbine is operating when the ALA is used the potential extent of downstream wake turbulence is could be noticeable from WTG 3_8 within the nominal circuit pattern and could be noticeable from the proposed wind turbines 3_7, 3_19, 3_20 and 3_21.

In this configuration, the proposed WTA will likely impact circuit operations at the Western ALA, although the magnitude of the impact will be a function of wind direction and wind speed and the aircraft being used.

The Proponent may engage with the operator of the Western ALA to firstly determine if the wake is an operational issue and then secondly if it is, agree a mitigation plan, which may include suspending the relevant wind turbine's operation (dependent on wind direction and wind speed) for the period that the ALA is in use for take-off and landing.

Note: The potential extent of downstream wake turbulence will be less noticeable from a wind turbine model with a smaller rotor diameter.

Further, the proposed WTA is located outside of the 3 nm radius area of interest and therefore will have no adverse impact on aircraft operations at Cooloola Cove Airpark (YCXA), Wide Bay (YWDY), Rainbow Beach (YRBB), Tobys Gap (YTBP), Eurong (YEUG), Hangaroo ALA and Gympie ALA (YGYM).

6.10. Air routes and LSALT

Manual of Standards Part 173 requires that a minimum obstacle clearance of 1000 ft below the published Lowest Safe Altitude (LSALT) is maintained along each air route.

The En Route Chart Low National shows the grid LSALT and the air routes in the vicinity of the proposed WTA (source: OzRunways).

Figure 25 provides the En-Route Chart Low National and air routes within the vicinity of the WTA (source: En Route Chart Low National, dated 23 May 2019).

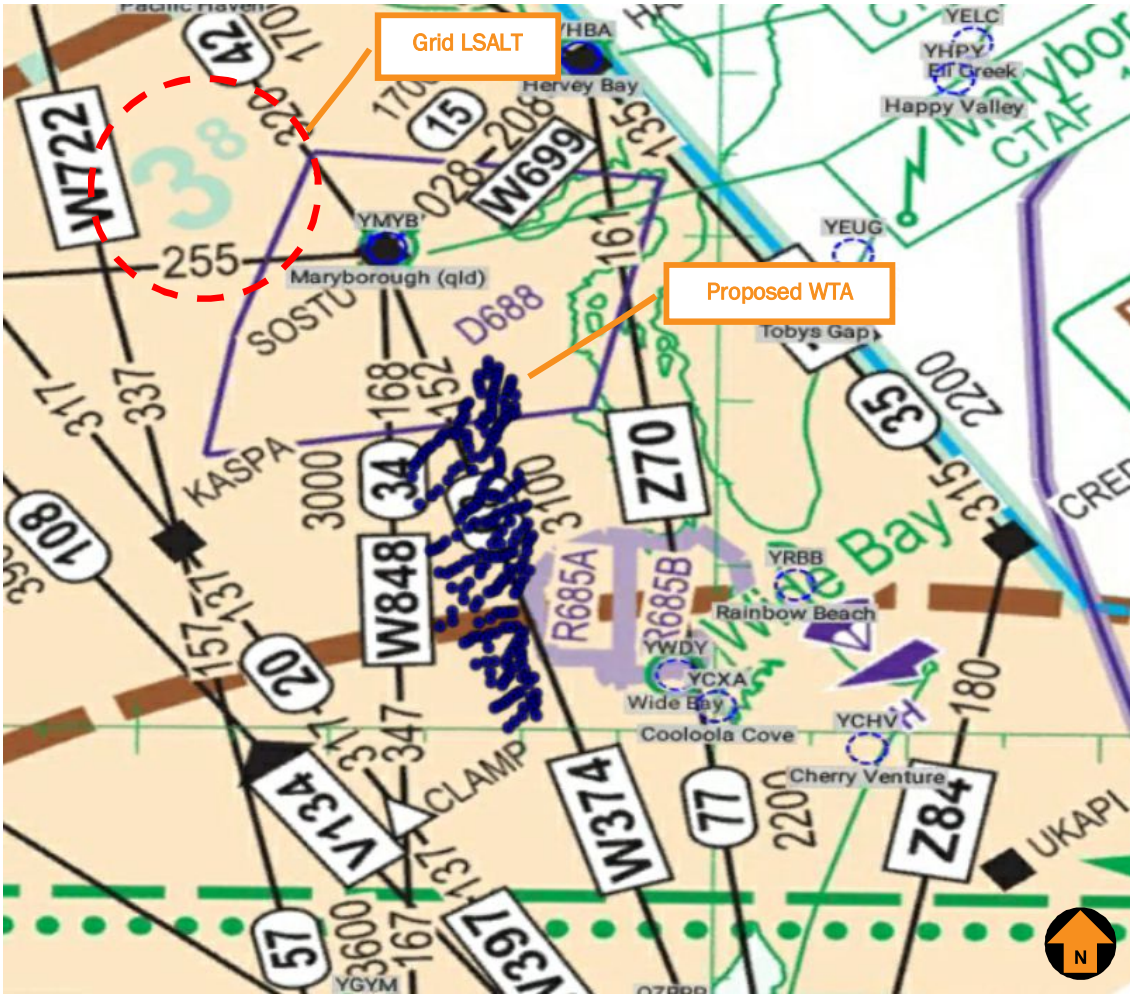

Figure 25 En-Route Chart Low National and air routes within the vicinity of the WTA

An impact analysis of the surrounding air routes is provided in Table 7.

Table 7 Air-route impact analysis

Air route	*Waypoint pair*	*Route LSALT*	*MOC*	*Impact on airspace design*	*Potential solution*	*Impact on aircraft ops*
Z70	Sunshine Coast and Hervey Bay	2200 ft AMSL	1200 ft AMSL 365 m AHD	Nil	NA	NA
W374	Sunshine Coast and Maryborough	3100 ft AMSL	2100 ft AMSL 640 m AHD	Nil	NA	NA
W848	Maryborough and Brisbane	3000 ft AMSL	2000 ft AMSL 610 m AHD	Nil	NA	NA
W397	Sunshine Coast and CLAMP	3400 ft AMSL	2400 ft AMSL 732 m AHD	Nil	NA	NA

Note: Minimum obstacle clearance (MOC) is the height above which obstacles would impact on LSALTS or air routes.

The Project is located in the area with a grid lowest safe altitude of 1158 m AHD (3800 ft AMSL), with an obstacle clearance surface of 853 m AHD (2800 ft AMSL).

Based on an overall maximum height of 408.7 m AHD (1341.1 ft AMSL) for WTG 2_119, the Project will not impact other nearby air routes or grid lowest safe altitudes.

6.11. Airspace

The Project is located outside controlled airspace (Class G airspace) and is not located in any Prohibited area. However, the Project is partially located in D688 Danger area and is adjacent to R685A/B Restricted area.

Maryborough Airport has a danger area D688 for flying training, with a vertical limit of surface to 5000 ft AMSL active during daylight hours (source: Airservices Australia, AIP – Designated Airspace Handbook).

The northern part of the WTA lies within danger area D688.

The Project is also located adjacent to R685A/B Restricted Areas military training area at Tin Can Bay known as Wide Bay Training Area. Both of these areas are classed as RA2 and are activated on NOTAM (source: AsA DAH, May 2019).

Figure 26 shows the Bundaberg VNC extract showing the horizontal extents of D688 Danger Area (in purple colour) and R685A/B Restricted Areas (in purple colour) within the vicinity of the WTA (source: Bundaberg VNC, dated 22 May 2019).

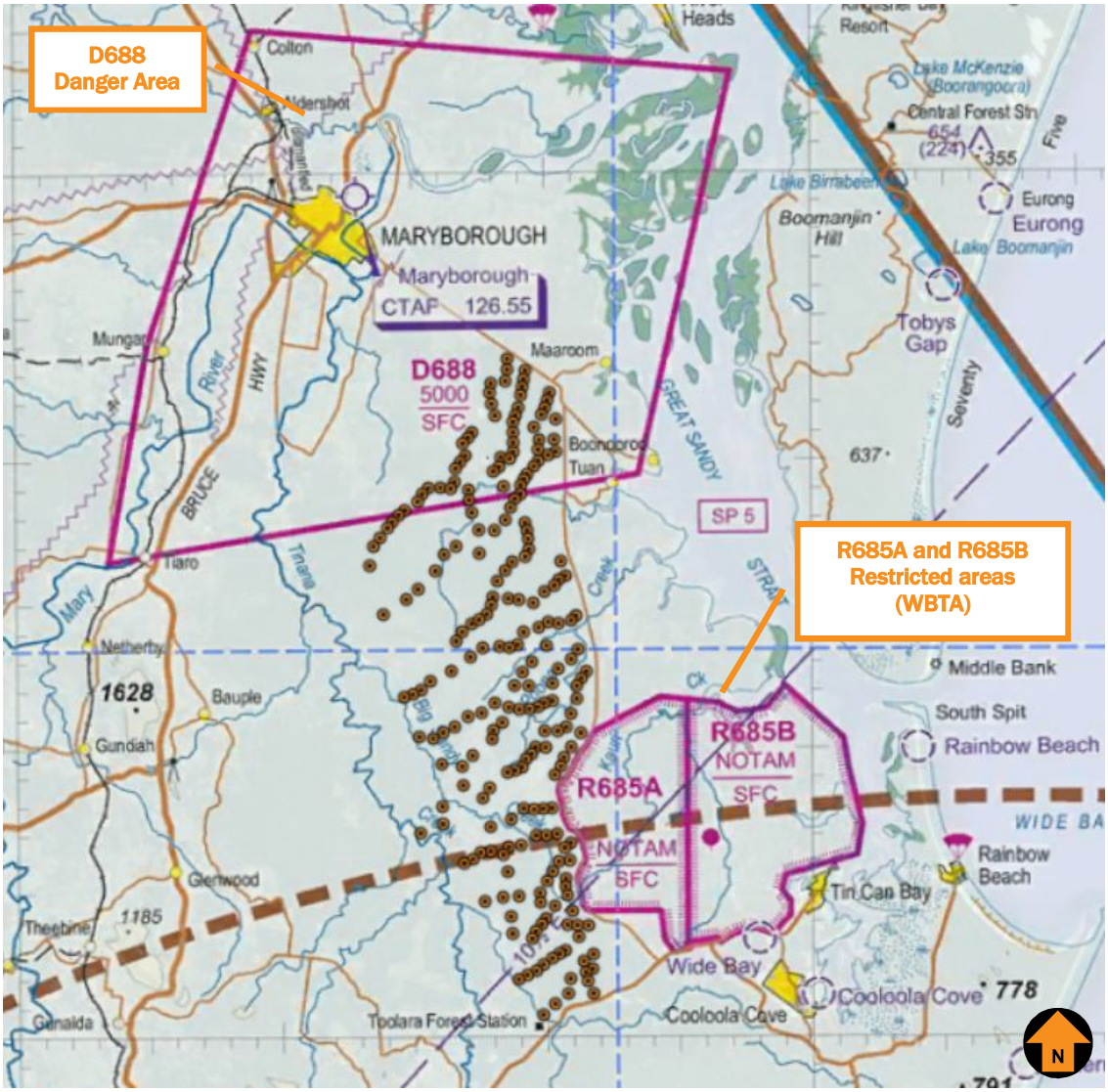

Figure 26 Danger and restricted areas within the vicinity of the WTA

Wind turbines are located outside of R685A/B Restricted Areas and will unlikely impact military fly training performed in these areas.

Some of the wind turbines are located within Danger Area D688.

A close up illustration of turbines located inside D688 Danger Area is provided in Figure 27.

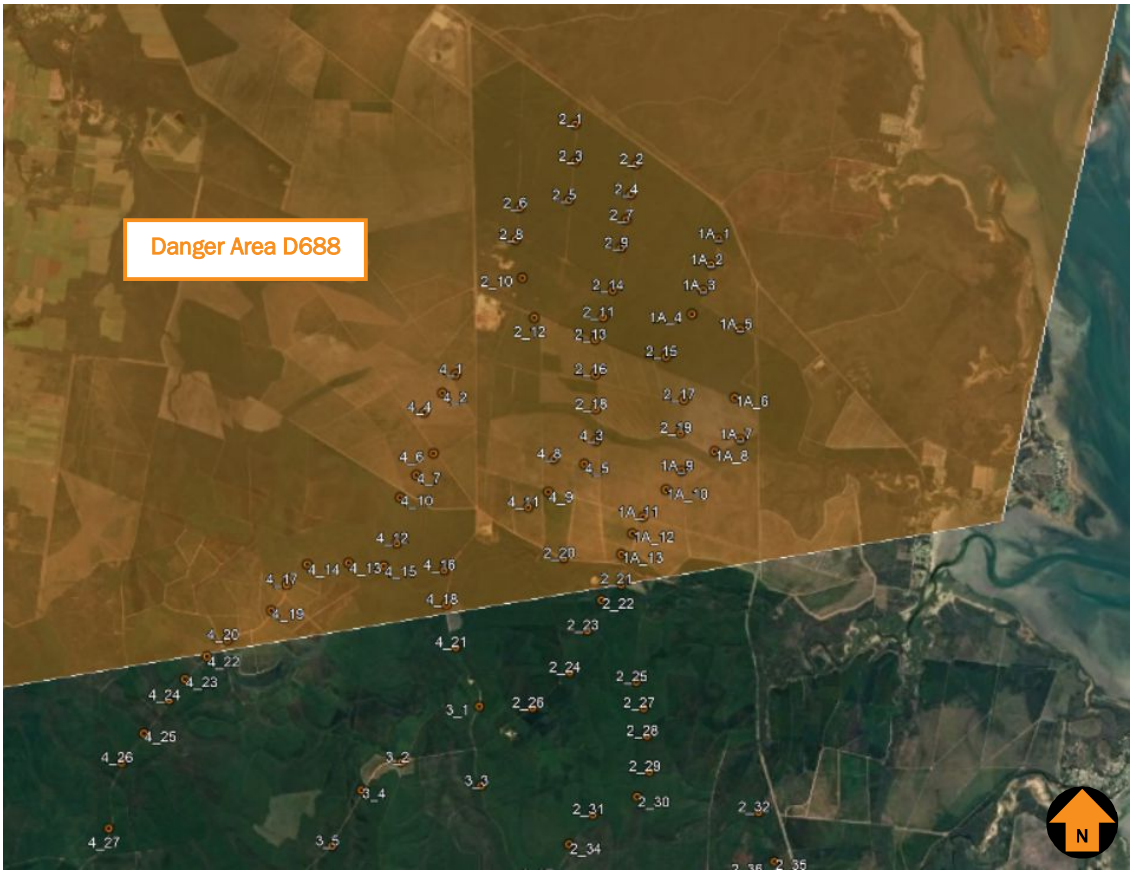

Figure 27 A close up of turbines inside D688 Danger Area

Note: The highest wind turbine located inside D688 Danger Area is WTG 4_20 which has a maximum overall height of approximately 354.9 m AHD (1164.4 ft AMSL).

Consultation with Department of Defence regarding lighting has been undertaken during the preparation of the aviation impact assessment. Defence has no objection to the proposed wind farm provided that the project complies with the conditions outlined in **Annexure 2.**

6.12. Aviation facilities

A search was conducted of the State Planning Policy (SPP) interactive mapping system, Fraser Coast Planning Scheme 2014 (Airport Enviro Overlay Code) and SPP –State Interest Guideline Strategic airports and aviation facilities, Appendix 5, to identify any aviation facilities that may be affected by the Project. This assessment concluded the Project would not infringe any protection areas associated with identified aviation facilities.

6.13. Radar

With respect to aviation radar facilities, the closest is located at Brisbane Airport, approximately 155 km (83.5 nm) to the south of the Project site. The proposed WTA is unlikely to impact on radar facilities in the vicinity of the wind farm.

6.14. Airservices Australia

Airservices Australia response is copied below:

> *With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a maximum height of 408.7 m (1341 ft) AHD, the wind farm will affect the 25 NM and 10 NM minimum sector altitude (MSA) of Maryborough Airport and the 25 NM minimum sector altitude (MSA) of Hervey Bay Airport.*
>
> *In order to accommodate the proposal, the MSA is required to be amended for Hervey Bay and Maryborough as follows:*
>
> - *The existing Maryborough 3100 ft 25 NM MSA sector will need to be expanded to cover B-260° to B-110°. The Maryborough 10 nm MSA will need to be raised by 500 ft from 1700 ft to 2200 ft.*
> - *The Hervey Bay 25NM MSA will need to be revised to include a new 2300 ft sector between B-340° and B-025°.*
> - *The missed approach termination altitude of the YMYB RNAV-Z (GNSS) RWY 17 procedure will need to be increased to 3100 ft.*
>
> *The maximum height of wind farm without affecting any procedures at Maryborough Airport is* ***218.2 m (716 ft) AHD****.*
>
> *The maximum height of wind farm without affecting any procedures at Hervey Bay Airport is* ***340.15 m (1116 ft) AHD****.*
>
> *The windfarm will not affect any air route lowest safe altitudes.*
>
> *Note that:*
>
> 1. *Procedures not designed by Airservices at Maryborough or Hervey Bay Airport were not considered in this assessment.*
> 2. *Airservices will require a commercial agreement to conduct the aforementioned redesign work required to accommodate the Forest Wind Farm.*
>
> ***Communications/Navigation/Surveillance (CNS) Facilities***
>
> *This wind farm, to a maximum height of 408.7m (1341ft) AHD, will not adversely impact the performance of Precision/Non-Precision Navigational Aids, HF/VHF Communications, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.*

Summary

Airservices requires that the operator of Hervey Bay and Maryborough Airport (included in this email response) to be consulted and confirm that the proposed permanent change to MSA will not adversely impact on their operations before any change (temporary or permanent) can be supported by Airservices. Furthermore, any Airservices work associated with amending the flight procedures will be undertaken on a commercial basis and require further consultation with Airservices.

Vertical Obstacle Notification

If the wind farm receives approval, as soon as construction commences, the proponent must complete the Vertical Obstacle Notification Form for tall structures and submit the completed form to VOD@airservicesaustralia.com . For further information regarding the reporting of tall structures, please contact (02) 6268 5622, email VOD@airservicesaustralia.com or refer to the web link below: http://www.airservicesaustralia.com/services/aeronautical-information-and-management-services/part-175/

6.15. Fraser Coast Regional Council

Mr James Cockburn, Executive Manager Planning and Growth at FCRC, in his email dated 13 September 2019 advised that council has no objection to the proposal subject to ongoing compliance with all CASA, Airservices and relevant aviation regulatory requirements.

6.16. Summary

Based on the proposed wind farm layout and overall turbine blade tip height limit of 295 m AGL, the blade tip elevation of the highest WTG, which is WTG 2_199, will not exceed 408.7 m AHD (1341.1 ft AMSL) and:

- will not penetrate any OLS surfaces;
- will penetrate the following:
    - Maryborough Airport 10 nm MSA MOC 1700 ft AMSL by approximately 468.3 ft (142.7 m);
    - Maryborough Airport 25 nm MSA MOC 2000 ft AMSL in the sector between bearings 110°and 340° by approximately 341.1 ft (104 m) Hervey Bay Airport 25 nm MSA MOC 2100 ft AMSL by approximately 147 ft (44.8 m).

  Therefore, the following is required:
    - the 10 nm MSA for Maryborough Airport will need to be increased by 500 ft to 2200 ft;
    - the 25 nm MSA for Maryborough Airport in the sector between bearings 110°and 340° will need to be increased by 400 ft to 2400 ft; and
    - the 25 nm MSA for Hervey Bay Airport will need to be increased by 200 ft to 2300 ft.
- will not impact Maryborough Airport circling areas;
- will likely restrict circuit operations at the Unnamed ALA (to the west of the Project site);
- will partially impact Danger Area D688;

- will not have an impact on nearby designated air routes;
- is wholly contained within Class G airspace; and
- is outside the clearance zones associated with aviation navigation aids and communication facilities.

The list of wind turbines and the wind monitoring tower (obstacles), showing coordinates and elevation data that are applicable to this AIS, are provided in **Annexure 1**.

7. AIRCRAFT OPERATOR CHARACTERISTICS

7.1. Passenger transport operations

Regular public transport (RPT) operations are only conducted at registered and certified aerodromes. Maryborough Airport and Hervey Bay Airport are the only registered and certified aerodrome within 30 nm of the Project.

RPT and passenger carrying charter operations are generally operated under the Instrument Flight Rules (IFR). The Aviation Impact Statement provided in Section 6 addresses the matters associated with IFR aircraft operations.

In the email response dated 2 August 2019, Ms Logan - Flight Operations Engineering Manager at Virgin Australia advised that Virgin Australia does not operate to Maryborough Airport. With respect to Hervey Bay Airport, Ms Logan advised that Virgin Australia flying operations will not be significantly impacted by the proposed MSA changes.

During email consultation for the final project layout, QantasLink was informed of the Project. Captain Adrian Young (Head of Flying Operations and Chief Pilot) in his email dated 2 August 2019 advised that after reviewing the aviation impact assessment (version 0.6), QantasLink will have no issue with the Projects development.

7.2. Private operations

Hangaroo and Western ALAs are uncertified aerodromes with private operations. Private operations are generally conducted under day or night VFR, with some IFR. Flight under day VFR is conducted above 500 ft AGL.

7.3. Flying training, private, recreational and gliding operations

Flight under day VFR is conducted above 500 ft (152.4 m) above the highest point of the terrain within a 600 m radius (300 m for helicopters), unless the operation is approved to operate below 500 ft above the highest point of the terrain.

It is expected that the wind turbines will be sufficiently visually conspicuous to pilots conducting VFR operations within the vicinity of the Project to enable appropriate obstacle avoidance manoeuvring.

7.4. Aerial application

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

Aerial agriculture operations

> Aerial agricultural operations including such activities as fertiliser, pest and crop spraying are generally conducted under day VFR below 500 ft AGL; usually between 60 ft (18.3 m) and 100 ft (30.5 m) AGL.
>
> Due to the nature of the operations conducted, aerial agriculture pilots are subject to rigorous training and assessment requirements in order to obtain and maintain their licence to operate under these conditions.

The AAAA has a formal risk management program which is recommended for use by its members.

Local aerial application operators

Aviation Projects has prepared a plantation aviation impact assessment for the benefit of the Plantation Licensee.

The Plantation Licensee may use fixed and rotary wing aircraft for the purpose of pre- and post-planting spraying, fertiliser spraying and other aerial agriculture activities. In the future forestry operations may increasingly use remotely piloted aircraft– at present these operations are mostly restricted to within line of sight, although beyond visual line of sight operations may become increasingly common in the future if remotely piloted aircraft are used in the future.

Based on previous studies, and subject to the results of consultation with AAAA and any further consultation with local aerial application operators, it is reasonable to conclude that safe aerial application operations would be possible on properties within the Project site and neighbouring the Project site, subject to final turbine locations, and subject to a case-by-case assessment and by following recommendations provided in this report.

To facilitate the flight planning of aerial application operators, details of the Project, including location and height information of wind turbines, wind monitoring towers and overhead powerlines should be provided to land owners so that, when asked for hazard information on their property, the land owner may provide the aerial application pilot with all relevant information.

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

7.5. Aerial fire fighting

The Australasian Fire and Emergency Services Council (AFAC) developed a national position on wind turbines: *Wind Farms and Bush Fires Operations*, version 2.0, dated 30 October 2014.

Of specific interest in this document is the paragraph copied below:

> *Aerial fire fighting operations will treat 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.*

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

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

7.6. Emergency services

Royal Flying Doctor Services (RFDS) and other emergency services operations are generally conducted under the IFR, except when arriving/departing a destination that is not serviced by instrument approach aids or procedures.

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

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

Mr Anthony Hooper, Manager Line Operations at RFDS, in his email dated 02 August 2019 advised that the Project will not impact on the RRDS' operations at both Maryborough and Hervey Bay airports.

8. HAZARD LIGHTING AND MARKING

8.1. Civil Aviation Safety Authority

In considering the need for aviation hazard lighting, the applicable regulatory context was determined and direct consultation with CASA was undertaken.

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

Civil Aviation Safety Regulations 1998, Part 139—*Aerodromes*

> In areas remote from an aerodrome, CASR 139.365 requires the owner of a structure (or proponents of a structure) that will be 110 m or more above ground level to inform CASA. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.

Manual of Standards Part 139—Aerodromes

> Chapter 7 of MOS 139 sets out the standards applicable to Obstacle Restriction and Limitation. Section 7.1.5 deals with Objects Outside the OLS:
>
> > *7.1.5.1 Under CASR Part 139 any object which extends to a height of 110 m or more above local ground level must be notified to CASA.*
> >
> > *Note: For instrument runways, obstacle monitoring includes the PANS-OPS surface which extends beyond the OLS of the aerodrome. See MOS 139 paragraph 7.1.1.*
> >
> > *7.1.5.2 Any object that extends to a height of 150 m or more above local ground level must be regarded as an obstacle unless it is assessed by CASA to be otherwise.*
>
> Chapter 9 sets out the standards applicable to Visual Aids Provided by Aerodrome Lighting.
>
> Section 9.4.1 provides some general guidance on obstacle lighting:
>
> > *9.4.1.2 In general, an object in the following situations would require to be provided with obstacle lighting unless CASA, in an aeronautical study, assesses it as being shielded by another lit object or that it is of no operational significance:*
> >
> > *(b) outside the obstacle limitation surfaces of an aerodrome, if the object is or will be more than 110 m above ground level.*
>
> Section 9.4.2 provides guidance on Types of Obstacle Lighting and Their Use:
>
> > *9.4.2.1 Three types of lights are used for lighting obstacles. These are low intensity, medium intensity and high intensity lights, or a combination of such lights.*
> >
> > *9.4.2.2 Low intensity obstacle lights are steady red lights and are to be used on non-extensive objects whose height above the surrounding ground is less than 45 m.*
> >
> > *Note: A group of trees or buildings is regarded as an extensive object.*

9.4.2.3 Medium intensity obstacle lights are to be used either alone or in combination with low intensity lights, where:

(a) the object is an extensive one;

(b) the top of the object is 45 m or more above the surrounding ground; or

(c) CASA determines that early warning to pilots of the presence of the object is desirable.

9.4.2.4 There are three types of medium intensity obstacle lights:

(a) Flashing white light. Likely to be unsuitable for use in environmentally sensitive locations, and near built-up areas. May be used in lieu of obstacle markings during the day to indicate temporary obstacles in the vicinity of an aerodrome, for example construction cranes, etc. and are not to be used in other applications without specific CASA agreement.

(b) Flashing red light, also known as a hazard beacon. Is suitable for all applications, and is extensively used to mark terrain obstacles such as high ground.

(c) Steady red light. May be used where there is opposition to the use of a flashing red light, for example in environmentally sensitive locations.

9.4.2.5 High intensity obstacle lights are flashing white lights used on obstacles that are in excess of 150 m in height...

Section 9.4.3.4A provides guidance on obstacle lighting specific to wind farms:

9.4.3.4A In the case of a wind farm whose wind turbines must have obstacle lighting, medium intensity lights are to be installed as follows:

(a) if any part of the wind turbine, including the rotating blades, penetrates the obstacle limitation surface (OLS) of an aerodrome, top lights must mark the highest point reached by the rotating blades;

Note: Because it is not practicable to install obstacle lights at the tip of the blades, these lights may be located on a separate structure, adjacent to the wind turbine, at a height that corresponds to the highest point of the rotating blade of the turbine.

(b) if the rotating blades do not penetrate the OLS, the top lights must be placed on top of the generator housing;

(c) obstacle lights must be provided on a sufficient number of individual wind turbines to indicate the general definition and extent of the wind farm, with intervals between lit turbines not exceeding 900 m;

(d) all of the obstacle lights on a wind farm must be synchronised to flash simultaneously;

(e) the downward component of obstacle lighting may be shielded to the extent mentioned in either or both of the following sub-subparagraphs:

(i) so that no more than 5% of the nominal light intensity is emitted at or below 5° below horizontal;

(ii) so that no light is emitted at or below 10° below horizontal;

(f) to prevent obstacle light shielding by the rotating blades, 2 lights must be provided on top of the generator housing in a way that allows at least 1 of the lights to be seen from every angle in azimuth.

CASA has recently advised that it will only review assessments referred to it by a planning authority or agency.

8.1.1. Advisory Circular 139-08 v2—Reporting of Tall Structures

In Advisory Circular (AC) 139-08 v2—*Reporting of Tall Structures*, CASA provides guidance to those authorities and persons involved in the planning, approval, erection, extension or dismantling of tall structures so that they may understand the vital nature of the information they provide.

Airservices Australia has been assigned the task of maintaining a database of tall structures, the top measurement of which is:

a) 30 metres or more above ground level—within 30 kilometres of an aerodrome; or

b) 45 metres or more above ground level elsewhere.

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

The proposed wind turbines and WMT (permanent and temporary) must be reported to Airservices Australia. This action should occur once the final layout after micrositing is confirmed and prior to construction.

8.2. International Civil Aviation Organization

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

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

6.2.4 Wind turbines

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

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

Note 2.— See 4.3.1 and 4.3.2

Markings

6.2.4.2 Recommendation.— The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study.

Lighting

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

a) to identify the perimeter of the wind farm;

b) respecting the maximum spacing, in accordance with 6.2.3.15, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;

c) so that, where flashing lights are used, they flash simultaneously throughout the wind farm;

d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and

e) at locations prescribed in a), b) and d), respecting the following criteria:

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

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

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

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

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

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

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

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

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

> *6.2.3.15 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and*
>
> *a) low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m; and*
>
> *b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.*

Section 4.3 Objects outside the obstacle limitation surfaces states the following:

> *4.3.1 Recommendation.— Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.*
>
> *4.3.2 Recommendation.— In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.*
>
> *Note.— This study may have regard to the nature of operations concerned and may distinguish between day and night operations.*

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

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

8.3. Visual impact of night lighting

Annex 14 Section 6.2.4 and MOS 139 9.4.3.4A are specifically intended for wind turbines and recommends that medium intensity lighting is installed.

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

- To minimise the visual impact on the environment, some shielding of the obstacle lights is permitted, provided it does not compromise their operational effectiveness;
- Shielding may be provided to restrict the downward component of light to either, or both, of the following:
    - such that no more than 5% of the nominal intensity is emitted at or below 5 degrees below horizontal; and
    - such that no light is emitted at or below 10 degrees below horizontal;
- Where two lights are mounted on a nacelle, dynamic shielding or light extinction of one light at a time, for the period that a blade is passing in front of the light, is permissible, providing that at all times at least one light can be seen, without interruption, from every angle of azimuth;

- If flashing obstacle lighting is required, all obstacle lights on a wind farm should be synchronised so that they flash simultaneously; and
- A relatively small area on the back of each blade near the rotor hub may be treated with a different colour or surface treatment, to reduce reflection from the rotor blades of light from the obstacle lights, without compromising the daytime visibility of the overall turbine.

8.4. Marking of turbines

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

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

8.5. Wind monitoring towers

The details of the WMTs were introduced in Section 4.3 of this report.

Consideration could be given to marking any WMTs according to the requirements set out in MOS 139 Section 8.10 Obstacle Markings; specifically:

> *8.10.2.1 A structure must be marked when more than 150 m higher than the surrounding terrain. Surrounding terrain means the area within 400 m of the structure. Structures above 90 m may need to be marked, and inconspicuous structures 75 m above ground level should also be marked. Fixed objects on the aerodrome movement area, such as ILS buildings, must be marked as obstacles.*
>
> *8.10.2.6 Masts, poles and towers must be marked in contrasting bands with the darker colour at the top, as shown in Figure 8.10-3. The bands must be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less.*
>
> *8.10.2.8 Wires or cable obstacles must be marked using three-dimensional coloured objects such as spheres and pyramids, etc; of a size equivalent to a cube with 600 mm sides, spaced 30 m apart.*

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

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

The proponent proposes the following marking and lighting solutions for the proposed permanent and temporary WMTs:

- ICAO compliant medium intensity flashing white for day, low intensity steady red for night;
- Top 1/3 of mast structure painted in red and white alternating bands;
- Contrasting colour markings at guy wire ground attachments; and
- Paint the fencing around anchor points in high contrasting colour.

8.6. Overhead power lines

Within the Project site there will be a range of underground and overhead electrical lines of various voltages, in the order of 33kV, 66kV, 132kV and 275kV. The detailed design of the electrical reticulation will be finalised prior to the financing and construction of each stage of the Project.

A high voltage transmission line is proposed to be built between the Project and the Powerlink Woolooga substation, 30 km to the southwest, located northwest of Gympie.

There is no regulatory requirement to mark or light power poles or overhead transmission lines.

According to the AAAA *Powerlines Policy* dated March 2011:

> *Most agricultural land in Australia is crisscrossed with powerlines and aerial application companies and pilots put enormous effort into managing these hazards safely, generally using a risk identification, assessment and management process in line with Australian Standard AS4360/ISO 3[1]000.*
>
> *The agricultural pilot curriculum mandated by CASA includes training for the safe management of powerlines and AAAA has been active in providing ongoing professional development for application pilots that includes a focus on planning, risk management and a knowledge of human factors relevant to managing powerlines in a low-level aviation environment.*
>
> *AAAA runs a specific training course for aerial application pilots entitled 'Wire Risk Management' to address these issues.*

The route of the electrical reticulation will follow the forestry tracks. Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators and marked in accordance with MOS 139 Section 8.10 Obstacle Markings; specifically:

> *8.10.2.8 Wires or cable obstacles must be marked using three-dimensional coloured objects such as spheres and pyramids, etc; of a size equivalent to a cube with 600 mm sides, spaced 30 m apart.*

9. ACCIDENT STATISTICS

9.1. General aviation operations

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

- Aerial work. This includes flying for the purposes of agriculture (spraying and spreading), mustering, search and rescue, fire control, or survey and photography;
- Flying training; and
- Private, business and sports aviation. Sports aviation includes gliding, parachute operations, ballooning, warbird operations, and acrobatics.

9.2. ATSB occurrence taxonomy

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

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

9.3. National aviation occurrence statistics 2006-2015

The Australian Transport Safety Bureau recently published a summary of aviation occurrence statistics for the period 2008 to 2017 (AR-2018-030) Final, 21 December 2018.

According to the report, there were no fatalities in high or low capacity RPT operations during the period 2008-2017. In 2017 there was 21 fatalities from 93 accidents in general aviation operations.

Of the 337 fatalities recorded in the 10-year period, almost two thirds (206 or 61.12%) occurred in the general aviation segment. On average, there were 1.44 fatalities per aircraft associated with a fatality in this segment. The fatalities to aircraft ratio ranges from 1:07 to 1.7:1. Whilst it can be inferred from the data that the majority of fatal accidents are single person fatalities, it is reasonable to assert that the worst credible effect of an aircraft accident in the general aviation category will be multiple fatalities.

A breakdown of aircraft and fatalities by general aviation sub-categories is provided in Table 8 (source: ATSB).

Table 8 Number of fatalities by GA sub-category – 2008 to 2017

Sub-category	*Aircraft assoc. with fatality*	*Fatalities*	*Fatalities to aircraft ratio*
Agriculture	19	19	1:1
Mustering	14	15	1.07:1
Search and rescue	2	2	1:1
Fire control	2	2	1:1
Survey and photography	5	8	1.6:1
Other aerial work	3	5	1.66:1
Flying training	11	17	1.545:1
Private/business	68	116	1.7:1
Sport aviation (excluding gliding)	4	4	1:1
Gliding	10	12	1.2:1
Totals	138	200	1.44:1

According to the ATSB report, the number of fatal accidents per million departures for GA aircraft over the 10-year reporting period ranged between 3.6 in 2016 and 10.8 in 2008. Figure 28 refers to Fatal Accident Rate by operation type per million departures over the 10-year period (source: ATSB).

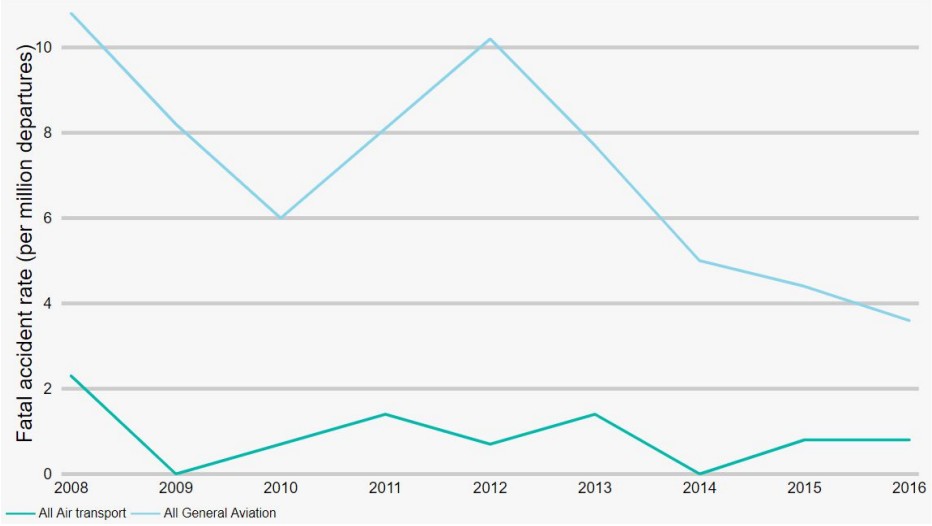

Figure 28 Fatal Accident Rate (per million departures) by Operation Type

In 2015, there were 10 fatal accidents and 12 fatalities involving GA aircraft, resulting in a rate of 4.4 fatal accidents per million departures and 8.4 fatal accidents per million hours flown.

In 2016, there were 1,920,000 departures, and 1,301,000 hours flown by VH-registered general aviation aircraft in Australia, with 7 fatal accidents and 10 fatalities. Based on these results, in 2016 there were 3.6

fatal accidents per million departures and 5.4 fatal accidents per million hours flown. A summary of fatal accidents from 2008-2017 by GA sub-category is provided in Table 9 (source: ATSB).

Table 9 Fatal accidents by GA sub-category – 2008 to 2017

Sub-category	*Fatal accidents*	*Fatalities*
Aerial work	47	54
Aerial agriculture	19	19
Aerial mustering	14	15
Search and rescue	2	2
Fire control	2	2
Survey and photography	5	8
Flying training	11	17
Private/business	68	116
Sports	4	4
Foreign registered	1	1
Totals	173	238

Over the 10-year period, there were 17,331,000 general aviation departures in Australia, during which time no aircraft collided with a wind turbine or a wind monitoring tower.

Of the 8071 incidents and accidents in GA operations in the 10-year period, 1089 (13.49%) were terrain collisions.

There is an underlying fatality rate for GA operations that is considered tolerable within Australia's regulatory and social context.

9.4. Worldwide accidents involving wind farms

To provide some perspective on the likelihood of a VFR aircraft colliding with a wind turbine, a summary of the four accidents that involved an aircraft colliding with a wind turbine, and the relevant factors applicable to this assessment, is incorporated in this section.

Note that there are no recorded accidents involving an aircraft colliding with a wind turbine in Australia.

Global Wind Energy Council reports on its website there were 314,000 wind turbines operating around the world at the end of 2015.

Australia's Clean Energy Council reports on its website there were 2062 wind turbines in Australia at the end of 2015.

Aviation Projects has researched public sources of information, accessible via the world wide web, regarding aviation safety occurrences associated with wind farms. Occurrence information published by Australia, Canada, Europe (Belgium, Denmark, France, Germany, Norway, Sweden and The Netherlands), New Zealand, the United Kingdom and the United States of America was reviewed.

Of the four known accidents, one was caused by inflight separation of the majority of the right canard and all of the right elevator resulting from a failure of the plane builder to balance the elevators per the kit manufacturer's instructions. The accident occurred overhead a wind farm, and the aircraft struck a wind turbine on its descent. This accident is not applicable to the circumstances under consideration.

There have been two accidents involving collision with a wind turbine during the day (in 2008 and 2017), and one at night (in 2014).

Only one of these (Melle, Germany 2017) resulted in a single fatality, as the result of a collision with a wind turbine steel lattice mast at a very low altitude during the day with good visibility and no cloud.

In the other case (Plouguin, France, 2008), the pilot decided to descend below cloud in an attempt to find the destination aerodrome. The aircraft was in conditions of significantly reduced horizontal visibility in fog where the top of the turbine was obscured by cloud. The turbines became visible too late for avoidance manoeuvring and the aircraft made contact with two turbines. The aircraft was damaged but landed safely.

In both cases, it is difficult to conclude that obstacle lighting would have prevented the accident.

The other fatal accident occurred at night in IMC.

There is one other accident mentioned in a database compiled by an anti-wind farm lobby group, which suggests a Cessna 182 collided with a wind turbine near Baraboo, Wisconsin, on 29 July 2000. The NTSB database records details of an accident involving a Cessna 182 that occurred on 28 July 2000 in the same area, but suggests that the accident was caused by IFR flight into IMC encountered by the pilot and exceeding the design limits of the aircraft. A factor was flight to a destination alternate not performed by the pilot. No mention is made of wind turbines or a wind farm.

A summary of the four accidents is provided in Table 10.

Table 10 Summary of accidents involving collision with a wind turbine

ID	Description	Date	Location	Fatalities	Flight rules	Turbine height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting Day VFR?
1	Diamond DA320-A1 D-EJAR Collided with a wind turbine approximately 20 m above the ground, during the day in good visibility. The mast was grey steel lattice, rather than white, although the blades were painted in white and red bands.	02 Feb 2017	Melle, Germany	1	Day VFR No cloud and good visibility	Not specified	Not specified	Not specified	It is difficult to conclude that obstacle lighting would have prevented the accident.
2	The Piper PA-32R-300, N8700E, was destroyed during an impact with the blades of a wind turbine tower, at night in IMC. The pilot was reportedly aware of the presence of the wind farm.	27 Apr 2014	10 miles south of Highmore, South Dakota	4	Night IMC Low cloud and rain	420 ft AGL overall	Fitted but reportedly not operational	Not specified	No

ID	Description	Date	Location	Fatalities	Flight rules	Turbine height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting Day VFR?
3	Beechcraft B55 The pilot was attempting to remain in VMC by descending the aircraft through a break in the clouds. The pilot, distracted by trying to visually locate the aerodrome, flew into an area of known wind turbines. After sighting the turbines, he was unable to avoid them. The tip of the left wing struck the first turbine blade, followed by the tip of the right wing striking the second turbine. The pilot was able to maintain control of the aircraft and landed safely.	04 Apr 2008	Plougin, France	0	Day VFR The weather in the area of the wind turbines had deteriorated to an overcast of stratus cloud, with a base between 100 ft to 350 ft and tops of 500 ft.	328 ft AGL hub height, 393 ft AGL overall	Not specified	This pilot reported having been distracted by a troubling personal matter which he had learned of before departing for the flight. The wind farm was annotated on aeronautical charts.	It is difficult to conclude that obstacle lighting would have prevented the accident.

ID	Description	Date	Location	Fatalities	Flight rules	Turbine height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting Day VFR?
4	VariEze N25063 The aircraft collided with a wind turbine following in-flight separation of the majority of the right canard and all of the right elevator	20 July 2001	Palm Springs, USA	2	Day VFR	N/A	N/A	The failure of the builder to balance the elevators per the kit manufacturer's instructions	No

10. RISK ASSESSMENT

The methodology used herein for preparing the risk assessment is as per NASF – *Guideline D Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation.*

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

Section 2.1 *The concept of safety* defines safety as follows [author's underlining]:

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

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

10.1. Likelihood

Likelihood is defined in AS/NZS ISO 3100:2018 as the chance of something happening. Likelihood descriptors used in this report are as indicated in Table 11.

Table 11 Likelihood Descriptors

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

10.2. Consequence

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

Consequence descriptors used in this report are as indicated in Table 12.

Table 12 Consequence Descriptors

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

10.3. Risk matrix

The risk matrix, which correlates likelihood and consequence to determine a level of risk, used in this report is shown in Table 13.

Table 13 Risk Matrix

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

10.4. Actions required

Actions required according to the derived level of risk are shown in Table 14.

Table 14 Actions Required

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

10.5. Risk Identification

The primary risk being assessed is that of aviation safety. Based on an extensive review of occurrence data and input from stakeholders, the significant risks that are manifested by the Project have been identified for further assessment:

- there is potential for an aircraft to collide with a wind turbine (CFIT);
- there is potential for an aircraft to collide with a wind monitoring tower (CFIT);
- there is potential for a pilot to initiate manoeuvring in order to avoid colliding with a wind turbine or monitoring tower resulting in collision with terrain; and
- there is potential for the hazards associated with the Project to invoke operational limitations or procedures on operating crew.

It should be noted that according to guidance provided by the Commonwealth Department of Infrastructure and Regional Development, and in line with generally accepted practice, the risk to be assessed should primarily be associated with passenger transport services. The risk being assessed herein is primarily associated with smaller aircraft likely to be flying under the VFR, and so the maximum number of passengers exposed to the nominated consequences is likely to be limited.

The secondary risk being assessed is the visual impact that obstacle lights (if fitted) will have on the surrounding residents.

10.6. Risk Analysis, Evaluation and Treatment

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

Each of the five risk events are considered in separate tables in the following pages.

Risk ID:	1. Aircraft collision with wind turbine

Discussion

An aircraft collision with a wind turbine would result in harm to people and damage to property. Property could include the aircraft itself, as well as the wind turbine.

There have been four reported occurrences worldwide of aircraft collisions with wind farm infrastructure since the year 2000 as discussed in Section 9. These reports show a range of situations where pilots were conducting various flying operations at low level and in the vicinity of wind farms in both IMC and VMC. No reports of aircraft collisions with wind farms in Australia have been found.

In consideration of the circumstances that would lead to a collision with a wind turbine:

- GA VFR aircraft operators generally don't individually fly a significant number of hours in total, let alone in the area in question;
- There is a very small chance that a pilot, suffering the stress of weather, will continue into poor weather conditions (contrary to the rules of flight) rather than divert away from it, is not aware of the wind farm, will not consider it or will not be able to accurately navigate around it; and
- If the aircraft was flown through the wind farm, there is still a very small chance that it would hit a wind turbine.

Refer to the discussion of worldwide accidents at Section 9.4.

There are no known aerial agriculture operations conducted at night in the vicinity of the Project.

Any object that extends to a height of 150 m or more above local ground level must be regarded as an obstacle unless it is assessed by CASA to be otherwise.

The Project is clear of the obstacle limitation surfaces of any aerodrome.

Aircraft are restricted to a minimum height of 500 ft (152.4 m) AGL above the highest point of the terrain and any object on it within a radius of 600 m (or 300 m for helicopters) in visual flight during the day when not in the vicinity of built up areas. The proposed turbines will be a maximum of 295 m (968 ft) at the top of the blade tip. The rotor blade at its maximum height will be approximately 142.6 m (468 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).

In the event that descending cloud forces an aircraft lower than 500 ft (152.4 m) AGL, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines.

If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective.

Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).

Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) AGL (day) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.

Assumed risk treatments

- The wind turbines are typically coloured white so they should be visible during the day.
- The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts.
- Because the turbines are above 110 m AGL, there is a statutory requirement to report the towers to CASA.

Consequence If an aircraft collided with a wind turbine, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.	
Consequence	Catastrophic
Untreated Likelihood There have been four aircraft collisions with wind farm infrastructure worldwide, which have resulted in a range of consequences, where aircraft occupants sustained minor injury in some cases and fatal injuries in others. Similarly, aircraft damage sustained ranged from minor to catastrophic. One of these accidents resulted from structural failure of the aircraft before the collision. Only two relevant accidents occurred during the day, and only one resulted in a single fatality. It is assessed that collision with a wind turbine resulting in multiple fatalities and damage beyond repair is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.	
Untreated Likelihood	Possible
Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.	
Current Level of Risk	8 - Unacceptable
Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
Risk Decision	Unacceptable
Proposed Treatments The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Details of the Project should be communicated to local and regional aircraft operators prior to, during and following construction to heighten their awareness of its location and so that they can plan their operations accordingly. Specifically: ○ Provide the details to the South Queensland Regional Airspace and Procedures Advisory Committee for consideration by its members in relation to VFR transit routes in the vicinity of the wind farm. ○ Engage with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, stopping the rotation of the wind turbine rotor blades prior to the commencement of the subject aircraft operations within the Project area ○ Arrangements should be made to publish details of the wind farm in ERSA for surrounding aerodromes	

Residual Risk With the additional recommended treatments, the likelihood of an aircraft collision with a wind turbine resulting in multiple fatalities and damage beyond repair will be Unlikely, and the consequence remains Catastrophic, resulting in an overall risk level of 7 - Tolerable. It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified. In the circumstances, the level of risk under the proposed treatment plan is considered as low as reasonably practicable (ALARP). It is our assessment that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines of the Project. However, the Proponent may consider other factors in its decision as to whether obstacle lighting should be installed.

Residual Risk	7 - Tolerable

Risk ID:	2. Aircraft collision with a wind monitoring tower

Discussion

An aircraft collision with a wind monitoring tower (WMT) would result in harm to people and damage to property.

CleanSight advises that there will be three temporary and up to six permanent WMTs at up to a height of 180 m (590.6 ft) AGL.

The towers will be steel lattice masts (at or below the wind turbine hub height) and will be installed at different locations around the WTA.

There are a few instances of aircraft colliding with a WMT, but they were all during the day with good visibility, and none was in Australia.

There is a relatively low rate of aircraft activity in the vicinity of the wind farm.

There are no known aerial agriculture operations conducted at night in the vicinity of the wind farm.

For objects at a height of 110 m AGL or more and outside the OLS of an aerodrome, CASA must be notified. Obstacle lighting may be required unless CASA, in an aeronautical study, assesses it as being shielded by another lit object or that it is of no obstacle significance.

Aircraft are restricted to a minimum height of 152.4 m (500 ft) AGL above the highest point of the terrain and any object on it within a radius of 600 m (or 300 m for helicopters) in visual flight during the day when not in the vicinity of built up areas. The WMT will likely be at a maximum height of 180 m (590.6 ft) AGL and will be approximately 27 m (90.6 ft) above the minimum height of 500 ft AGL for an aircraft flying at this height.

In the event that descending cloud forces an aircraft lower than 152.4 m AGL (500 ft), the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of the tower.

Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).

Aircraft authorised to intentionally fly below 152.4 m (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.

Further, the proposed permanent WMTs will be shielded by wind turbines located within the WTA.

Assumed risk treatments

- The WMT locations will be advised to CASA and Airservices Australia.
- The proposed WMTs will have ICAO compliant medium intensity flashing white for day and low intensity steady red for night.
- The top 1/3 of mast structure will be painted in red and white alternating bands.
- The proponent will provide contrasting colour markings at guy wire ground attachments and will paint the fencing around anchor points in high contrasting colour.

Consequence

If an aircraft collided with a WMT, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.

Consequence	Catastrophic

Untreated Likelihood There are a few occurrences of an aircraft colliding with a WMT, but all were during the day with good visibility when obstacle lighting would arguably be of no effect, and none was in Australia. It is assessed that collision with a wind monitoring tower without obstacle lighting that would be effective in alerting the pilot to its presence is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.	
Untreated Likelihood	Possible
Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.	
Current Level of Risk	8 - Unacceptable
Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
Risk Decision	Unacceptable
Proposed Treatments The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Ensure details of the proposed WMT have been communicated to local and regional aerodrome and aircraft operators before, during and following construction.	
Residual Risk With the additional recommended treatments, the likelihood of an aircraft collision with a WMT resulting in multiple fatalities and damage beyond repair will be Unlikely, and the consequence remains Catastrophic, resulting in an overall risk level of 7 – Tolerable. In the circumstances, the level of risk under the proposed treatment plan is considered as low as reasonably practicable (ALARP).	
Residual Risk	7 - Tolerable

Risk ID:	3. Harsh manoeuvring leads to controlled flight into terrain (CFIT)

Discussion

An aircraft colliding with terrain as a result of manoeuvring to avoid colliding with a wind turbine would result in harm to people and damage to property.

There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day.

The Project is clear of the obstacle limitation surfaces of any aerodrome.

Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 600 m (or 300 m for helicopters) in visual flight during the day when not in the vicinity of built up areas.

Wind turbines will be a maximum of 295 m (968 ft) at the top of the blade tip, so the rotor blade at its maximum height will be approximately 142.6 m (468 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).

Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines.

If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective.

Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).

Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.

Assumed risk treatments

- The wind turbines are typically coloured white so they should be visible during the day.
- The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts.
- Since the turbines will be higher than 110 m AGL, there is a statutory requirement to report the turbines to CASA.

Consequence

If an aircraft collided with terrain, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.

Consequence	Catastrophic

Untreated Likelihood

There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day. It is assessed that a ground collision accident following manoeuvring to avoid a wind turbine is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.

Untreated Likelihood	Possible

Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.	
Current Level of Risk	8 – Unacceptable
Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
Risk Decision	Unacceptable
Proposed Treatments The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Ensure details of the Project have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators before, during and following construction. • The Proponent will engage with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, stopping the rotation of the wind turbine rotor blades, prior to the commencement of the subject aircraft operations within the Project area.	
Residual Risk With the additional recommended treatments, the likelihood of ground collision resulting from manoeuvring to avoid a wind turbine resulting in multiple fatalities and damage beyond repair will be Unlikely, and the consequence remains Catastrophic, resulting in an overall risk level of 7 – Tolerable. It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified. In the circumstances, the level of risk under the proposed treatment plan is considered as low as reasonably practicable (ALARP). It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for ground collision resulting from manoeuvring to avoid a wind turbine, without obstacle lighting on the turbines of the Project.	
Residual Risk	7 - Tolerable

Risk ID:	4. Effect of the Project on operating crew

Discussion

Introduction or imposition of additional operating procedures or limitations can affect an aircraft's operating crew.

There are no known aerial agriculture operations conducted at night in the vicinity of the Project.

The Project is clear of the obstacle limitation surfaces of any aerodrome.

Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 600 m (or 300 m for helicopters) in visual flight during the day when not in the vicinity of built up areas.

Wind turbines will be a maximum of 295 m (968 ft) at the top of the blade tip, so the rotor blade at its maximum height will be approximately 142.6 m (468 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).

In the event that descending cloud forces an aircraft lower than 500 ft (152.4 m) AGL, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines.

Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines.

If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective.

Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).

Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.

Assumed risk treatments

- The wind turbines are typically coloured white so they should be visible during the day.
- The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts.
- Since the turbines will be higher than 110 m AGL, there is a statutory requirement to report the turbines to CASA.

Consequence

The worst credible effect a wind farm could have on flight crew would be the imposition of operational limitations, and in some cases, the potential for use of emergency procedures. This would be a Minor consequence.

Consequence	Minor

Untreated Likelihood The imposition of operational limitations is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.	
Untreated Likelihood	Possible
Level of Risk The level of risk associated with a Possible likelihood of a Minor consequence is 5.	
Current Level of Risk	5 - Tolerable
Risk Decision A risk level of 5 is classified as Tolerable: Treatment action possibly required to achieve ALARP - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.	
Risk Decision	Accept, conduct cost benefit analysis
Proposed Treatments Given the current treatments and the limited scale and scope of flying operations conducted within the vicinity of the Project, there is likely to be little additional safety benefit to be gained by installing obstacle lighting. However, the following treatments, which can be implemented at little cost, will provide an additional margin of safety: • Ensure details of the Project have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators before, during and following construction. • The Proponent will engage with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, stopping the rotation of the wind turbine rotor blades, prior to the commencement of the subject aircraft operations within the Project area.	
Residual Risk Notwithstanding the current level of risk is considered tolerable, the additional recommended treatments will enhance aviation safety. The likelihood remains Possible, and consequence remains Moderate. In the circumstances, the risk level of 5 is considered as low as reasonably practicable (ALARP). It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for operational limitations to affect aircraft operating crew, without obstacle lighting on the turbines of the Project.	
Residual Risk	5 - Tolerable

Risk ID:	5. Effect of obstacle lighting on neighbours

Discussion

This scenario discusses the consequential impact of a decision to install obstacle lighting on the wind farm.

Installation and operation of obstacle lighting on wind turbines or WMT can have an effect on neighbours' visual amenity and enjoyment, specifically at night and in good visibility conditions.

If the wind turbines or WMT will be higher than 150 m AGL (492 ft), the wind turbines must be regarded as obstacles unless CASA assess otherwise. In general, objects outside an OLS and above 110 m would require obstacle lighting unless CASA, in an aeronautical study, assesses it is shielded by another lit object or it is of no operational significance.

If the wind turbines or WMT will be higher than 150 m AGL (492 ft), they must be regarded as obstacles unless CASA assess otherwise. In general, objects outside an OLS and above 110 m would require obstacle lighting unless CASA, in an aeronautical study, assesses it is shielded by another lit object or it is of no operational significance.

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

Assumed risk treatments

If lighting is required, there are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours, including:

- reducing the number of wind turbines with obstacle lights;
- specifying an obstacle light that minimises light intensity at ground level;
- specifying an obstacle light that matches light intensity to meteorological visibility; and
- mitigating light glare from obstacle lighting through measures such as baffling.

Consequence

The worst credible effect of obstacle lighting specifically at night in good visibility conditions would be:

Moderate site impact, minimal local impact, important consideration at local or regional level, possible long term cumulative effect. Not likely to be decision making issues. Design and mitigation measures may ameliorate some consequences. This would be a Moderate consequence.

Consequence	Moderate

Untreated Likelihood

The likelihood of moderate site impact, minimal local impact is Almost certain - the event is likely to occur many times (has occurred frequently).

Untreated Likelihood	Almost certain

Level of Risk The level of risk associated with an Almost certain likelihood of a Moderate consequence is 8.	
Current Level of Risk	8 - Unacceptable
Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
Risk Decision	Unacceptable
Proposed Treatments Not installing obstacle lighting would completely remove the source of the impact. If lighting is required, there are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours. These measures are designed to optimise the benefit of the obstacle lights to pilots while minimising the visual impact to those on the ground.	
Residual Risk Not installing obstacle lights would clearly be an acceptable outcome to those affected by visual impact. Consideration of visual impact in the lighting design should enable installation of lighting that produces an acceptable impact to neighbours, which reduces the likelihood of a Moderate consequence to Possible – the event might occur at some time in the future, resulting in a risk level of 7 – Tolerable. It is our assessment that visual impact from obstacle lights can be negated if they are not installed, but if obstacle lights are to be installed, they can be designed so that there is an acceptable risk of visual impact to neighbours.	
Residual Risk	7 – Tolerable

11. CONCLUSIONS

The results of this study are summarised as follows:

11.1. Project description

- The WTA will accommodate up to 226 wind turbine generators (WTG) in total, with a tip height of up to 295 m (968 ft) AGL located within the exotic pine plantation located adjacent to existing forestry tracks. Electrical distribution lines will be installed within the Wind Turbine Area to connect the wind turbines to the substations and will be installed underground along forestry tracks or overhead within the Overhead Line Corridor. Site entrances, substations and operations compounds will be constructed within the WTA. Temporary construction compounds and concrete batching plants will be required through the construction phase, as well as any relevant manufacturing and assembly facilities; and
- Three temporary and up to six permanent wind monitoring towers (WMT) are proposed to be built within the WTA up to hub height to 180 m (590.6 ft) AGL.

11.2. Regulatory requirements

- For WTGs or WMTs more than 150 m in height, State Code 23 requires written endorsement by Airservices Australia and CASA stating they have no objection to the proposed development.
- With respect to MOS 139 7.1.5.1, the proposed WTGs and WMTs must be reported to CASA if they will be higher than 110 m AGL.
- With respect to MOS 139 7.1.5.2, the WTGs or WMTs must be regarded as an obstacle if they are higher than 150 m AGL, unless CASA assesses otherwise. Obstacle monitoring includes the PANS OPS surface which extends beyond the OLS of the aerodrome.
- With respect to MOS 139 9.4.1.2 (b), the WTGs or WMTs will need to be lit if they are outside the OLS and above 110 m AGL, unless an aeronautical study assesses they are of no operational significance.

11.3. Planning considerations

The Project as proposed satisfies the following Outcomes of State Code 23:

Performance outcomes	*Acceptable outcomes - Compliance*
Aviation safety, integrity and efficiency	
PO1 The safety, operational integrity and efficiency of air services and aircraft operations are not adversely affected by the location, siting, design and operation of the development.	AO1.1 - Not applicable as WTG and WMT are more than 150 m in height AO1.2 (3) – [TBA pending CASA written endorsement] (4) – Not applicable as the WTA is outside 30 km of a military aerodrome, or a certified aerodrome or registered aerodrome jointly used as a military aerodrome,
PO2 Development includes lighting and marking measures to ensure the safety, operational integrity and efficiency of air services and aircraft operations.	AO2.1 – Complies, the WTG will be marked AO2.2 – Complies, the top one-third of the WMT will be painted in alternating bands of contrasting colour AO2.3 – [TBA pending CASA written endorsement] AO2.4 In areas where low flying aircraft occur: (4) – Complies, marker balls will be placed on the guy wires (5) – Complies, the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation (6) – Complies - ICAO compliant medium intensity flashing white for day, low intensity steady red for night AO2.5 – N/A as LED lighting is not proposed

The Project as proposed satisfies all Performance Criteria and Acceptable Outcomes of the Fraser Coast Airport Environs Overlay Code and does not conflict with provisions of the Gympie Regional Council Planning Scheme as outlined in Section 3 of this report.

11.4. Consultation

An appropriate and justified level of consultation is being undertaken with relevant parties.

11.5. Aviation Impact Statement

Based on the proposed WTA layout and overall turbine blade tip height limit of 295 m AGL, the blade tip elevation of the highest WTG, which is WTG 2_199, will not exceed 408.7 m AHD (1341.1 ft AMSL) and:

- will not penetrate any OLS surfaces;
- will penetrate the following:
    - Maryborough Airport 10 nm MSA MOC 1700 ft AMSL by approximately 468.3 ft (142.7 m);
    - Maryborough Airport 25 nm MSA MOC 2000 ft AMSL in the sector between bearings 110°and 340° by approximately 341.1 ft (104 m)Hervey Bay Airport 25 nm MSA MOC 2100 ft AMSL by approximately 147 ft (44.8 m).

  Therefore, the following is required:
    - the 10 nm MSA for Maryborough Airport will need to be increased by 500 ft to 2200 ft;
    - the 25 nm MSA for Maryborough Airport in the sector between bearings 110°and 340° will need to be increased by 400 ft to 2400 ft; and
    - the 25 nm MSA for Hervey Bay Airport will need to be increased by 200 ft to 2300 ft.
- will not impact Maryborough Airport circling areas;
- will likely restrict circuit operations at the Unnamed ALA (to the west of the WTA);
- will partially impact Danger Area D688;
- will not have an impact on nearby designated air routes;
- is wholly contained within Class G airspace; and
- is outside the clearance zones associated with aviation navigation aids and communication facilities.

Airservices Australia response:

> *With respect to procedures designed by Airservices in accordance with ICAO PANS-OPS and Document 9905, at a maximum height of 408.7 m (1341 ft) AHD, the wind farm will affect the 25 NM and 10 NM minimum sector altitude (MSA) of Maryborough Airport and the 25 NM minimum sector altitude (MSA) of Hervey Bay Airport.*
>
> *In order to accommodate the proposal, the MSA is required to be amended for Hervey Bay and Maryborough as follows:*
>
> - *The existing Maryborough 3100 ft 25 NM MSA sector will need to be expanded to cover B-260° to B-110°. The Maryborough 10 nm MSA will need to be raised by 500 ft from 1700 ft to 2200 ft.*
> - *The Hervey Bay 25NM MSA will need to be revised to include a new 2300 ft sector between B-340° and B-025°.*
> - *The missed approach termination altitude of the YMYB RNAV-Z (GNSS) RWY 17 procedure will need to be increased to 3100 ft.*

Airservices requires that the operator of Hervey Bay and Maryborough Airport (included in this email response) to be consulted and confirm that the proposed permanent change to MSA will not adversely impact on their operations before any change (temporary or permanent) can be supported by Airservices.

Fraser Coast Regional Council's response:

Mr James Cockburn, Executive Manager Planning and Growth at FCRC, in his email dated 13 September 2019 advised that council has no objection to the proposal subject to ongoing compliance with all CASA, Airservices and relevant aviation regulatory requirements.

11.6. Aircraft operator characteristics

- Aircraft will be required to navigate around the Project site in low cloud conditions where aircraft need to fly at 500 ft AGL.
- The Proponent will engage with local aerial agricultural and aerial firefighting operators in relation to forestry operations to develop procedures, which may include, for example, stopping the rotation of the wind turbine rotor blades, prior to the commencement of the subject aircraft operations within the WTA
- Wind turbines are generally not a safety concern to aerial agricultural operators. WMTs remain the primary safety concern to aerial agricultural operators, who have expressed a general desire for these towers to be more visible.
- Mr Anthony Hooper, Manager Line Operations at RFDS, in his email dated 02 August 2019 advised that the Project will not impact on the RRDS' operations at both Maryborough and Hervey Bay airports.
- In the email response dated 2 August 2019, Ms Logan - Flight Operations Engineering Manager at Virgin Australia advised that Virgin Australia does not operate to Maryborough Airport. With respect to Hervey Bay Airport, Ms Logan advised that Virgin Australia flying operations will not be significantly impacted by the proposed MSA changes.
- During email consultation for the final project layout, QantasLink was informed of the Project. Captain Adrian Young (Head of Flying Operations and Chief Pilot) in his email dated 2 August 2019 advised that after reviewing the aviation impact assessment (version 0.6), QantasLink will have no issue with the Projects development.

11.7. Hazard lighting and marking

- With respect to MOS 139 7.1.5.1, the proposed wind turbines must be reported to CASA if they are higher than 110 m AGL. With respect to MOS 139 7.1.5.2, the proposed 295 m wind turbine overall blade tip height must be regarded as obstacles since they are higher than 150 m AGL, unless CASA assesses otherwise.
- With respect to MOS 139 9.4.1.2 (b), the wind turbines and WMTs will need to be lit if they are higher than 110 m AGL, unless an aeronautical study assesses they are of no operational significance.

- **Aviation Projects assesses that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines of the Project.**
- CASA has recently advised that it will only review assessments referred to it by a planning authority or agency.
- Consultation with Department of Defence regarding lighting has been undertaken during the preparation of the aviation impact assessment. Defence has no objection to the proposed wind farm provided that the project complies with the conditions outlined in **Annexure 2.**
- With respect to marking of turbines, a shade of white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.
- There will be three temporary and up to six permanent WMTs at a height of up to 180 m (590.6 ft) AGL. The proposed towers will be reported to Airservices Australia.
- Consideration should be given to marking any WMT according to the requirements set out in MOS 139 Section 8.10 Obstacle Markings (as modified by the guidance in NASF Guideline D).
- The route of the electrical reticulation will follow the infrastructure corridors. Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators and marked in accordance with MOS 139 Section 8.10 Obstacle Markings; specifically:

  > *8.10.2.8 Wires or cable obstacles must be marked using three-dimensional coloured objects such as spheres and pyramids, etc; of a size equivalent to a cube with 600 mm sides, spaced 30 m apart.*

11.8. Risk assessment

A summary of the level of risk associated with the Project under the proposed treatment regime, with specific consideration of the effect of obstacle lighting, is provided in Table 15.

Note: A risk level below 8 is considered tolerable.

Table 15 Risk assessment criteria

Risk Element	*Consequence*	*Likelihood*	*Risk*	*Actions Required*
Aircraft collision with wind turbine	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Aircraft collision with monitoring tower	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Consider marking the wind monitoring towers according to the requirements set out in MOS 139 Section 8.10 Obstacle Markings, specifically 8.10.2.6 and 8.10.2.8. Any WMT that exceeds a height of 150 m AGL should be lit with a high intensity white flashing obstacle light during the day and a low intensity steady red light at night, until such time as a wind turbine is constructed within close proximity to the WMT (nominally 900 m). Communicate details of wind monitoring towers to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes following construction.
Avoidance manoeuvring leads to ground collision	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Effect on crew	Minor	Possible	5	Acceptable without obstacle lighting (ALARP) Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Visual impact from obstacle lights	Moderate	Likely	7	Acceptable without obstacle lighting (zero risk of visual impact from obstacle lighting). If lights are installed, design to minimise impact.

12. RECOMMENDATIONS

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

Planning considerations

1. If all the recommendations contained herein are implemented, the Project will not adversely affect the safety, operational integrity and efficiency of air services as:
    a. The Project will comply with the Acceptable Outcomes and Performance Outcomes of State Code 23; and
    b. The Project will comply with the Fraser Coast Airport Environs Overlay Code and does not conflict with provisions of the Gympie Regional Council Planning Scheme.

Notification and reporting

2. 'As constructed' details of wind turbine and WMT coordinates and elevations should be provided to Airservices Australia, using the following email address: vod@airservicesaustralia.com.
3. Department of Defence should be consulted if there is any subsequent modification in the wind turbine height or scale of development.
4. Any obstacles above 110 m AGL (including temporary construction equipment) should be reported to Airservices Australia NOTAM office until they are incorporated in published operational documents. With respect to crane operations during the construction of the Project, a notification to the NOTAM office may include, for example, the following details:
    a. The planned operational timeframe and maximum height of the crane; and
    b. Either the general area within which the crane will operate and/or the planned route with timelines that crane operations will follow.
5. Details of the wind farm should be provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm on their operations. Specifically, details should be provided to the Queensland Regional Airspace and Procedures Advisory Committee for consideration by its members in relation to VFR transit routes in the vicinity of the wind farm.

Operation

6. The Proponent should consider engaging with local aerial agricultural operators and aerial firefighting operators and the Plantation Licensee in developing procedures for such aircraft operations in the vicinity of the Project. The Proponent may consider developing procedures such as, for example, stopping the rotation of the wind turbine rotor blades prior to the commencement of the subject aircraft operations within the Project area.

Marking of turbines

7. The rotor blades, nacelle and the supporting mast of the wind turbines should be painted a shade of white.

Lighting of turbines

8. **Aviation Projects has assessed that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft based on the following conclusions**:

    a. outcomes of the Aeronautical Impact Statement (once the MSAs of the 10 nm and 25 nm of Maryborough Airport and the 25 nm of Hervey Airport are increased); and

    b. conclusions of the risk assessment.

Marking of wind monitoring towers

9. Consideration should be given to marking the WMTs according to the requirements set out in MOS 139 Section 8.10 (as modified by the guidance in NASF Guideline D). It is understood that all WMTs will comply.

Lighting of wind monitoring towers

10. The proposed permanent and temporary WMTs should be lit with ICAO compliant medium intensity flashing white for day, low intensity steady red for night.

Marking of overhead transmission lines and poles

11. Overhead transmission lines and/or supporting poles that are located where they could adversely affect aerial application operations should be identified in consultation with local aerial agriculture operators and marked in accordance with MOS 139 Section 8.10.2.8.

Micrositing

12. The potential micrositing of the turbines and WMTs have been taken into account. The proposed WTGs and WMTs will be within the proposed WTA. The micrositing of the turbines and WMTs is unlikely to result in a change in the maximum overall blade tip height of the Project. This is based on the information provided by the proponent noting 295 m AGL wind turbine is the highest impact scenario possible and current layout has WTGs on the highest area of site.

Triggers for review

13. Triggers for review of this risk assessment are provided for consideration:

    a. prior to construction to ensure the regulatory framework has not changed;

    b. following any significant changes to the context in which the assessment was prepared, including the regulatory framework; and

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

ANNEXURES

1. Turbine coordinates and heights
2. Department of Defence response

ANNEXURE 1 – TURBINE COORDINATES AND HEIGHTS

Source: CleanSight, Forest Wind Layout coordinates, file: FW_Layout Coordinates 226 WTGs_All Stages_190610.

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
1A_1	-25.62809995	152.8383093	295	8.9	308.9	1013.4
1A_2	-25.63255165	152.8368775	295	9.1	309.1	1014.3
1A_3	-25.63686897	152.8354193	295	9.6	309.6	1015.8
1A_4	-25.64089726	152.8332702	295	10.4	310.4	1018.3
1A_5	-25.6434584	152.8423925	295	9.0	309.0	1013.9
1A_6	-25.65512653	152.8413477	295	10.2	310.2	1017.9
1A_7	-25.66223756	152.8424604	295	9.1	309.1	1014.3
1A_8	-25.66425274	152.837544	295	9.3	309.3	1014.7
1A_9	-25.66755945	152.8313042	295	10.9	310.9	1020.1
1A_10	-25.67076165	152.8284077	295	12.6	312.6	1025.8
1A_11	-25.6754056	152.8240753	295	15.1	315.1	1033.7
1A_12	-25.67820954	152.8220838	295	16.2	316.2	1037.6
1A_13	-25.68175481	152.8199724	295	17.6	317.6	1041.9
1B_1	-25.96281231	152.8622651	295	95.2	395.2	1296.5
1B_2	-25.96657575	152.8524844	295	82.4	382.4	1254.7
1B_3	-25.96787122	152.8635709	295	90.9	390.9	1282.7
1B_4	-25.9750695	152.8671944	295	85.0	385.0	1263.2
1B_5	-25.97517889	152.851031	295	67.2	367.2	1204.7
1B_6	-25.98110924	152.8426087	295	55.7	355.7	1167.1
1B_7	-25.98753064	152.8350328	295	43.7	343.7	1127.6
2_1	-25.60864722	152.8112342	295	11.1	311.1	1020.8
2_2	-25.61542364	152.8227315	295	11.0	311.0	1020.3
2_3	-25.61489711	152.8112321	295	12.1	312.1	1024.1
2_4	-25.62055667	152.8217218	295	11.3	311.3	1021.3

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
2_5	-25.62155895	152.8100001	295	13.0	313.0	1027.1
2_6	-25.62286742	152.8007628	295	14.7	314.7	1032.5
2_7	-25.62488817	152.820839	295	11.8	311.8	1023.1
2_8	-25.62828195	152.7999861	295	15.8	315.8	1036.2
2_9	-25.62962536	152.8199026	295	12.6	312.6	1025.5
2_10	-25.6347613	152.8012756	295	17.3	317.3	1041.1
2_11	-25.64143657	152.8165391	295	14.7	314.7	1032.7
2_12	-25.64153773	152.8035211	295	17.7	317.7	1042.4
2_13	-25.64523709	152.8150185	295	14.9	314.9	1033.2
2_14	-25.63686302	152.8183221	295	14.0	314.0	1030.2
2_15	-25.64815329	152.828402	295	11.8	311.8	1023.1
2_16	-25.65117623	152.8150833	295	14.7	314.7	1032.6
2_17	-25.65545805	152.8317829	295	11.6	311.6	1022.5
2_18	-25.65706811	152.8151556	295	14.6	314.6	1032.3
2_19	-25.66110418	152.8311135	295	11.3	311.3	1021.4
2_20	-25.68239329	152.8090947	295	20.9	320.9	1052.7
2_21	-25.68684924	152.8199216	295	16.4	316.4	1038.1
2_22	-25.68956705	152.8162233	295	13.9	313.9	1029.9
2_23	-25.69466566	152.8135693	295	14.7	314.7	1032.4
2_24	-25.70177885	152.8102264	295	21.9	321.9	1056.3
2_25	-25.70341139	152.8228125	295	23.6	323.6	1061.6
2_26	-25.70781921	152.8032836	295	29.0	329.0	1079.4
2_27	-25.70788112	152.8242135	295	25.8	325.8	1068.8
2_28	-25.71257428	152.8248389	295	28.3	328.3	1077.1
2_29	-25.71864702	152.8252956	295	36.5	336.5	1104.2
2_30	-25.722935	152.8229721	295	35.5	335.5	1100.9
2_31	-25.72596927	152.8146603	295	32.2	332.2	1089.9

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
2_32	-25.72553292	152.8458972	295	20.8	320.8	1052.6
2_33	-25.74314567	152.8353257	295	26.4	326.4	1071.0
2_34	-25.73101623	152.8101533	295	40.2	340.2	1116.3
2_35	-25.73392937	152.8489242	295	24.4	324.4	1064.4
2_36	-25.73614525	152.8445754	295	25.3	325.3	1067.5
2_37	-25.73710409	152.8050962	295	50.3	350.3	1149.5
2_38	-25.73963461	152.841668	295	26.6	326.6	1071.6
2_39	-25.76147576	152.8444327	295	23.3	323.3	1060.7
2_40	-25.74629649	152.8022932	295	53.0	353.0	1158.1
2_41	-25.74967094	152.8281885	295	29.0	329.0	1079.6
2_42	-25.75937363	152.7935641	295	59.9	359.9	1180.9
2_43	-25.74716553	152.8121622	295	49.6	349.6	1147.1
2_44	-25.74784037	152.8189132	295	41.2	341.2	1119.5
2_45	-25.75623984	152.7984448	295	56.7	356.7	1170.2
2_46	-25.75696063	152.8556459	295	25.1	325.1	1066.6
2_47	-25.75090576	152.8012907	295	53.2	353.2	1158.8
2_48	-25.75974372	152.8525213	295	22.5	322.5	1058.2
2_49	-25.76064383	152.8378041	295	29.4	329.4	1080.8
2_50	-25.76180516	152.7887464	295	64.7	364.7	1196.5
2_51	-25.89093233	152.848642	295	68.2	368.2	1208.1
2_52	-25.76381552	152.831738	295	31.9	331.9	1088.9
2_53	-25.84457018	152.8211713	295	68.9	368.9	1210.5
2_54	-25.76649832	152.8220141	295	37.0	337.0	1105.7
2_55	-25.83975749	152.8236548	295	63.8	363.8	1193.6
2_56	-25.77381263	152.8182048	295	46.0	346.0	1135.1
2_57	-25.77550728	152.8129472	295	48.3	348.3	1142.9
2_58	-25.77636009	152.8568612	295	18.2	318.2	1044.1

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
2_59	-25.77485056	152.8066062	295	48.1	348.1	1142.2
2_60	-25.77569664	152.7957919	295	59.6	359.6	1180.0
2_61	-25.86884801	152.8288241	295	63.7	363.7	1193.3
2_62	-25.7820946	152.8525983	295	21.2	321.2	1053.8
2_63	-25.8829194	152.8437251	295	70.2	370.2	1214.7
2_64	-25.93513585	152.8339021	295	56.9	356.9	1171.0
2_65	-25.78910399	152.8622622	295	23.7	323.7	1062.0
2_66	-25.78760709	152.8442227	295	28.9	328.9	1079.3
2_67	-25.79306921	152.8590862	295	26.5	326.5	1071.2
2_68	-25.79607273	152.8406044	295	28.0	328.0	1076.3
2_69	-25.79740564	152.856186	295	35.2	335.2	1099.7
2_70	-25.80489854	152.8562069	295	37.1	337.1	1106.2
2_71	-25.80613422	152.8405736	295	31.9	331.9	1089.0
2_72	-25.80749197	152.8035979	295	63.2	363.2	1191.6
2_73	-25.80993775	152.8125655	295	55.4	355.4	1166.2
2_74	-25.80733242	152.8354942	295	34.7	334.7	1098.1
2_75	-25.81113658	152.8193861	295	55.8	355.8	1167.3
2_76	-25.83292332	152.8296574	295	53.1	353.1	1158.6
2_77	-25.81355506	152.8525137	295	27.0	327.0	1072.8
2_78	-25.8097362	152.8312348	295	47.1	347.1	1138.8
2_79	-25.81090041	152.8259171	295	59.2	359.2	1178.4
2_80	-25.82354903	152.835651	295	40.0	340.0	1115.4
2_81	-25.81873923	152.8084313	295	52.4	352.4	1156.1
2_82	-25.82126993	152.8495007	295	32.3	332.3	1090.3
2_83	-25.82327157	152.802744	295	61.7	361.7	1186.6
2_84	-25.82356881	152.8440438	295	35.5	335.5	1100.7
2_85	-25.82465686	152.8588482	295	35.9	335.9	1102.1

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
2_86	-25.82832213	152.8019339	295	62.9	362.9	1190.5
2_87	-25.83275641	152.8527452	295	43.7	343.7	1127.8
2_88	-25.83307349	152.8363086	295	39.3	339.3	1113.2
2_89	-25.83884624	152.8480327	295	50.1	350.1	1148.6
2_90	-25.83684272	152.8273583	295	64.5	364.5	1196.0
2_91	-25.8439217	152.8460501	295	46.2	346.2	1135.8
2_92	-25.84639481	152.8167098	295	91.5	391.5	1284.6
2_93	-25.84887169	152.8422166	295	43.2	343.2	1125.9
2_94	-25.84753886	152.8118055	295	82.9	382.9	1256.3
2_95	-25.85652519	152.8003042	295	67.9	367.9	1206.9
2_96	-25.86243006	152.7960076	295	70.4	370.4	1215.3
2_97	-25.8683785	152.8223355	295	66.9	366.9	1203.8
2_98	-25.86806187	152.840466	295	59.3	359.3	1178.7
2_99	-25.8684756	152.8348012	295	59.1	359.1	1178.2
2_100	-25.87463867	152.8142329	295	64.0	364.0	1194.3
2_101	-25.87899358	152.8009592	295	53.1	353.1	1158.4
2_102	-25.88810842	152.8525842	295	69.3	369.3	1211.7
2_103	-25.88381082	152.8368078	295	66.3	366.3	1202.0
2_104	-25.89889108	152.8448492	295	66.8	366.8	1203.4
2_105	-25.89826339	152.8519255	295	77.8	377.8	1239.5
2_106	-25.88384538	152.8303192	295	60.9	360.9	1184.2
2_107	-25.90491626	152.8120127	295	66.4	366.4	1202.1
2_108	-25.90466874	152.8410169	295	66.0	366.0	1200.9
2_109	-25.90873712	152.8494186	295	68.0	368.0	1207.4
2_110	-25.91021621	152.8373208	295	67.9	367.9	1207.1
2_111	-25.91321932	152.8491884	295	72.3	372.3	1221.7
2_112	-25.91968335	152.8090079	295	50.2	350.2	1149.0

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
2_113	-25.91708634	152.8328691	295	70.9	370.9	1217.0
2_114	-25.9183786	152.8503854	295	82.0	382.0	1253.2
2_115	-25.91902062	152.8192675	295	49.5	349.5	1146.6
2_116	-25.92254227	152.8331201	295	66.6	366.6	1202.8
2_117	-25.92210647	152.7973933	295	51.0	351.0	1151.7
2_118	-25.92447779	152.8423824	295	71.7	371.7	1219.6
2_119	-25.92748997	152.8536377	295	108.7	408.7	1341.1
2_120	-25.93074434	152.8141991	295	59.6	359.6	1179.8
2_121	-25.93179341	152.8366216	295	58.9	358.9	1177.6
2_122	-25.93540793	152.8504528	295	84.7	384.7	1262.2
2_123	-25.93569362	152.8567581	295	105.2	405.2	1329.3
2_124	-25.93581737	152.8639288	295	90.9	390.9	1282.4
2_125	-25.93924255	152.8300542	295	60.0	360.0	1181.2
2_126	-25.94063385	152.815177	295	65.3	365.3	1198.7
2_127	-25.94234271	152.8577459	295	98.6	398.6	1308.0
2_128	-25.94347571	152.827789	295	62.8	362.8	1190.3
2_129	-25.9502706	152.8492033	295	79.7	379.7	1245.9
2_130	-25.952155	152.8452492	295	73.4	373.4	1225.1
2_131	-25.95240244	152.8671084	295	82.7	382.7	1255.6
2_132	-25.95478596	152.8407658	295	74.8	374.8	1229.6
2_133	-25.96083296	152.8667032	295	90.4	390.4	1280.8
2_134	-25.95640102	152.8609203	295	93.2	393.2	1290.1
2_135	-25.95846938	152.835079	295	65.9	365.9	1200.5
2_136	-25.96208246	152.8305412	295	60.3	360.3	1182.1
2_137	-25.96456167	152.8247542	295	57.6	357.6	1173.4
2_138	-25.96704437	152.8192251	295	48.0	348.0	1141.9
3_1	-25.70757978	152.7932125	295	32.0	332.0	1089.3

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
3_2	-25.71707222	152.7785813	295	40.6	340.6	1117.4
3_3	-25.72107821	152.7935417	295	37.5	337.5	1107.5
3_4	-25.72181247	152.770984	295	45.8	345.8	1134.5
3_5	-25.73130498	152.7654308	295	42.4	342.4	1123.4
3_6	-25.74187728	152.7543133	295	53.5	353.5	1159.7
3_7	-25.74777615	152.7467641	295	56.1	356.1	1168.3
3_8	-25.75649132	152.7320593	295	48.5	348.5	1143.3
3_9	-25.76642593	152.7826555	295	62.8	362.8	1190.5
3_10	-25.77181685	152.7788081	295	72.5	372.5	1222.1
3_11	-25.77426616	152.8367132	295	32.7	332.7	1091.7
3_12	-25.7809776	152.7879932	295	67.8	367.8	1206.8
3_13	-25.78364011	152.8273445	295	42.3	342.3	1123.1
3_14	-25.78912953	152.7757115	295	80.1	380.1	1247.0
3_15	-25.78967019	152.8213279	295	42.6	342.6	1124.0
3_16	-25.79499453	152.7622378	295	43.8	343.8	1128.2
3_17	-25.79761541	152.825377	295	42.5	342.5	1123.7
3_18	-25.7973965	152.8162276	295	58.1	358.1	1174.9
3_19	-25.80256907	152.7510741	295	47.5	347.5	1140.2
3_20	-25.80010018	152.7563262	295	52.5	352.5	1156.4
3_21	-25.80421348	152.7453711	295	38.1	338.1	1109.2
3_22	-25.81324437	152.7951332	295	80.0	380.0	1246.7
3_23	-25.81538217	152.7864211	295	71.5	371.5	1218.9
3_24	-25.82134283	152.7778391	295	46.5	346.5	1136.8
3_25	-25.82463747	152.7705173	295	49.5	349.5	1146.6
3_26	-25.82715606	152.7551286	295	40.3	340.3	1116.5
3_27	-25.82814401	152.7640358	295	50.0	350.0	1148.2
3_28	-25.83785847	152.7893693	295	77.5	377.5	1238.5

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
3_29	-25.84294744	152.7696208	295	45.0	345.0	1132.0
3_30	-25.84413413	152.782663	295	58.7	358.7	1177.0
3_31	-25.85510469	152.7834293	295	58.9	358.9	1177.6
3_32	-25.86738574	152.7700394	295	47.7	347.7	1140.8
3_33	-25.8773742	152.7704343	295	44.6	344.6	1130.6
3_34	-25.88277963	152.7560214	295	46.3	346.3	1136.2
3_35	-25.88960827	152.8205667	295	58.0	358.0	1174.6
3_36	-25.89065377	152.8126644	295	63.7	363.7	1193.4
3_37	-25.89309022	152.8010785	295	66.8	366.8	1203.6
3_38	-25.8950765	152.8092121	295	67.0	367.0	1204.2
3_39	-25.89389791	152.7946024	295	58.4	358.4	1175.9
3_40	-25.89766112	152.7897312	295	46.3	346.3	1136.3
3_41	-25.90006709	152.7840878	295	41.0	341.0	1118.8
4_1	-25.65119957	152.7887007	295	19.6	319.6	1048.7
4_2	-25.65434886	152.7862088	295	20.0	320.0	1049.9
4_3	-25.66248588	152.8152127	295	15.2	315.2	1034.0
4_4	-25.65762428	152.7827791	295	20.7	320.7	1052.1
4_5	-25.66641031	152.8129908	295	16.2	316.2	1037.6
4_6	-25.66462165	152.7845372	295	22.8	322.8	1059.0
4_7	-25.66829356	152.7812798	295	24.5	324.5	1064.6
4_8	-25.66555165	152.8072234	295	17.8	317.8	1042.7
4_9	-25.67114283	152.8061955	295	19.6	319.6	1048.5
4_10	-25.67211503	152.7782125	295	26.9	326.9	1072.5
4_11	-25.67374911	152.8024138	295	21.7	321.7	1055.4
4_12	-25.67986736	152.7776205	295	28.5	328.5	1077.9
4_13	-25.68320687	152.7685471	295	35.4	335.4	1100.3
4_14	-25.68345987	152.7607847	295	46.2	346.2	1135.8

WTG ID	Latitude	Longitude	Maximum Tip Height (m AGL)	Base Elevation (m AHD)	Wind turbine tip height (m AHD)	Wind turbine tip height (ft AMSL)
4_15	-25.68377948	152.775153	295	30.2	330.2	1083.4
4_16	-25.68443304	152.7865409	295	23.4	323.4	1061.0
4_17	-25.68688077	152.7568995	295	53.6	353.6	1160.1
4_18	-25.69028875	152.786983	295	26.0	326.0	1069.7
4_19	-25.69133314	152.7540323	295	54.5	354.5	1163.0
4_20	-25.69630282	152.7457842	295	54.9	354.9	1164.4
4_21	-25.69753707	152.7887427	295	26.8	326.8	1072.4
4_22	-25.69910144	152.7418705	295	49.8	349.8	1147.8
4_23	-25.70293765	152.7376973	295	46.5	346.5	1137.0
4_24	-25.7065093	152.7346574	295	44.0	344.0	1128.7
4_25	-25.71218766	152.7298823	295	45.9	345.9	1135.0
4_26	-25.71717211	152.725662	295	44.2	344.2	1129.4
4_27	-25.72833751	152.7232455	295	38.2	338.2	1109.7

ANNEXURE 2 – RELEVANT STAKEHOLDERS RESPONSE

1. Department of Defence response

Australian Government
Department of Defence
Estate and Infrastructure Group

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Director Land Planning and Regulation
Estate Planning Branch
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ID-EP-DLP&R/OUT/2017/AF31473486

Raelene Corner
Specialist Consultant – Planning
Aviation Projects
PO Box 116
TOOWONG DC QLD 4066

Dear Ms Corner

RE: 101402-02 – FOREST WIND – WIDE BAY REGION, QUEENSLAND

Thank you for your correspondence of 7 August 2017 referring the Aviation Impact Assessment for the abovementioned wind farm proposal to the Department of Defence (Defence) for comment. Defence understands that the proposal is to construct up to 300 wind turbines at a site within the Neerdie, Toolara and Tuan State Forests, near Maryborough in Queensland. The proposal includes turbines with an overall height of up to 250 metres above ground level (AGL).

Defence has conducted an assessment of the proposed wind farm for potential impacts on the safety of military flying operations as well as possible interference to Defence communications and radar.

A review of the proposal raised concerns regarding the potential for interference with high frequency (HF) radiocommunications used within the Wide Bay Training Area (WBTA). Defence requests that should the proposed wind farm have an adverse impact on Defence training capabilities, the operators of the wind farm work with Defence to resolve the issue. A copy of correspondence from the Defence Spectrum Office is attached.

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 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 structures will meet the above definition of a tall structure. Defence therefore requests that the proponent provide ASA with "as constructed" details. The details can be emailed to ASA at vod@airservicesaustralia.com.

Defence notes that the *National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* recommends that where a wind turbine 150 metres or taller in height is proposed away from

aerodromes, the proponent should conduct an aeronautical risk assessment. It also recommends that the risk assessment be submitted to the Civil Aviation Safety Authority (CASA) to determine whether the proposal is a hazard to aircraft safety and requires lighting or marking. Defence supports this requirement and believes that in this instance it would be prudent for the risk assessment of this proposal to be sent to CASA for consideration.

If CASA determines that obstacle lighting is to be provided, it should be compatible with persons using night vision devices. If LED lighting is proposed, the frequency range of the LED light emitted should be within the range of wavelengths 665 to 930 nanometers.

Defence regularly operates Unmanned Air Vehicles (UAV) at WBTA. While UAV malfunction resulting in collision with a wind turbine would be a rare event, it is still a risk to consider.

Should you wish to discuss the content of this advice further, my point of contact is Mrs Rebecca Soric at DSRGIDEP.ExecutiveSupport@defence.gov.au or by telephone on (02) 6266 8186.

Yours sincerely

Sonya Dare
Director
Land Planning and Regulation
Estate Planning Branch

8 December 2017

Australian Government

Department of Defence
Chief Information Officer Group

MINUTE

File Ref: AF31357356

MRS REBECCA SORIC EIG

PROVISION OF SPECTRUM SUPPORTABILITY – FOREST WIND

1. This notification is to confirm that based on the information provided, the spectrum supportability assessment for the Wind Farm immediately adjacent to the Wide Bay Training Area (WBTA) has been conditionally approved.

2. DSO supports the construction of the Wind Farm adjacent to WBTA with the following consideration:

(1) There is anecdotal evidence that some windfarms have impacted HF radiocommunications systems when in reasonably near proximity. Given Defence has significant use of itinerant HF systems within the WBTA, If there is adverse effects to Defence training capability, the Wind Farm will need to work with Defence to remedy the impact to capability.

3. My point of contact on this matter is Mr. Nathan Smith, contactable on (02) 6144 4986 or Nathan.smith33@defence.gov.au.

Yours sincerely,

GLENN ODLUM
Principal Engineer, Spectrum Planning and Engineering
Defence Spectrum Office
Phone: (02) 6144 4110
Email: Glenn.Odlum@defence.gov.au
1 December 2017

Australian Government
Department of Defence
Estate and Infrastructure Group

Charles Mangion
Director Land Planning and Regulation
Estate Planning Branch
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ID-EP-DLP&R/OUT/2019/BS6976460

Mr Pavel Davidyuk
Specialist Consultant - Aviation
Aviation Projects
PO Box 116
TOOWONG DC QLD 4066

Dear Mr Davidyuk

NOTIFICATION REGARDING AMENDMENT TO FOREST WIND, 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 request to amend an existing application, to construct up to 226 wind turbines at a site situated between Gympie and Maryborough in the Wide Bay Region of Queensland. The proposal includes turbines with an overall tip height of 295 metres above ground level (AGL).

Defence has conducted an assessment of the amended proposal for potential impacts on the safety of Defence flying operations.

Defence provided earlier comments on the wind farm in correspondence dated 8 December 2018 (see attached) the issues raised in this letter are still relevant. It's important to note that Defence has identified concerns regarding the potential for the wind farm to interfere with high frequency radio communications used within the Wide Bay Training Area. Defence advise that should the proposed wind farm have an adverse impact on Defence training capabilities, the operators of the wind farm would need to work with Defence to resolve the issue by introducing measures to reduce levels of interference to acceptable levels.

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 295 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.

Defence notes that the *National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers* recommends that where a wind turbine 150 metres or taller in height is proposed away from aerodromes, the proponent should conduct an aeronautical risk assessment. It also recommends

that the risk assessment be submitted to the Civil Aviation Safety Authority (CASA) to determine whether the proposal is a hazard to aircraft safety and requires approved lighting or marking. Defence supports this requirement and believes that in this instance, it would be prudent for the risk assessment of this proposal to be sent to CASA for consideration. If CASA determines that obstacle lighting is to be provided, it should be compatible with persons using night vision devices. If LED lighting is proposed, the frequency range of the LED light emitted should be within the range of wavelengths 665 to 930 nanometres.

If wind monitoring towers are to be constructed as part of the proposal, Defence notes that the *National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers - Paragraph 39* recommends the top 1/3 of wind monitoring towers are painted in alternating contrasting bands of colour in accordance with the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998.

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

Should you wish to discuss the content of this advice further, my point of contact is Mr Tim Hogan at land.planning@defence.gov.au or telephone on (02) 6266 8193.

Yours sincerely

Charles.Mangion Digitally signed by Charles.Mangion
Date: 2019.11.20 10:17:59 +11'00'

Charles Mangion
Director Land Planning & Regulation

November 2019

Attachment

1. Defence correspondence dated 8 December 2018

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