

Mackay Airport

Wildlife Hazard Management Plan

Mackay Airport Proprietary Limited

Version 5.0

March 2022



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Executive Summary

This document forms the Wildlife Hazard Management Plan for Mackay Airport. It defines the risk that wildlife poses to air traffic and outlines the objectives, responsibilities and procedures for monitoring, recording, assessing and managing wildlife hazards.

This Wildlife Hazard Management Plan has been prepared by Mackay Airport Pty Ltd, a business unit of North Queensland Airports, and airport-appointed qualified biologists (Avisure) to meet the applicable requirements of the Mackay Airport Aerodrome Operations Manual, the Safety Management System approach and the Civil Aviation Safety Regulations Part 139 (Aerodromes) Manual of Standards 2019, made under division 130.C.4 of the Civil Aviation Safety Regulations 1998.

Between July 2020 to June 2021 Mackay Airport reported 20 confirmed on-airport and vicinity strikes; including one damaging strike. For this period, Mackay Airport's strike rate was 7.96 confirmed strikes per 10,000 aircraft movements, and 31.83 adverse effect strikes per 100,000 aircraft movements; ranking the airport above the industry average. A total mass struck of 2.55 kg per 10,000 aircraft movements is also considered a high risk by industry standards. Bush Stone-curlew was involved in four strikes for the period, contributing 40% of the total mass struck. Of the confirmed strikes, eight occurred between 1900 and 2200 hours.

The risk assessment identified six high risk (Bush Stone-curlew, Australian White Ibis, Wandering Whistling-Duck, Unidentified Bird, Feral Pigeon, and Magpie Goose) and 20 moderate risk species.

Avisure surveyed off-aerodrome land uses that attracted, or had the potential to attract, wildlife and identified 15 within 3 km of the airport, five between 3-8 km, one between 8-13 km and a potentially hazardous habitat beyond 13 km.

Four key sections form the Wildlife Hazard Management Plan framework:

1. The **Strategy** that addresses the overall commitment, legal framework, roles, and responsibilities to ensure that the plan is effectively implemented.
2. The **Wildlife Hazard Assessment** that provides information to effectively implement the tactical component of the plan.
3. The **Tactical Plan** that establishes the wildlife hazard context, the risk assessment, risk evaluation and risk mitigation. It also outlines how the risk is communicated, monitored and reviewed.
4. The **Safety and Quality Assurance** that outlines the process of managing change, continually improving the plan, and assessing achievement against the objectives.

The Wildlife Hazard Management Plan aims to reduce the frequency and severity of strikes by focusing management efforts on species and habitats that constitute significant hazards to aircraft operations. Objectives, targets, key performance indicators, and monitoring are used to evaluate plan implementation.

Authorisation

This Wildlife Hazard Management Plan has been prepared by Mackay Airport Pty Ltd (MAPL), a business unit of North Queensland Airports and airport-appointed qualified biologists (Avisure) to meet the applicable requirements of the Mackay Airport Aerodrome Operations Manual, the Safety Management System approach and the Civil Aviation Safety Regulations Part 139 (Aerodromes) Manual of Standards 2019, made under division 130.C.4 of the Civil Aviation Safety Regulations 1998.

It provides procedures to deal with danger to aircraft operations caused by the presence of wildlife (birds or animals) on or near the aerodrome. An objective when producing this plan has been to ensure that the documented procedures are an accurate reflection of both current and best practice. The organisation responsible for coordinating this plan is Mackay Airport Pty Ltd and is authorised by the Manager Aviation Operations.

Any external references made to regulations, standards, and documents should be read in conjunction with this document. MAPL will review this document regularly to ensure as far as possible that the information contained within is current, accurate and suitable for the intended purpose.



31/03/2022

Philip Clark
Manager Aviation Operations
Mackay Airport Pty Ltd

Date

Acknowledgement of Country

Mackay Airport is committed to honouring Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to the land, water and seas and their rich contribution to society.

The land on which Mackay airport operates, has significant cultural heritage value to the Yuwibara people of Mackay. It is important that these values are acknowledged, and that Aboriginal and Torres Strait Islander cultural heritage is recognised and preserved.

We acknowledge those of the past, the ancestors whose strength has nurtured this land and its people, and First Nations people of the present for their leadership and ongoing effort to protect and promote Aboriginal and Torres Strait Islander peoples and their cultures.

North Queensland Airports recognises it is our collective efforts, and responsibility as individuals and communities to ensure equality, recognition, and advancement of Aboriginal and Torres Strait Islander people across all aspects of society and everyday life.

Record of Review

Version	Year	Description of Change	Signed
1.0	Feb. 2005	Wildlife Hazard Management Plan	Philip Clark Manager Aviation Operations
1.1	Nov. 2011	Wildlife Hazard Management Plan	Philip Clark Manager Aviation Operations
1.2	Feb. 2012	Wildlife Hazard Management Plan	Philip Clark Manager Aviation Operations
1.3	Sep. 2012	Updates to: <ul style="list-style-type: none"> • Risk assessment • Species action plans 	Philip Clark Manager Aviation Operations
1.4	Sep. 2013	Updates to: <ul style="list-style-type: none"> • Culling and egg/nest removal • Risk assessments • Species actions plans 	Philip Clark Manager Aviation Operations
1.5	Jul. 2014	Updates to: <ul style="list-style-type: none"> • Risk assessment • Species management table • Species action plans 	Philip Clark Manager Aviation Operations
1.6	Jul. 2015	Updates to: <ul style="list-style-type: none"> • Risk assessment • Risk characterisation • Landscaping Policy • Species action plans 	Philip Clark Manager Aviation Operations
1.7	Jul. 2016	Updates to: <ul style="list-style-type: none"> • Risk assessment • Risk Characterisation • Species Action Plans • Wildlife Count Procedure 	Philip Clark Manager Aviation Operations
1.8	Jul. 2017	Updates to: <ul style="list-style-type: none"> • Risk assessment • Risk Characterisation • Species Action Plans 	Philip Clark Manager Aviation Operations
2.0	Jul. 2018	<ul style="list-style-type: none"> • WHMP re-issue • Full document re-write • Risk assessment • Risk characterisation 	Philip Clark Manager Aviation Operations

Version	Year	Description of Change	Signed
3.0 Draft	Jul. 2019	<ul style="list-style-type: none"> • WHMP re-issue • Full document re-write • Risk assessment • Risk characterisation • Updated SOPs • Updated SAPs 	Philip Clark Manager Aviation Operations
3.0 Final	Jan. 2020	<ul style="list-style-type: none"> • Minor amendments • Created separate document for SAPs • Created separate document for SOPs 	Philip Clark Manager Aviation Operations
4.0 Draft	Aug. 2020	Updates to: <ul style="list-style-type: none"> • Legislation • Annual Wildlife Hazard Assessment section including wildlife strike and survey trends, density maps and, risk assessment • Standard operating procedures • Species action plans 	Philip Clark Manager Aviation Operations
4.1 Final	May 2021	Updates to: <ul style="list-style-type: none"> • Legislation • Annual Wildlife Hazard Assessment section including wildlife strike and survey trends, density maps and, risk assessment • Standard operating procedures • Species action plans 	Philip Clark Manager Aviation Operations
5.0 Draft & Final	Mar. 2022	Updates to: <ul style="list-style-type: none"> • Section 5 Wildlife Strike Trends • Section 6 Wildlife Hazard Assessment • Standard operating procedures • Species action plans • Updated Distribution and Appendix C with contacts for Skytrans Airlines 	Philip Clark Manager Aviation Operations

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Distribution

Held By	Organisation
Soft Copy	
Mackay Air Traffic Control	Airservices Australia
Allan Maddison	Airservices Australia
Danny Eatock	Civil Aviation Safety Authority
Amy Burns	Oceania Aviation
Safety Department	Rex
Tunui Wano	Flyon
Craig Shepard	Mackay Regional Council
Jane Burns	Department of Environment and Science
Mel Power	Virgin Australia
Kellie Banditt	Swissport
Operations	Sharp Aviation
Hans Kunzi	Petroleum Helicopters International
Karina Tane	Thomas Borthwicks & Son
Keith Thompson	Aviator Group
Paul Coull	Qantas
QantasLink Safety	Qantas
Operations	PelAir
Racing Manager	Mackay Turf Club
JQ Operations	Jetstar
-	Alliance Airlines
Kartik Purohit	Skytrans Airlines
Brent Wise	Skytrans Airlines
Will Whitham	Skytrans Airlines
Barbara Munro	Proserpine Airport

Glossary

Active Management	The use of short-term management techniques such as distress calls, pyrotechnics, trapping and culling to disperse or remove birds.
Aerodrome/Airfield	Any location where aircraft take off, land and are stored and maintained. An airfield consists of at least one runway for an aircraft to take off and land, and may contain a helipad, buildings such as control towers, hangars and terminal buildings.
Aerodrome Operator	The aerodrome is operated by Mackay Airport Proprietary Limited.
Aerodrome Vicinity ¹	As a guide aerodrome vicinity for the purposes of wildlife hazard may be considered as being: <ul style="list-style-type: none"> (a) For sources of attractants and wildlife movements which presents a hazard – within a radius of 3 km from all the runways of an aerodrome; and (b) For significant sources of attractants or hazardous wildlife movements across the aerodrome site- within a radius of 8 km from the aerodrome reference point.
Aircraft	Any machine that can derive support in the atmosphere from reactions of the air rather than the reactions of air against the earth's surface.
Aircraft Operator	A person, organisation or enterprise engaged in, or offering to engage in, aircraft operations.
Airside	A defined area of land or water intended to be used either wholly or in part for the arrival, departure and movement of aircraft which is access controlled.
Air Traffic Control	Ground based aircraft control and information service.
Apron	A defined area on a land aerodrome intended to accommodate aircraft for the purpose of loading or unloading passengers or cargo, refuelling, parking or maintenance.

¹ According to Civil Aviation Safety Regulations Part 139 (Aerodromes) Manual of Standards 2019, Chapter 5, Division 2, Section 5.17

Certified Aerodrome ²	Aerodromes that have regular public transport or frequent charter operations with more than 30 passengers and have been certified by Civil Aviation Safety Authority in accordance with Civil Aviation Safety Regulations 139.050.
Consequence	The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.
Critical Area	Areas within or in proximity to the runway strip, approach and landing paths, and movement areas of an aerodrome.
Damaging Wildlife Strike	<p>A wildlife strike that results in damage in accordance with one of the below definitions:</p> <p>A substantial damaging wildlife strike occurs when there is damage or structural failure incurred by an aircraft by a wildlife strike that adversely affects the structural strength, performance or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component³.</p> <p>A serious damaging wildlife strike occurs when there is damage to a transport vehicle that affects the structural integrity, performance, or operational characteristics of that vehicle, and requires major repair or replacement of the affected component or components of that vehicle, or destruction of the transport vehicle⁴.</p>
Diurnal	Wildlife that are active during the daytime.
Firearm	A shotgun, rifle or other weapon as defined under State and Commonwealth Legislation.
Foraging	When animals search for and obtain food.
Hazard	A source of potential harm or a situation with potential to cause loss.
Incident	An occurrence, other than an emergency/disaster, associated with the operation of an aircraft that impacts on the safety of operations.
Log Book	Sequential recording system used to record daily events, including significant events and actions entered by the ASO.

² According to Civil Aviation Safety Regulations Part 139.

³ Advisory circular 139-26 (0) Wildlife Hazard management at Aerodromes.

⁴ Transport Safety Investigation Regulations 2003.

Manoeuvring Area	Airport areas used for taxiing, take-off and landing of aircraft, excluding the aprons.
Migratory	When animals pass periodically from one region to another.
Movement Area	Airport areas used for the movement of aircraft, including aprons and manoeuvring areas.
Nocturnal	Wildlife that are active during the night-time.
Notice to Airmen	A notice issued by the NOTAM Office containing information or instructions concerning the establishment, condition, or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.
Passive Management	The modification of habitat, including buildings and other manmade structures to render it less attractive to wildlife.
Probability	The likelihood of a specific event or outcome, measured by the ratio of specific events or outcomes to the total number of possible events or outcomes.
Risk	The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and probability.
Roost	When birds repeatedly return to a particular place in numbers to loaf or spend the night.
Runway	A defined area on an aerodrome prepared for the take-off and landing of aircraft.
Runway Strip	A defined area around a runway, marked by gable markers, that is considered part of the runway.
Significant Strike	A significant strike is when there is damage or an adverse effect on flight. This includes aborted or non-standard procedure, precautionary or forced landing, delay/cancellation, diversion, accident or affects the serviceability of the aerodrome.
Taxiway	A defined path on an aerodrome established for the movement of aircraft between one part of the aerodrome and another including: <ul style="list-style-type: none"> Aircraft stand taxi lane: A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

- Apron taxiway: A portion of the apron designated as a taxiway and intended to provide access to aircraft parking positions.

Transit

When birds fly from one place to another.

Wildlife

Wildlife refers to animals that may pose hazards to aircraft when struck. This includes birds, bats and terrestrial mammals such as rabbits, hares, foxes, dogs etc.

Wildlife Count

Standardised and regular counts of birds and other animals. Usually completed by Airport Operations Coordinator.

Wildlife Strike

A collision between wildlife, including a bird⁴ and a moving aircraft³. Wildlife strikes are categorised as either a confirmed, suspected, or near miss strike, with various strike designations (refer to Wildlife Strike Designation).

A **suspected wildlife strike** is an event where a wildlife strike has been suspected by aircrew or ground personnel but upon inspection:

no carcass from the wildlife is found; and there is no physical evidence on the aircraft of the strike having occurred.

A confirmed wildlife strike is an event where:

- Physical evidence of a wildlife strike is found on the runway or runway strip used by the aircraft involved (unless another reason for the death of the wildlife can be found);
- Physical evidence of the strike is found on the aircraft involved following an inspection; and
- In any other instance where it can be reasonably proved from evidence that wildlife was struck as a direct result of a moving aircraft. For example, when aircrew report they definitely saw, heard or smelt a wildlife strike.
- Aircrew report that they definitely saw, heard, or smelt a bird strike.

A **wildlife near miss** is deemed to have occurred whenever a pilot takes evasive action to avoid birds or animals^{5,6}.

⁵ Australian Airports Association 2015, *Managing Bird Strike Risk – Species Information Sheets*, Airport Practice Note 6, New South Wales, September 2015.

⁶ Australian Airports Association 2016, *Wildlife Hazard Management at Airports*, Airport Practice Note 9, New South Wales, March 2016.

Wildlife Strike Designation

Wildlife strikes are designated as either occurring on-airport, in the vicinity of an aerodrome, or remote from aerodrome.

An **on-airport wildlife strike** is any strike that occurs within the boundary fence of the aerodrome, or where this is uncertain, where it occurred below 500 ft. on departure and 200 ft. on arrival^{6,7}.

A **wildlife strike in the vicinity of an aerodrome** occurs whenever a bird strike occurs outside the area defined as 'on aerodrome' but within an area of 15 kilometres radius from the aerodrome reference point (ARP) or up to 1,000 feet above the elevation of the aerodrome^{6,7}.

A **wildlife strike remote from the aerodrome** occurs whenever a bird strike occurs more than 15 kilometres from an aerodrome or more than 1,000 feet above the elevation of the aerodrome^{6,7}.

Wildlife Survey

Standardised surveys that capture data regarding wildlife species, their behaviours and their distribution. Completed by suitably trained and qualified wildlife ornithologists or biologists.

⁷ International Civil Aviation Organization 1989, Manual on the ICAO Bird Strike Information System (IBIS), Third Edition.

Abbreviations

AC	Advisory Circular
ACFT	Aircraft
ADA	Authority to Drive Airside
AFRU	Aerodrome Frequency Response Unit
AGL	Above Ground Level
AIP	Aeronautical Information Package
AMSL	Above Mean Sea Level
AOM	Aerodrome Operations Manual
ARFFS	Aircraft Rescue and Firefighting Service
ARP	Aeronautical Reference Point
ASIC	Aviation Security Identification Card
ASMS	Aerodrome Safety Management System
ASO	Aerodrome Safety Officer
ASRI	Aerodrome Survey Risk Index
AS/NZS	Australian Standard/New Zealand Standard
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATL	Aviation Team Leader
ATSB	Australian Transport Safety Bureau
AUA	Authority to Use Airside
BAP	Business Analyst Programmer
CAMBA	China-Australia Migratory Bird Agreement
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
CEO	Chief Executive Officer

CTAF	Common Traffic Advisory Frequency
DES	Department of Environment and Science
DME	Distance Measuring Equipment
DMP	Damage Mitigation Permit
DNA	Deoxyribonucleic Acid
EPBC	Environment Protection & Biodiversity Conservation Act
ERSA	En Route Supplement Australia
FR	Following Rainfall
GA	General Aviation
GIS	Geographic Information System
GMMA	General Manager Mackay Airport
ICAO	International Civil Aviation Organisation
JAMBA	Japan-Australia Migratory Bird Agreement
KPI	Key Performance Indicator
MAO	Manager Aviation Operations
MAPL	Mackay Airport Pty Ltd
MOS	Manual of Standards
MOU	Memorandum of Understanding
NASF	National Airport Safeguarding Framework
NDB	Non-Directional Beacon
NOTAM	Notice to Airmen
PAPI	Precision Approach Path Indicator
PPE	Personal Protective Equipment
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
RPT	Regular Public Transport
RWY	Runway
SAP	Species Action Plan

SOP	Standard Operating Procedure
SRI	Survey Risk Index
SWP	Standard Work Procedure
TL	Aviation Team Leader
TWY	Taxiway
UNICOM	Universal Integrated Communications
US	United States
UTC	Coordinated Universal Time
VHF	Very High Frequency
VOR	VHF Omnidirectional Range
WHA	Wildlife Hazard Assessment
WHMC	Wildlife Hazard Management Committee
WHMP	Wildlife Hazard Management Plan
WHN	Wildlife Hazard Notification
YBMK	Mackay Airport ICAO Code

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1. Introduction

Mackay Airport (YBMK)⁸ is a Certified Aerodrome owned and operated by Mackay Airport Pty Ltd (MAPL), a business unit of North Queensland Airports (NQA). MAPL is responsible for the safe and secure operation, maintenance, commercial development, and strategic planning functions of YBMK.

This Wildlife Hazard Management Plan (WHMP) has been written to meet the requirements of the Mackay Airport Aerodrome Operations Manual, the Safety Management System approach and the Civil Aviation Safety Regulations (CASR) Part 139 (Aerodromes) Manual of Standards (MOS) 2019⁹, made under division 130.C.4 of the Civil Aviation Safety Regulations 1998.

1.1. The Wildlife Strike Issue

The consequence of wildlife strikes with aircraft can be very serious. Worldwide, in civil and military aviation, fatal wildlife strike incidents, have resulted in more than 581 human fatalities and 657 aircraft losses since the beginning of aviation (Shaw and Dolbeer, 2022). Wildlife strikes cost the commercial civil aviation industry an estimated US\$1.2 billion per annum (Allan, 2002) and involve more than just the repair of damaged engines and airframes. Even apparently minor strikes which result in no damage can reduce engine performance, cause concern among aircrew and add to airline operating costs.

Strike risk depends on the probability of colliding with wildlife and the consequence to the aircraft if collision occurs. The probability of a wildlife strike occurring increases as the number of wildlife and aircraft operating in the same airspace increases (Dolbeer, 2006). Strike probability also increases with airspeed. In practice, this means that the likelihood of colliding with a bird in flight increase when operating at high speed below 5000' above ground level (AGL), which is where the majority of birds operate (CAA, 2020). Wildlife density, and therefore strike probability, increases with decreasing height above ground. Operating at low altitudes over, or near, known wildlife hazards will significantly increase strike probability.

The main factors determining the consequences of a strike are the number and size of animals struck, the combined closing speed at which the strike occurred, the phase of flight when struck and the part of the aircraft hit. Generally, the larger the animal, the greater the damage. Large animals can destroy engines and windshields and cause significant damage to airframe components and leading edges (CAA, 2020). Strikes involving more than one animal (i.e., a multiple strike) can be serious, even with relatively small wildlife, potentially disabling engines and/or resulting in major accidents. While total mass struck and impact site on the aircraft are important strike consequence considerations, final impact speed is the most significant determinant as impact force varies exponentially with the square of closing speed (CAA, 2020).

⁸ International Civil Aviation Organization (ICAO) airport reference code.

⁹ Herein referred to as Part 139 MOS 2019.

In civil aviation around 93% of strikes occur at below 3500ft AGL (Dolbeer, 2011). Consequently, management focusses almost solely on terminal airspace and management responsibility has typically resided with aerodrome operators. In addition to terminal airspace management, aircrew and air traffic controllers should be engaged in strike risk assessment and mitigation processes, and that high-risk operations consider predicted or observed wildlife movement patterns. It is also important that external stakeholders, including wildlife authorities and local landholders, are engaged to monitor and communicate local wildlife movement activity, and that both on- and off-aerodrome hazards are critically assessed.

1.2. Strategy

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(e) set out the aerodrome operator's strategy for wildlife hazard reduction.

The WHMP forms part of an overall strategic program to reduce the wildlife hazard reduction (Figure 1).

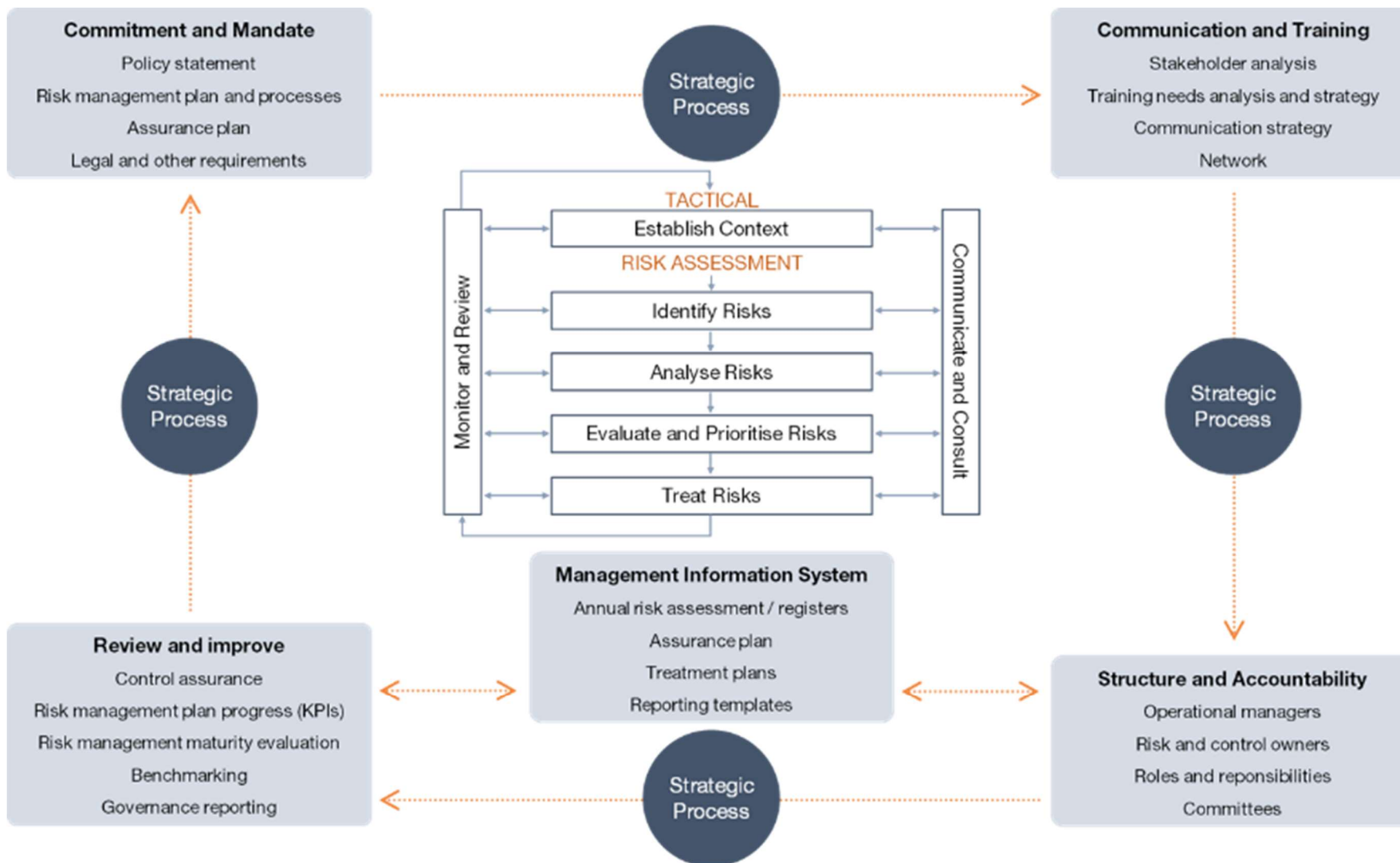


Figure 1. MAPL strategic approach to wildlife hazard management.

1.3. Function

The WHMP’s function is to outline the management methods employed by MAPL to manage the dynamic risk that wildlife poses to air traffic at YBMK; using the Deming Wheel of plan-do-check-act whilst assuring compliance to relevant legislation (Figure 2).

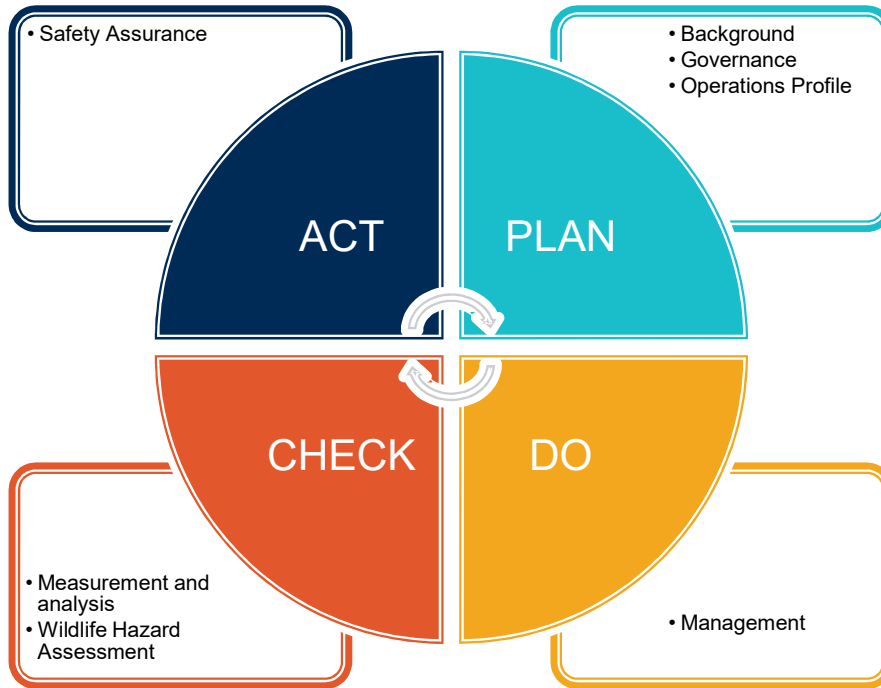


Figure 2. WHMP structure

1.4. Aims

The MAPL Wildlife Management Program and this WHMP aim to reduce the frequency and severity of strikes by focusing management efforts on species and habitats that constitute significant hazards to aircraft operations at YBMK.

1.5. Objectives

Table 1. Mackay Airport WHMP objectives.

Area	Objectives
Legislation and Regulation	To develop, implement and maintain procedures and systems to ensure operations comply with applicable legislation, regulations, standards and industry best practice.
Assurance	To review the WHMP: <ul style="list-style-type: none"> • annually and reassess the risk • following serious incidents

Area	Objectives
Assurance	<ul style="list-style-type: none"> • in response to operational or legislative changes. <p>To develop performance goals and targets.</p> <p>To conduct regular internal and external audits.</p> <p>To clearly define accountabilities and responsibilities for all YBMK personnel, contractors and stakeholders.</p>
Culture	<p>To ensure the actions under this Plan does not have any adverse effect on indigenous and heritage values at Mackay Airport.</p> <p>To develop, embed and continually encourage:</p> <ul style="list-style-type: none"> • A positive culture where wildlife management is a priority and the WHMP is recognised and valued. • Encourage a reporting culture supported by YBMK senior management.
Risk Management	<p>To understand and minimise the risk of wildlife strike through a continuous process of identifying, recording and reviewing risks, objectives, targets and indicators.</p> <p>To reduce:</p> <ul style="list-style-type: none"> • The costs of unscheduled maintenance associated with wildlife strike. • Wildlife mortality. <p>To preserve life and aviation capability through reducing the risk of wildlife strike.</p>
Communication	<p>To develop, implement and maintain effective mechanisms that encourage open communication, delivery of key messages and awareness of responsibilities under the WHMP to all YBMK personnel, business partners and contractors.</p>
Training	<p>To ensure</p> <ul style="list-style-type: none"> • The availability of skilled and trained resources to develop, implement, maintain and improve the WHMP. • All personnel are trained and competent in their respective wildlife hazard management responsibilities. <p>To have no firearm incidents.</p>
Infrastructure and Facilities	<p>To develop, implement and maintain a maintenance system that ensures new and existing infrastructure and facilities are kept clean, safe and operational to reduce the wildlife attraction.</p>
Participation and Action	<p>Define roles, responsibilities and procedures for managing wildlife risk.</p>

Area	Objectives
	<p>To actively encourage YBMK staff, aircraft operators, airlines and aircraft operators, visitors, business partners and contractors to help implement the WHMP.</p> <p>To encourage activities that promote and establish positive wildlife management on airport land.</p>

2. Governance

This section outlines the legal framework, document governance and the roles and responsibilities of the personnel responsible for the implementation of this WHMP.

2.1. Legal and other requirements

Managing wildlife strike risk on and around airports is guided by a suite of national and international legislative and regulatory requirements. This WHMP complies with the following requirements and recommendations:

- CASR Part 139 (Aerodromes) MOS
 - Section 5.17 (b) – Aerodrome Information for the Aeronautical Information Publication (AIP) and the Aerodrome Manual
 - Section 6.22 (3) – Surface of graded area of runway strips
 - Section 10.02 (3) and (4) – Form, contents and updating the Aerodrome Manual.
 - Section 11.08 (1), (2) and Section 11.11 – Information that must be included in the Aerodrome Manual.
 - Section 12.03 (7), (9) and 12.04 (1) – Serviceability Inspections
 - Chapter 17 – Wildlife Hazard Management
- CASA Advisory Circulars (AC)¹⁰
 - AC 139-26(0) Wildlife Hazard Management at Aerodromes
 - AC 139.C-01 v1.0 Aerodrome Manual
 - AC 139.C-02 v1.0 Aerodrome Personnel
 - AC 139.C-0. V1.0 Serviceability Inspections
 - AC 139.C-27 v1.0 Risk Management Plans for Aerodromes
- *Air Navigation Act 1920* Section 19A & B
- *Transport Safety Investigation Act 2003*.
- ICAO Annex 14, Volume 1 (Aerodrome Design and Operation)
- ICAO Annex 14, Volume 2 (Aerodromes - Heliports)
- ICAO Airport Services Manual Doc. 9184: Part 2 Land Use and Environmental Control

¹⁰ Correct as of 17 November 2020 – noting CASA is currently updating ACs.

- ICAO Airport Services Manual Doc. 9137: Airport Services Manual Part 3, Wildlife Control and Reduction

Wildlife hazard management requires a complex legal framework that addresses:

- Aerodrome safety and compliance
- Firearms safety and compliance
- Ethics

A detailed list of legislation is included in Appendix A.

2.1.1. Permits

Mackay Airport are exempt from requiring a Damage Mitigation Permit to lawfully take or relocate wildlife under the Nature Conservation (Animals) Regulation 2020, because pre-conditions have been met (Table 2).

Table 2. Exemption pre-conditions under the Nature Conservation (Animals) Regulations 2020.

Legislation	Requirement	Conformance
Nature Conservation (Animals) Regulation 2020	Pre-conditions must be satisfied for a strategic airport to be able to rely on the authorisation to lawfully take wildlife without a Damage Mitigation Permit:	
	Part 6 Division 1 The standing authorisation applies to strategic airports identified in the Queensland State Planning Policy.	Table 2, Part E Transport Infrastructure of the State Planning Policy lists YBMK as a Strategic Airport.
	Part 6 Division 2 (1) (a) The animal is causing, or may cause, damage at an airport and/or its presence at an airport is, or may be, a threat to a person's health and wellbeing.	The Wildlife Culling Standard Operating Procedure details that lethal control is an effective last resort option in circumstances where there is an imminent safety hazard and to reinforce non-lethal dispersal tools. Wildlife count data is reviewed and assessed monthly and dispersal data is reviewed and analysed quarterly for their risk to aircraft operations.
	Part 6 Division 2 (1) (b) The airport owner has made a reasonable attempt to prevent or minimise the threat (e.g. by installing a fence or an audio/visual deterrence device). That action has failed.	Airport Safety Officers record all non-lethal dispersal attempts which are entered into TrackerAIRSIDE™ ¹¹ . Non-lethal tools used include pyrotechnics, sirens, vehicle, and spotlights. The airport also employs passive management techniques to deter wildlife from the aerodrome.
	Part 6 Division 2 (2) (a) The taking will not adversely affect the survival of the animal in the wild.	The Wildlife Culling Procedure and Identifying and Handling Wildlife Remains details the appropriate considerations for humane culling, and safe relocation and handling of animals.
	The proposed way of taking the animal is humane.	The taking of endangered species is avoided at all costs unless absolutely necessary. Airport Safety Officers are trained in species identification to avoid listed species, and professional aviation biologists are contracted to identify

¹¹ TrackerAIRSIDE™ is an online aviation compliance and risk management software YBMK use for reporting and document storage.

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Legislation	Requirement	Conformance
Nature Conservation (Animals) Regulation 2020	Part 6 Division 3 The owner of an airport must keep a record of an animal taken, removed or relocated, under this authorisation.	remains to ensure appropriate lethal taking is occurring. Species Action Plans include conservations status to assist in identification. Wildlife culling data are recorded and maintained via TrackerAIRSIDE™. Professional aviation biologists and the Manager Aviation Operations review and assess the data quarterly as part of wildlife summary reports.

YBMK personnel require the following authorisations to operate in the airside area, including:

- Aeronautical Radio Operator Certificate (AROC)
- Authority to Drive Airside (ADA)
- Airside Vehicle Permit
- Aviation Security Identification Card (ASIC)
- Firearms licence.

All YBMK firearms are licenced under *Weapons Act 1990*. YBMK complies with the requirements regarding the use, maintenance, storage, and transportation of firearms.

2.2. Documentation Governance

The WHMP is a subsidiary document of the Aerodrome Safety Management System (ASMS) and the Aerodrome Operations Manual (AOM). Standard Operating Procedures (SOPs) and Standard Work Procedure (SWP) support WHMP implementation. These procedures are available through SharePoint. Procedures include:

- Wildlife Patrols and Inspections SOP
- Wildlife Strike Reporting SOP
- Wildlife Culling including Egg and Nest Removal SOP
- Wildlife Dispersal SOP
- Identification and Handling of Wildlife Remains SOP
- Bird Counts SOP
- Daily Aerodrome Inspections SOP
- WHMP review SOP
- Wildlife Hazard Management Training and Competency Assessment
- Firearm Use SWP
- DNA Sampling SWP
- Wildlife Hazard Management Committee SOP
- Monthly Wildlife Surveys SOP
- Wildlife Hazard Communication SOP
- Data Review SOP
- Gas Cannon Operation SWP
- Habitat and Land Management SOP

2.3. Preparation

Part 139 MOS 2019 Section: 17.04

(1) A wildlife hazard management plan must be prepared in consultation with a suitably qualified or experienced person, for example:

- an ornithologist, zoologist, biologist, ecologist; or
- a person with demonstrated expertise in the management of wildlife hazards to aviation.

Airport-appointed qualified biologists (Avisure) prepared this WHMP. Refer Appendix B (Table B2) for experience and qualifications.

2.4. Roles and Responsibilities

Part 139 MOS 2019 Section: 11.08

(2) The aerodrome manual must identify the individuals or positions responsible for monitoring and mitigating wildlife hazards to aircraft operating at the aerodrome.

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

- (a) identify the key aerodrome or contracted personnel and define their responsibilities or functions in the plan
- (f) include records of the qualifications and experience of key personnel identified in the plan.

The Chief Executive Officer (CEO) is the person responsible for overall WHMP implementation. On an operational level, the Manager Aviation Operations (MAO), Aviation Team Leader (ATL), and the Aerodrome Safety Officers (ASO) implement the WHMP.

Managing the wildlife strike risk requires a cooperative effort amongst various stakeholders. Refer Appendix B for details on stakeholder roles and responsibilities.

All records of the qualifications and experience of key personnel identified in the plan are stored by Mackay Regional Council and are summarised in Appendix B.

2.5. Stakeholder Engagement

Part 139 MOS 2019 Section: 11.08

(1) The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following:

(e) for proposed or actual sources of wildlife attraction outside the aerodrome boundary — liaising with the relevant planning authorities or proponents to facilitate wildlife hazard mitigation.

MOS Part 139 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(d) specify the liaison arrangements for local planning authorities within a radius of at least 13 km from the aerodrome reference point;

Input from on- and off-aerodrome stakeholders help YBMK achieve an effective and integrated approach to wildlife hazard management. This is realised through the Wildlife Hazard Management Committee (WHMC). The WHMC is an important avenue for sharing information, identifying risks and ensuring stakeholders are engaged in collaborative management of these risks. Roles and responsibilities are outlined in Appendix B. The WHMC membership is listed in Appendix C.

2.6. Communication

Stakeholder understanding of hazards encourages appropriate mitigation. For instance, communicating wildlife hazards to aircrew can inform decision-making to avoid a strike. Communicating wildlife hazards to aerodrome operators increases awareness, contributing to improved wildlife management practices and a safer environment for aircraft operations.

YBMK communicates relevant information of the wildlife hazard management program as follows:

- Twice-yearly Wildlife Hazard Management Committee meetings
- Annual WHMP update
- Quarterly program report
- Monthly wildlife info-cards
- Real time communication of hazards to Air Traffic Control (ATC) and pilots
- Notice to Airmen (NOTAM) (as required)
- Automatic Terminal Information Service (ATIS) (as required)
- En-route Supplement Australia (ERSA) (as required).

2.7. Training

Part 139 MOS 2019 Section: 17.07 Training

(1) Wildlife hazard monitoring and reporting personnel must be trained to competently do the following:

- (a) conduct wildlife observations and identify high-risk species;
- (b) assess wildlife populations and describe their behaviour;
- (c) record information;
- (d) collect any remains of a wildlife strike on the aerodrome;
- (e) attempt to facilitate the identification of:
 - (i) any wildlife involved in a strike event; and
 - (ii) any resulting damage to an aircraft;
- (f) report the outcomes of observation, monitoring and strike collection activities.

Note: To perform their roles properly, CASA recommends that monitoring personnel have access to wildlife identification materials and equipment such as a field guides, identification books, scopes or binoculars, active management tools, carcass handling tools, identification kits and relevant PPE.

(2) Personnel engaged in wildlife hazard mitigation must be trained to competently:

- (a) engage in active wildlife management without causing a hazard to aviation safety; and
- (b) assess the effectiveness of any mitigation measures that are taken.

(3) The aerodrome operator must create training records for its monitoring and reporting personnel to show compliance with subsections (1) and (2). Each record must be kept in safe custody for a period of at least 3 years after the record was created.

Personnel charged with wildlife management responsibilities are trained in identifying, recording, and managing wildlife hazards, assessing, and communicating risks, as well as strike reporting, carcass handling, bird identification and behaviour and regulatory requirements.

YBMK maintains training records and provides additional training as required. The ATL is responsible for monitoring and retaining the records for three years.

YBMK delivers training and awareness programs at various levels to achieve the training objectives (Table 3).

Table 3. Training programs completed by YBMK staff.

Training Module	Position(s)	Frequency	Training Delivery
Aerodrome Reporting Officer course	All ASOs and nominated relief staff.	Every 24 months	External training course offered by accredited provider/or in-house training.
Firearm Safety Course	All licensed staff.	Every five years	External training course offered by accredited provider.
Firearm Refresher Training	All ASOs and nominated relief staff.	Every 24 months	External training course offered by accredited provider or in-house training by qualified staff.
Wildlife Hazard Management Training	All ASOs and nominated relief staff.	Every 24 months	External training course offered by suitably qualified provider.
YBMK Bird Identification	All ASOs and nominated relief staff.	Part of induction or as required	Internal training course. Field Manual available to staff for species identification.
Wildlife Hazard Management Plan	Available to staff and stakeholders involved in the management of bird and wildlife hazards at YBMK.	Annually or as required	ASO briefing during team meetings.
Wildlife Species Action Plans	All ASOs and nominated relief staff.	Reviewed as required	Field Manual available to staff for species identification.
Wildlife Info-cards	All ASOs and nominated relief staff.	Monthly	ASO briefing during team meetings.
Wildlife Hazard Management Committee	Stakeholders and YBMK staff.	Meets biannually	Advisory committee.

3. Operations Profile

YBMK is a major regional airport and gateway to the Whitsunday Coast. It supports passenger traffic (tourists, business, and resource industry) as well as cargo. There are regular flights to and from Brisbane, Rockhampton, Townsville, Cairns, and Hamilton Island. Airservices Australia provide ATC and Aviation Rescue Fire Fighting Service (ARFFS) services. Further information is available in the YBMK Aerodrome Operations Manual and the En-Route Supplement Australia.

3.1. Facilities and Operation

Table 4 summaries the YBMK site profile and operational characteristics.

Table 4. YBMK site profile and operational characteristics.

Aerodrome	Description		
Location	Mackay, Queensland, S 2110.3 E 14910.8		
Aerodrome type	Certified, Regular Public Traffic (RPT) Helicopter and General Aviation (GA)		
Aerodrome operator	Mackay Airport Pty Ltd		
Airlines and aircraft types	Operator	Aircraft Type	Maximum Passenger Numbers
	Jetstar	A320	180-186
	QantasLink	DH4	74
	Virgin Australia	B737-800	176
	Qantas	B737-800	176
Resident operators	Jetstar Airways Pel-air Qantas & QantasLink Alliance Airlines Virgin Australia		
2020/21 aircraft movements ¹²	25,130 RPT and GA		
Runways (RWY)	14/32		
Taxiways (TWY)	Sealed TWY A to L		
Helipads	Adjacent TWY C		
Aprons	RPT Apron, Eastern GA Apron and Western GA Apron		

¹² Source: Airservices Australia 2021, <https://www.airservicesaustralia.com/aviation-reporting/movements-at-australian-airports/>.

Aerodrome	Description
Navigation and landing aids	VHF Omnidirectional Radar (VOR), Distance Measuring Equipment (DME), Non-directional Beacon (NDB), Precision Approach Path Indicator (PAPI)
Air Traffic Control	Monday – Friday: 2020-1020, Saturday – Sunday: 2020-0930 UTC Rescue and Firefighting Service on-site with hours of operation defined in NOTAM.
Communication	Common Traffic Advisory Frequency (CTAF) 124.5MHz. Aerodrome Frequency Response Unit (AFRU).

4. Environmental and Ecological Profile

Part 139 MOS 2019 Section: 5.17 Local hazards that may adversely affect aviation safety (local hazard data) must be recorded, including the following:

(b) continual wildlife hazards at the aerodrome or in its vicinity, including descriptions, locations, and times or seasonal information;

Part 139 MOS 2019 Section: 17.04

(2) The Wildlife hazard management plan must at least:

(b) identify sources and locations of wildlife attraction:

(i) on the aerodrome;

which are likely to cause wildlife to transit the take-off, approach and transitional surfaces;

Wildlife activity is high at all times on and around YBMK, with on-airport attractants comprising of grasslands, drains, built structures and other features.

Mackay has a tropical climate with hot wet summers and dry sunny winters. YBMK is bordered by coastal mangroves and beaches to the east, sugarcane and agriculture to the south and urban development and industry to the west and north.

Table 5 and 6 outlines YBMK's environmental and ecological characteristics and Table 7 presents species breeding activity. Understanding how environmental conditions influence wildlife activity enables YBMK to manage predicted wildlife hazards.

Table 5. YBMK environmental characteristics.

Environment	Description
Elevation	19ft above mean sea level (AMSL).
Area	169 ha
Geography	Sub-tropical and humid environment, subjected to inundation based on Riverine wetland flooding.
Vegetation complex	Included in the Central Mackay Coast bioregion under the Biogeographic Regionalisation of Australia (IBRA 7) (Department of Agriculture, Water and the Environment 2022). This area consists of estuarine mangroves, salt flats, saltmarshes and other coastal habitat.
Aboriginal traditional lands	The airport sits on the traditional lands of the Yuwi people.
Surrounding land uses	Residential, industrial, agricultural, parklands, estuarine mangroves and coastal habitat.

Environment	Description
Habitat	<p>Grasslands that provide habitat for birds to forage for seeds and insects or hunt for prey.</p> <p>Adjacent areas include mangroves, salt marshes, estuaries, sugarcane, agriculture, and urban development.</p> <p>Siratro and Gomphrena weed on the western side of the airfield.</p>
Habitat modification	<p>Grass mowing:</p> <ul style="list-style-type: none"> • Runway strip: 200mm • Non-critical areas: 300mm
Artificial modification	<p>Drains, fences, buildings, and other infrastructure such as gable markers provide perches and nesting sites.</p>

Table 6. YBMK climate calendar¹³.

	2020						2021					
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mean Rainfall mm (1959-2021 average)	37.6 (39.7)	29.6 (30.6)	13.8 (19.3)	18.8 (33.9)	48.4 (92.1)	226.2 (186.9)	347.6 (276.6)	95.0 (312.5)	158.2 (282.1)	175.6 (146.8)	105.2 (102.5)	32.0 (60.8)
Mean Temperature High °C (1959-2021 average)	21.7 (21.4)	23.7 (22.7)	26.0 (25.4)	29.1 (27.8)	30.5 (29.3)	31.9 (30.3)	29.6 (30.2)	30.7 (29.7)	30.0 (28.7)	26.9 (26.8)	24.5 (24.2)	22.9 (22.0)
Mean Temperature Low °C (1959-2021 average)	13.2 (13.1)	14.8 (14.1)	18.8 (16.8)	20.5 (19.7)	22.5 (21.8)	23.9 (23.1)	23.5 (23.6)	24.0 (23.5)	23.1 (22.4)	20.8 (20.3)	17.2 (17.2)	15.7 (14.2)
9am Mean Wind Speed km/hr ¹⁴ (1991-2020 average)	17.0 (14.3)	16.4 (15.1)	16.3 (16.7)	17.6 (20.2)	17.9 (20.4)	17.6 (19.0)	19.4 (20.2)	20.6 (18.2)	16.5 (20.4)	17.3 (18.2)	17.9 (16.3)	13.7 (15.4)

Table 7. YBMK hazardous wildlife breeding characteristics calendar¹⁵.

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Peak Wildlife Risk¹⁶ and Breeding Season												
Magpie Goose	-	-	-	-	-	-	-	B	B	B	B	B
Plumed Whistling-Duck	-	-	-	-	-	-	-	B	B	B	B	-
Australian White Ibis	B ¹⁷	B	B	B	B	B	B	-	-	-	-	-
Straw-necked Ibis	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	B	B	B	B	FR/AR
Feral Pigeon	B	B	B	B	B	B	B	B	-	-	-	-
Cattle Egret	-	-	-	B	B	B	B	B	B	-	-	-

¹³ Bureau of Meteorology 2022, 'Climate statistics for Australian locations', [ONLINE]. Accessed 02/02/2022. Available at http://www.bom.gov.au/climate/averages/tables/cw_033045.shtml.

¹⁴ Bureau of Meteorology 2022, 'Climate statistics for Australian locations', [ONLINE]. Accessed 02/02/2022. Available at <http://www.bom.gov.au/climate/dwo/IDCJDW4077.latest.shtml>

¹⁵ Developed using information from Birds in Backyard (2022) and Avisure (2022).

¹⁶ Calculated from ASO Survey Data

¹⁷ B = Breeding Season

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Australian Pelican	FR ¹⁸	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR
Masked Lapwing	B	B	B	B	B	B	B	B	B	B	B	B
Galah	B	-	-	-	-	-	-	B	B	B	B	B
Torresian Crow	-	-	-	-	B	B	B	B	-	-	-	-
Black Kite	-	B	B	B	B	-	-	-	-	-	-	-
Rainbow Lorikeet	B	B	B	B	B	B	B	-	-	-	-	B
Pacific Black Duck	FR/AR ¹⁹	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR	FR/AR
Airside Grass and Ground Covers Species												
<i>Gomphrena celosioides</i>	f	f	f	f	F	F	F	F	F	F	f	f
Local Flora may increase regional wildlife risk												
Sugarcane Crush Season	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Melaleuca quinquenervia</i>	f	f	f	f	f	f	F	F	F	F	F	f
<i>Eucalyptus robusta</i>	f	f	f	f	f	f	F	F	F	F	F	f
<i>Acacia leiocalyx</i>	f	f	f	f	f	f	F	F	F	F	F	f
Insect Activity												
Mosquito	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR
Bird Migratory Season												
Waders present	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes

¹⁸ FR = Following Rainfall

¹⁹ AR = Abundant Resources

F = Flowering

f = unseasonal flowering

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5. Wildlife Strikes Trends

Part 139 MOS 2019 Section: 17.01 (3) The aerodrome operator must attempt to monitor any reported wildlife aircraft strike events at, or in the vicinity of, the aerodrome.

This section presents an analysis of strike data for July 2020 to June 2021. YBMK and Australian Transport Safety Bureau (ATSB) provided strike data and Airservices Australia provided aircraft movement data.

The confirmed on-airport and vicinity strike rate is 7.96 strikes per 10,000 aircraft movements, and an Adverse Effect to Planned Flight (AEPF) strike rate of 31.83 strikes per 100,000 aircraft movements; ranking YBMK above the international benchmark²⁰. These rates are higher compared to the previous financial year (2019/20).

Mass (kg) struck per 10,000 aircraft movements have increased (2.55 kg/10,000 movements) but have trended downwards since 2016/17. Nocturnal strikes with Bush Stone-curlew accounted for 40% of the total mass (kg) struck in 2021.

5.1. Strike Profile

YBMK reported 20 confirmed on-airport and airport vicinity strikes in 2020/21 (Figure 3). Aircraft movements declined during the COVID-19 pandemic but have increased since March 2021, which could account for the increase in confirmed strikes this year (Figure 3). Confirmed on-airport and airport vicinity strikes have been relatively consistent since 2015/16 (Figure 3).

Near Miss strikes have trended upwards since 2015/16 (Figure 3), peaking between March and May 2021. Virgin Australian and Qantas pilots either held on the runway or cancelled take-off clearance to allow the ARO to perform wildlife dispersal. Each incident resulted in a 2-minute or less flight delay and avoided a possible wildlife strike (Table 8). This increased the AEPF strike rate.

²⁰ The international benchmark for adverse effect strikes is 1.07 per 100,000 movements (Dolbeer and Begier 2012).

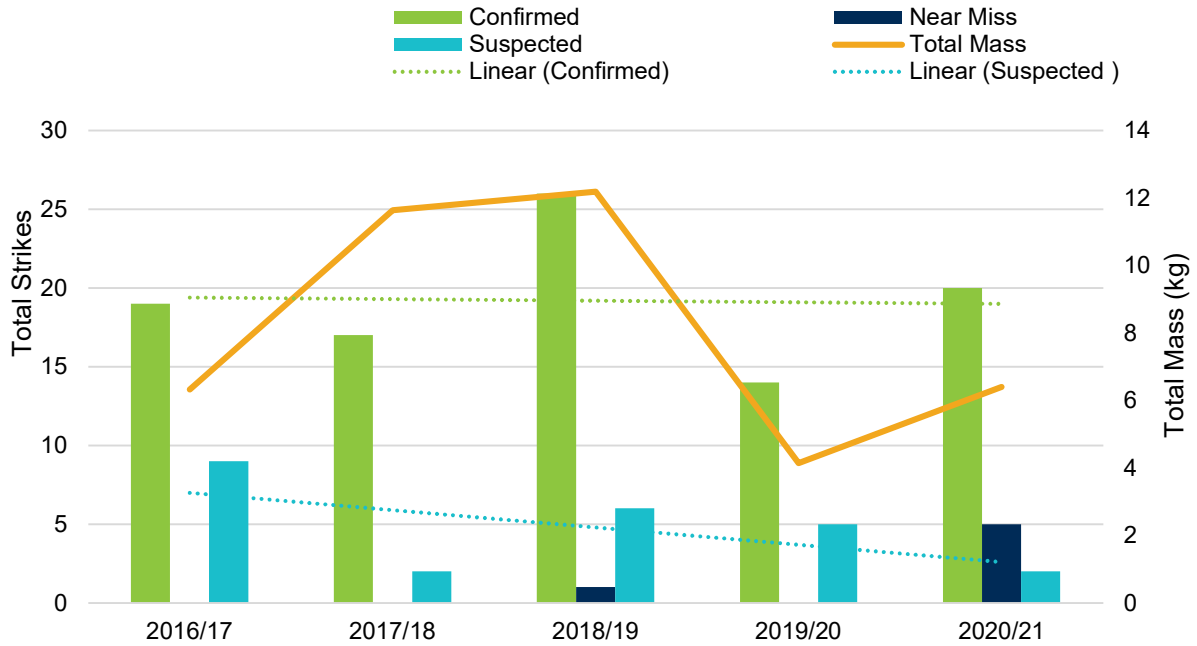


Figure 3. On-airport and vicinity wildlife strikes vs mass struck by year and strike type, YBMK, 2016/17 – 2020/21.

Confirmed on-airport and airport vicinity strikes peaked between March and June 2021, coinciding with the region’s wet season (TravelOnline 2022) and subsequent increasing foraging opportunities (Figure 4).

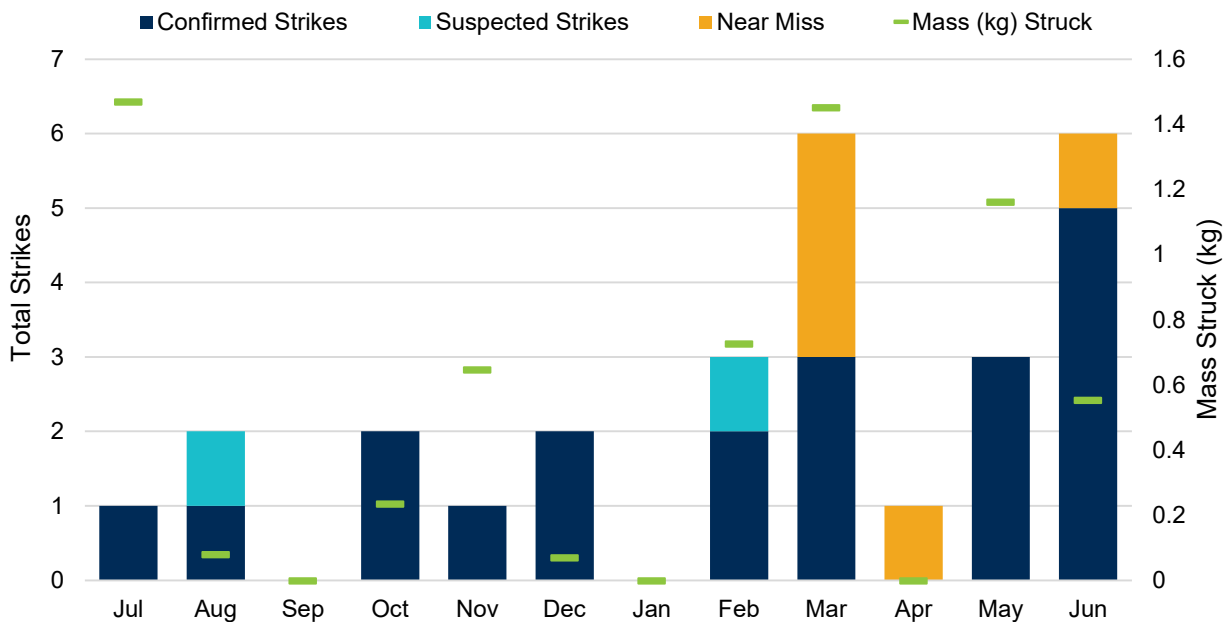


Figure 4. Confirmed and suspected on-airport and vicinity strikes vs mass (kg) struck by month, YBMK, 2020/21.

Bush-stone Curlew (**high risk**) was the most struck species for 2020/21, accounting for 20% of confirmed on-airport and airport vicinity strikes (Figure 5) and 40% of the mass struck, peaking between February and March 2021.

Australasian Pipit (**low risk**) were the second most common species struck (Figure 5), peaking in December following airside grass mowing works.

Masked Lapwing (**moderate risk**) strikes (3) were above the five-year average (1.2) (2015/16-2019/20) coinciding with increased activity, particularly at night, recorded during on-airport surveys. Masked Lapwing breeding pairs and chicks were recorded by the fire training area and helipad. Adults will return to successful breeding sites, increasing airside populations and increasing the strike risk.

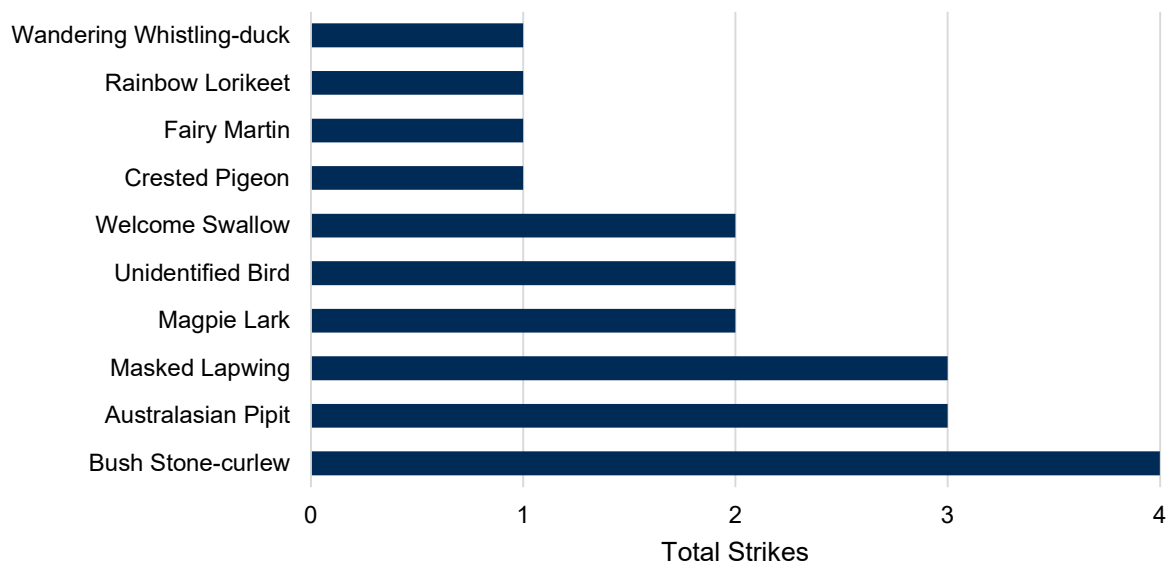


Figure 5. Confirmed, on-airport and vicinity species struck, YBMK, 2020/21.

Confirmed on-airport and airport vicinity strikes peaked at 2000 hours (Figure 6) with nocturnal species including Wandering Whistling-Duck (**high risk**), Bush Stone-curlew (**high risk**), and Masked Lapwing (**moderate risk**). MAPL are investigating options to purchase a night vision scope to assist in identifying nocturnal wildlife airside, and limiting night inspections to the runway to prevent dispersing nocturnal wildlife into critical areas during perimeter inspections. MAPL plans to grow the airside grass heights to 300mm outside of critical areas and 200mm inside the flight strip to deter foraging wildlife. Each species' activity increases as they forage in airside grassed areas at night.

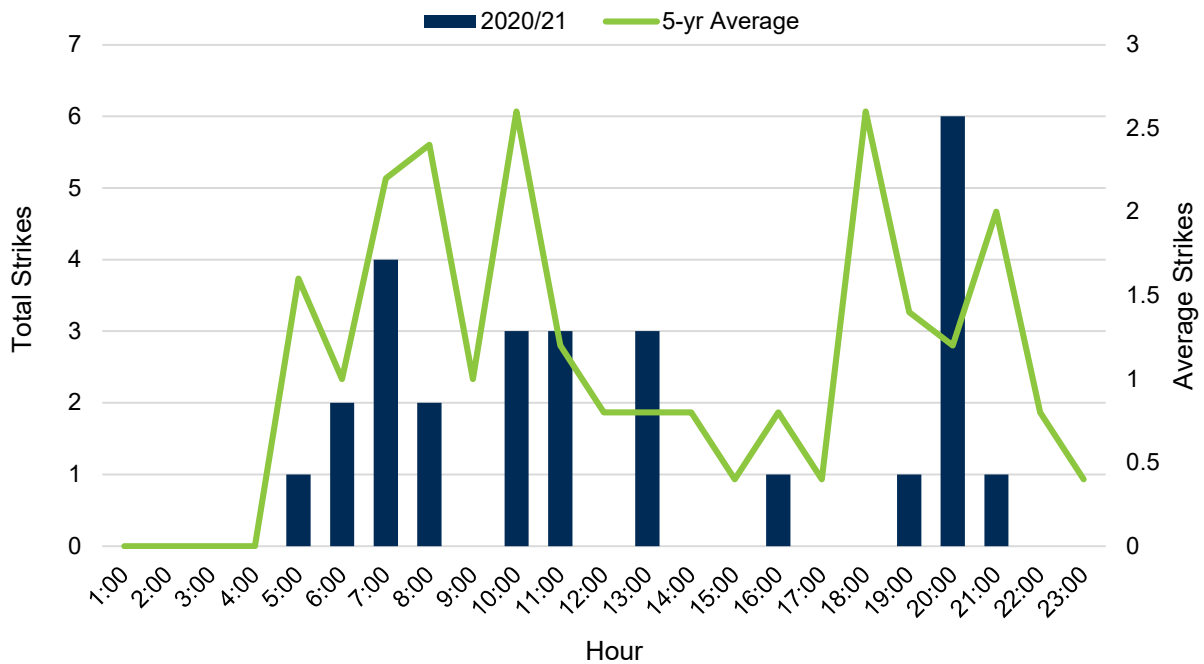


Figure 6. Total strikes²¹ by time-of-day 2020/21 vs. 5-year average strikes (excludes strikes where time was not reported), YBMK, 2015/16 – 2019/20.

5.2. Strikes Affecting Flight

YBMK have reported 20 AEPF strikes in the past 5 years (Table 8), this includes near misses where aircraft hold before take-off to allow wildlife activity to subside. This measure is not used as an indicator of risk, however it is considered good risk management. As an example, on 17/03/2021 the ASO reported three Australian White Ibis (total of 5.9 kg) tracking along Runway (RWY) 14 immediately prior to a Virgin Australia (VA600) take-off roll (Table 8). The pilot held short of the threshold until the ibis had vacated the runway strip. The action by the ASO and pilot avoided a potentially damaging strike.

Table 8. Adverse effective strikes summary, YBMK, 2016/17-2020/21.

Date	Operator	Location	Species	No.	Strike Type	Effect Type
09/08/2018	Unknown	RWY14	Masked Lapwing	1	Confirmed	Rejected take-off
30/12/2018	Unknown	On-airport	Rainbow Lorikeet	1	Confirmed	Delay
11/02/2019	Sunstate Airlines	South of TWY J	Nankeen Kestrel	1	Confirmed	Delay
08/03/2019	Virgin Australia	On-airport	Australian White Ibis	1	Confirmed	Delay
09/05/2019	Virgin Australia	Unknown	Black Flying-fox	2	Confirmed	Damage and delay

²¹ Includes confirmed, suspected, near miss and unknown on-airport, airport vicinity and unknown designation strikes.

Date	Operator	Location	Species	No.	Strike Type	Effect Type
09/05/2019	Virgin Australia	Unknown	Eastern Barn Owl	1	Confirmed	Delay
10/05/2019	Jetstar	Unknown	Unidentified Bird	0	Suspected	Delay
06/11/2019	Jetstar	Remote	Unidentified Bird	1	Confirmed	Delay
30/12/2019	Jetstar	On-airport	Australasian Pipit	1	Confirmed	Delay
18/02/2020	Virgin Australia	Unknown	Unidentified Bird	1	Confirmed	Delay
29/02/2020	Qantas	Opposite TWY B	Nankeen Kestrel	1	Confirmed	Damage and delay
05/03/2020	Qantas	On-airport	Masked Lapwing	1	Confirmed	Delay
03/08/2020	Qantas	On-airport	Magpie Lark	1	Confirmed	Delay
21/02/2021	Qantas	On-airport	Bush Stone-curlew	1	Confirmed	Minor damage
06/03/2021	Virgin Australia	On-airport	Unidentified Bird	1	Near Miss	Delay
08/03/2021	Virgin Australia	On-airport	Masked Lapwing	2	Confirmed	Delay
15/03/2021	Virgin Australia	On-airport	Masked Lapwing	1	Near Miss	Delay
17/03/2021	Virgin Australia	On-airport	Australian White Ibis	1	Near Miss	Delay
12/04/2021	Qantas	On-airport	Black Kite	1	Near Miss	Delay
10/06/2021	Qantas	On-airport	Feral Pigeon	1	Near Miss	Delay

6. Annual Wildlife Hazard Assessment

Part 139 MOS 2019 Section: 11.08

(1) The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following:

(b) assessing any wildlife hazard

Part 139 MOS 2019 Section: 17.02 (3)

(1) Any detected wildlife hazard must be assessed for its potential risk to aircraft operations.

(2) If the aerodrome operator has a safety management system, or a risk management plan, mentioned in Chapter 25 or 26 respectively, the assessment must be conducted in accordance with the system or the plan.

(3) When conducting a wildlife hazard assessment, available data from the following must be considered:

(a) wildlife observations;

(b) reported aircraft strike events;

(c) reported aircraft near miss events.

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(c) set out the procedures for the following in relation to wildlife hazards:

(iii) risk assessment and analysis;

Annual Wildlife Hazard Assessments (WHA) evaluate program progress and analyse program data to help inform and implement the WHMP. Trigger events or risk changes (e.g. increased aircraft operations, significant changes in wildlife numbers, off-aerodrome developments) may require more frequent assessments. Avisure completed a WHA of YBMK's wildlife management program which included:

- **Risk assessment** – based on strike history and airside wildlife surveys, including wildlife numbers, behaviour, and presence in critical areas of the aerodrome.
- **Hazard identification** – a broad assessment of the aerodrome's hazard profile that affect YBMK's wildlife strike risk profile including:
 - Airside wildlife attracting areas and facilities
 - Landside wildlife attracting areas and facilities
 - Off-aerodrome wildlife attracting sites
 - Analysis of Avisure survey data.

6.1. Safety Management System Risk Assessment

Part 139 MOS Section: 17.02 (3)

(2) If the aerodrome operator has a safety management system, or a risk management plan, mentioned in Chapter 25 or 26 respectively, the assessment must be conducted in accordance with the system or the plan

This section assesses the risk wildlife strikes pose to aircraft operations at YBMK, in line with Mackay Airport Safety Management System (SMS) version 2 (draft).

Table 9. Wildlife strike risk against Mackay Airport SMS, March 2022.

Risk	Existing Controls	Consequence	Likelihood	Risk Level		As Low As Reasonably Possible (Y/N)?	Risk Criteria		Additional Control Strategy Options (Where possible)
				Capability	Airframe Safety				
Asset / property damage	<ul style="list-style-type: none"> Wildlife dispersal Wildlife culling Wildlife egg and nest removal Passive management of attractants (section 7.6.2) 	Minor (D) to Catastrophic (A)	Almost Certain (5)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems; to Extensive impact on airport operations and damage to airport assets or airworthiness of aviation support systems.	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required); to Aircraft lost. Cat 5 damage (unrepairable, missing or inaccessible for recovery) to an aviation system.	N	5A-5C	Unacceptable under the existing circumstances	<ul style="list-style-type: none"> Pilots opt to use different runway from wildlife hotspot Pilots opt to hold aircraft movement until hazard period has ended Airlines alter aircraft movements outside of peak wildlife activity Off-airport stakeholders implement wildlife hazard management program, including wildlife dispersal, on site. Air Traffic Control close runway until wildlife hazard period has ended.
Business	<ul style="list-style-type: none"> Communication via CTAF and ATC Communication via NOTAMs and ERSA Engagement with off-airport stakeholders 	Minor (D) to Major (B)	Possible (3)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems; to Major impact on airport operations, significant damage to airport assets or airworthiness of aviation support systems.	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required); to Major aircraft damage. Cat 4 damage (repairable in more than 14 days) to an aviation system.	Y	3B-3D	Acceptable based on risk mitigation. It might require management decision.	
Negative community / social impact	<ul style="list-style-type: none"> Monthly on-airport surveys by consultant Daily bird counts by ASOs 	Minor (D)	Possible (3)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required)	Y	3D	Acceptable based on risk mitigation. It might require management decision.	
Decrease to customer service	<ul style="list-style-type: none"> Daily serviceability inspections Quarterly off-airport surveys by consultant 	Minor (D)	Possible (3)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required)	N	3D	Acceptable based on risk mitigation. It might require management decision.	
Environmental impact (loss of animal life)	<ul style="list-style-type: none"> Monthly and quarterly reporting to stakeholders 	Catastrophic (A)	Likely (4)	Extensive impact on airport operations and damage to airport assets or airworthiness of aviation support systems.	Aircraft lost. Cat 5 damage (unrepairable, missing or inaccessible for recovery) to an aviation system.	Y	4A	Unacceptable under the existing circumstances.	
Financial loss	<ul style="list-style-type: none"> Communication of wildlife hazards at Manzelmann's Farm to ASOs Wildlife hazard management committee meetings with stakeholders, including operators and airlines. 	Negligible (E) to Catastrophic (A)	Possible (2)	Negligible impact on airport operations or airworthiness of aviation support systems; to Extensive impact on airport operations and damage to airport assets or airworthiness of aviation support systems.	Aircraft category 1 damage. Cat 1 damage (repairable onsite with minimal or no consequence to operations); to Aircraft lost. Cat 5 damage (unrepairable, missing or inaccessible for recovery) to an aviation system.	Y	2A-2C	Acceptable based on risk mitigation. It might require management decision.	
							2D-2E	Acceptable	
Legislative non-compliance		Minor (D)	Unlikely (2)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems.	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required).	Y	2D	Acceptable	

Risk	Existing Controls	Consequence	Likelihood	Risk Level		As Low As Reasonably Possible (Y/N)?	Risk Criteria		Additional Control Strategy Options (Where possible)
				Capability	Airframe Safety				
Quality	<ul style="list-style-type: none"> All wildlife strikes, including suspected and near miss, are recorded and analysed. The wildlife hazard management program is supported by airport-appointment ornithologists and is frequently assessed. 	Minor (D)	Unlikely (3)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems.	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required).	Y	3D	Acceptable based on risk mitigation. It might require management decision.	
Negative reputation		Moderate (C)	Unlikely (2)	Moderate impact on airport operations damage to airport assets or airworthiness of aviation support systems.	Aircraft category 2 damage. Cat 3 damage (repairable but third-party assistance required).	Y	2C	Acceptable based on risk mitigation. It might require management decision.	
Flight schedule changes		Minor (D)	Possible (3)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems.	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required).	Y	3D	Acceptable based on risk mitigation. It might require management decision.	
Transport security program impact		Minor (D)	Unlikely (2)	Minor impact temporary disruption on airport operations or airworthiness of aviation support systems.	Aircraft category 2 damage Cat 2 damage (repairable onsite possible third-party assistance maybe required).	Y	2D	Acceptable	
Workplace health & safety to aircrew		Moderate (C)	Unlikely (2)	Moderate impact on airport operations damage to airport assets or airworthiness of aviation support systems.	Aircraft category 2 damage. Cat 3 damage (repairable but third-party assistance required).	Y	2C	Acceptable based on risk mitigation. It might require management decision.	
Workplace health & safety to personnel – zoonotic disease risk	Personnel are trained to competently handle wildlife, including DNA samples and carcasses. PPE is worn to decrease contamination and ASOs are vaccinated for zoonotic diseases.	Major (B)	Rate (1)	Major impact on airport operations, significant damage to airport assets or airworthiness of aviation support systems.	Aircraft category 3 damage. Cat 3 damage (repairable but third-party assistance maybe required).	Y	1B	Acceptable	N/A

6.2. Risk Assessment

Avisure assessed the species risk using strike data from YBMK and ATSB, and on-airport survey data collected during quarterly site visits. Refer to Appendix D for risk assessment methods and Appendix E for survey methods.

Table 10 summarises the combined results to provide the overall risk ranking of high and moderate risk species.

Table 10. Overall species risk rankings, high and moderate risk species only, YBMK 2020/21.

Species	Overall Risk	Survey Risk		Strike Risk
		Diurnal	Nocturnal	
Bush Stone-curlew	High	Moderate	Moderate	High
Wandering Whistling-duck	High	-	-	High
Unidentified Bird	High	-	-	High
Australian White Ibis	High	High	-	Moderate
Feral Pigeon	High	High	-	-
Magpie Goose	High	High	-	-
Masked Lapwing	Moderate	Moderate	Moderate	Moderate
Pacific Black Duck	Moderate	Moderate	-	Moderate
Plumed Whistling Duck	Moderate	-	Moderate	Moderate
Unidentified Snake	Moderate	-	-	Moderate
Australian Pelican	Moderate	-	-	Moderate
Unidentified Kite	Moderate	-	-	Moderate
Black Flying-fox*	Moderate	-	-	Moderate
Rainbow Lorikeet	Moderate	Moderate	-	Low
Black Kite	Moderate	Moderate	-	Low
Unidentified Flying-fox	Moderate	-	Moderate	Low
Royal Spoonbill	Moderate	Moderate	-	-
Torresian Crow	Moderate	Moderate	-	-
Straw-necked Ibis	Moderate	Moderate	-	-
Cattle Egret	Moderate	Moderate	-	-
Red-tailed Black-Cockatoo	Moderate	Moderate	-	-
Whistling Kite	Moderate	Moderate	-	-
Australian Magpie	Moderate	Moderate	-	-
Eastern Great Egret	Moderate	Moderate	-	-
Galah	Moderate	Moderate	-	-
Channel-billed Cuckoo	Moderate	Moderate	-	-

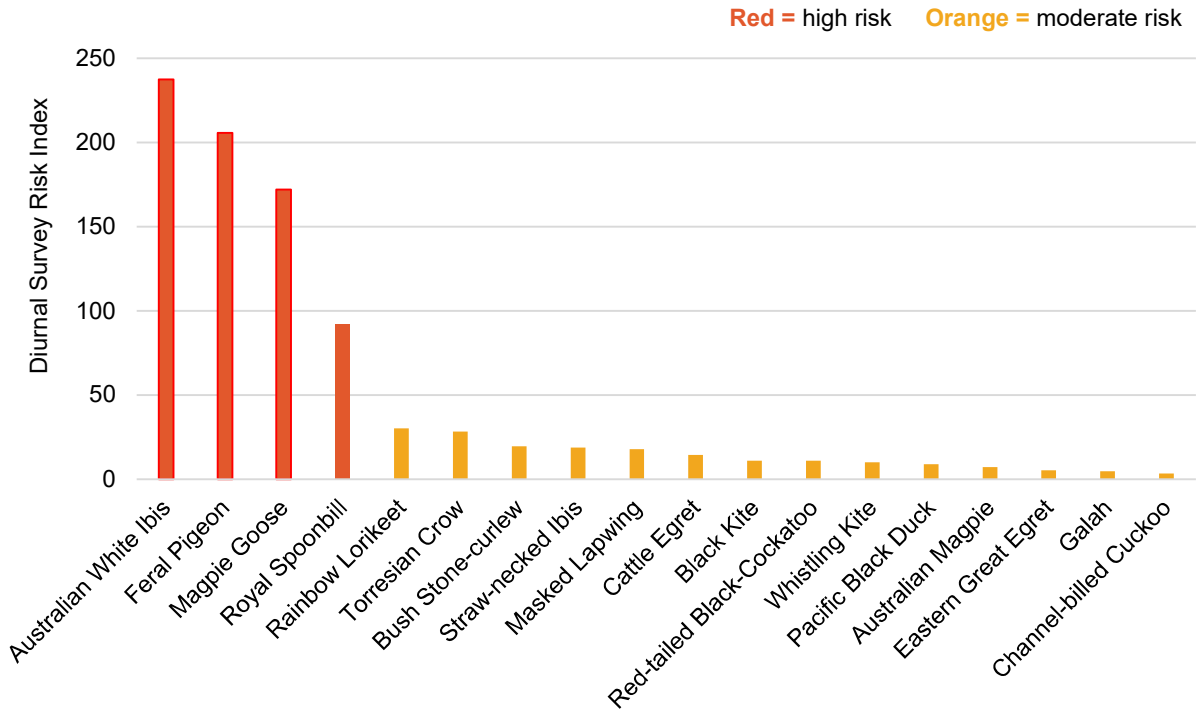


Figure 7. Average diurnal survey risk index, YBMK, 2020/21.

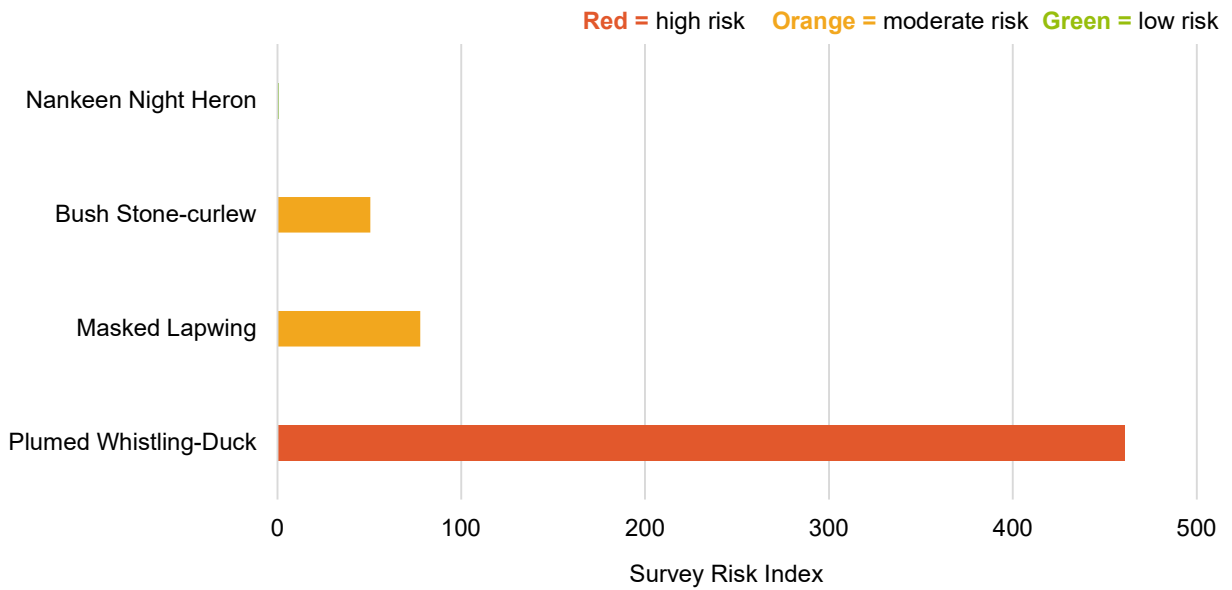


Figure 8. Average nocturnal survey risk index, YBMK, 2020/21.

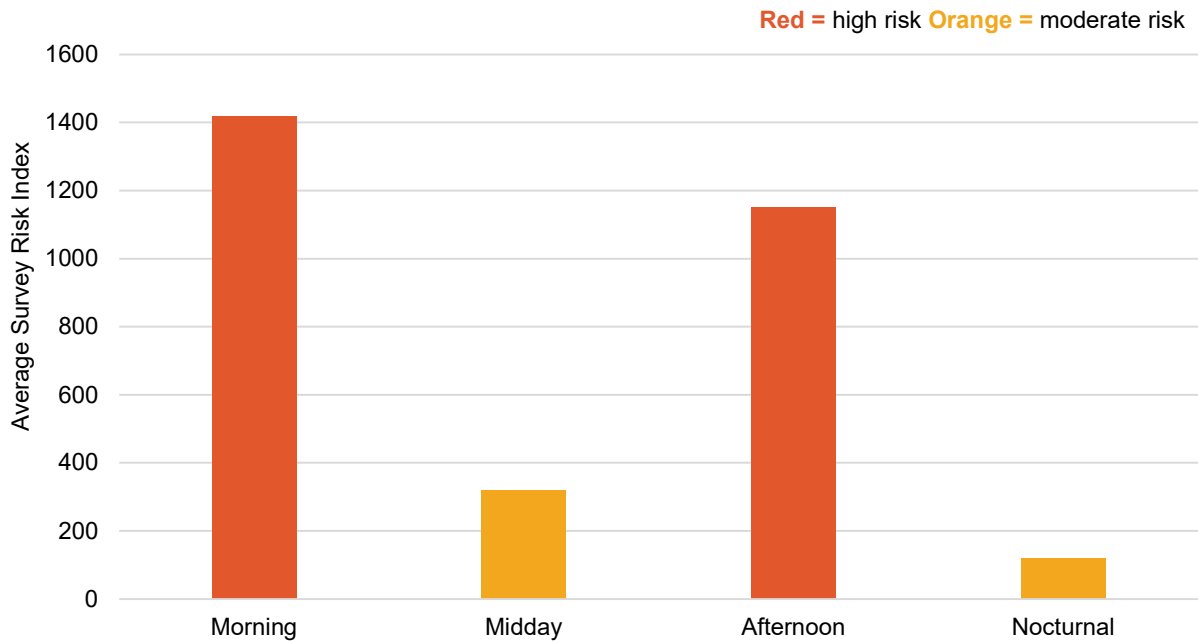


Figure 9. Airport Survey Risk Index (ASRI) by time of day, YBMK, 2020/21.

Bush Stone-curlew are ranked the highest risk (**high-risk**) because they forage and loaf in airside grass at all times in critical and non-critical areas, and they have a high tendency for being struck.

Flocks of Australian White Ibis frequently flew through critical airspace during morning and afternoon surveys contributing to their **high-risk** rank.

Magpie Geese fly over the critical airspace and occasionally forage in grass during mornings and afternoons. Their large body mass (2.4kg) and flocking tendency contributes to their **high-risk** ranking.

Surveys recorded over 50 Plumed Whistling-ducks in May 2020 which elevated their ranking to **high-risk**. Pooled water after rain and seeding grasses attract Plumed Whistling-ducks.

6.3. Airside Wildlife Hazard Summary

Table 11 summarises YBMK's annual strike and risk assessment trend.

Table 11. YBMK wildlife hazard summary 2016/17 to 2020/21.

Scorecard ²²	2016/17	2017/18	2018/19	2019/20	2020/21
Total strikes	29	22	44	19	27
Confirmed strikes ²³	20	19	37	14	20
Suspected strikes ²³	9	2	6	5	2
Near miss strikes ²³	0	0	1	0	5
Damaging strikes ²³	0	1	1	1	1
Unknown designation strikes	0	1	0	0	0
Adverse effect to planned flight strikes	0	0	7	5	8
Total mass reported struck (kg)	6.52	12.24	16.96	4.43	6.397
Total movements ²⁴	28,968	27,276	26,882	24,284	25,130
Total strikes / 10,000 ACFT movements	10.01	8.07	16.37	7.82	10.74
Confirmed strikes / 10,000 ACFT movements	6.90	6.97	13.76	5.77	7.96
Suspected strikes / 10,000 ACFT movements	3.11	0.73	2.23	2.06	0.80
Damaging strikes / 100,000 ACFT movements	0	3.67	3.72	4.12	3.98
Adverse effect strikes / 100,000 ACFT movements	0	0	26.04	20.59	31.83
High risk species struck / 10,000 ACFT movements	2.07	1.10	2.60	2.88	2.79
Total mass (kg) struck / 10,000 ACFT movements	2.25	4.49	6.31	1.83	2.55
% mass (kg) surveyed in critical areas	56%	67%	66%	51%	51%
No. very high-risk species	0	1	1	0	0
No. high risk species	6	3	7	7	7
No. moderate risk species	16	16	17	18	19

²² Strike data from YBMK and ATSB.

²³ On-airport and vicinity strikes only.

²⁴ Movement data from Airservices Australia.

6.4. On-airport Surveys and Hazards

Part 139 MOS 2019 Section: 5.17 Local hazards that may adversely affect aviation safety (local hazard data) must be recorded, including the following:

(b) continual wildlife hazards at the aerodrome or in its vicinity, including descriptions, locations, and times or seasonal information;

Part 139 MOS 2019 Section: 17.04

(2) The Wildlife hazard management plan must at least:



(b) identify sources and locations of wildlife attraction:



(i) on the aerodrome;

which are likely to cause wildlife to transit the take-off, approach and transitional surfaces;

Table 12 outlines on-airport attractants and the high and moderate risk species attracted to that area. Refer to Appendix E for Avisure survey methods.

Table 12. On-airport and landside wildlife hazard attractant and the high and moderate risk species attracted, YBMK.

Area	Hazard Description	High and Moderate Risk Species (2020/21)	
<p>Drains and depressions</p> 	<p>Drains and depressions retain water following rain events. Waterlogged soils in these areas force invertebrates closer to the surface, making them more accessible to foraging birds. Areas of retained water also provide frog-breeding habitat.</p>	<p>Australian White Ibis Straw-necked Ibis Masked Lapwing</p>	<p>Pacific Black Duck Wandering Whistling-Duck Unidentified Snake</p>
<p>Grass areas</p> 	<p>Hazardous water birds are present after rain when the ground remains moist. Grass regularly attracts foraging Australian Magpies and Torresian Crows. Insects and small mammals are easily accessible to raptors and herons following mowing and heavy rain.</p>	<p>Australian White Ibis Black Kite Bush Stone-curlew Cattle Egret Feral Pigeon Magpie Goose Masked Lapwing</p>	<p>Straw-necked Ibis Torresian Crow Unidentified Bird Unidentified Kite Wandering Whistling-Duck</p>

Area	Hazard Description	High and Moderate Risk Species (2020/21)	
<p>Sealed Areas</p> 	<p>Aircraft manoeuvring areas provide high ground for insects and molluscs during rain which attracts foraging birds.</p> <p>During hot periods when the hot air rises from the concrete, it creates ideal thermalling conditions for birds or heating opportunity for reptiles.</p>	<p>Bush Stone-curlew Masked Lapwing Straw-necked Ibis Torresian Crow</p>	<p>Unidentified Snake Unidentified Kite</p>
<p>Perimeter fence</p> 	<p>Gaps in gates and underneath fence lines may allow airside access for terrestrial mammals such as Red Fox and European Brown Hare.</p> <p>Fencing also provides perching opportunity for various moderate and high-risk birds.</p>	<p>Black Kite Cattle Egret Feral Pigeon Whistling Kite Australian Magpie</p>	<p>Torresian Crow Unidentified Bird Unidentified Kite Black Kite Galah</p>
<p>Built environment</p> 	<p>This includes the terminal building, ATC, apron lighting, hangars, fire station, windsocks, the NDB, and other airside infrastructure. These structures provide perches, shelter and potential nesting sites for various wildlife.</p>	<p>Black Kite Feral Pigeon Torresian Crow Unidentified Kite Whistling Kite</p>	<p>Unidentified Bird Black Kite Australian Magpie Galah</p>



Area	Hazard Description	High and Moderate Risk Species (2020/21)	
<p>Landside Vegetation</p> 	<p>Various ornamental trees and landside habitats provide foraging, roosting and breeding opportunities. Species that attract wildlife may contribute to the strike risk. Species such as Melaleuca and Eucalyptus has the potential to attract hazardous species such as Rainbow Lorikeets, flying-foxes, and honeyeaters when in bloom (March to May).</p>	<p>Black Flying-fox Channel-billed Cuckoo Galah</p>	<p>Rainbow Lorikeet Red-tailed Black-Cockatoo Australian Magpie</p>
<p>Airspace</p> 	<p>Transit area between foraging and roosting sites; thermals.</p>	<p>Australian White Ibis Australian Pelican Black Kite Black-necked Stork Cattle Egret Channel-billed Cuckoo Feral Pigeon Galah</p>	<p>Magpie Goose Masked Lapwing Pacific Black Duck Rainbow Lorikeet Red-tailed Black-Cockatoo Straw-necked Ibis Torresian Crow Unidentified Bird</p>
<p>Construction work</p>	<p>Airside and landside construction activities can elevate wildlife activity above normal levels. Areas of temporary water retention can attract ducks and other water birds. Earthworks expose soils that attract birds to forage on the exposed invertebrates and temporary stockpiles of soil or other material can provide additional loafing and perching opportunities for birds. Pipes and other construction material can provide temporary shelter and, in some cases, birds such as Fairy Martins have established nests in these materials.</p>	<p>Australian White Ibis Feral Pigeon Australian Magpie</p>	<p>Torresian Crow Straw-necked Ibis Pacific Black Duck</p>



Figure 10: Average mass (kg) per quarter during morning airside surveys, 2020/21, YBMK.

Mackay Regional Council
Mackay Airport Bird Management Program 2020/21

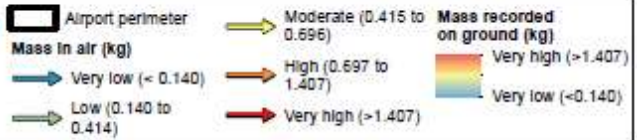




Figure 11: Average mass (kg) per quarter during midday airside surveys, 2020/21, YBMK.

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Mackay Airport Bird Management Program 2020/21

Airport perimeter	Moderate (0.415 to 0.696)	Mass recorded on ground (kg) Very high (>1.407) Very low (<0.140)
Mass in air (kg)	Very low (< 0.140)	
Low (0.140 to 0.414)	High (0.697 to 1.407)	
Very high (>1.407)		



Figure 12: Average mass (kg) per quarter during afternoon airside surveys, 2020/21, YBMK.

Mackay Regional Council
Mackay Airport Bird Management Program 2020/21

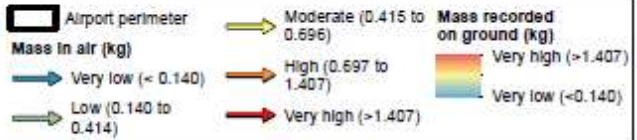
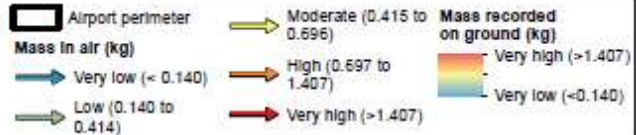




Figure 13: Average mass (kg) per quarter during nocturnal airside surveys, 2020/21, YBMK.

Mackay Regional Council
Mackay Airport Bird Management Program 2020/21



AVISURE safety aviation wildlife	Job number: PR5403 Revision: 0 Author: KF Date: 2/23/2022		GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Units: Meter
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Australian White Ibis (**High risk**), Cattle Egret (**Moderate risk**) and Masked Lapwing (**Moderate risk**) were the most observed species during diurnal surveys (Figure 14). Australian White Ibis and Cattle Egret transited over the airspace to nearby foraging habitat off-aerodrome (Figure 17 and 18). Ibis preferred to forage airside during periods of high rainfall. Their flocking tendency and high body mass (1.3kg) pose a damaging strike risk. A near miss with a flock of ibis occurred this year.

Other species that commonly transit over the airspace include Magpie Goose (**High risk**), Feral Pigeon (**High risk**) and Torresian Crow (**Moderate risk**).

Most risk species choose to forage in grass outside of the runways (non-critical) (Figure 15, 17 and 18). Common species included Magpie Lark (**Low risk**), Torresian Crow (**Moderate risk**), Straw-necked Ibis (**Moderate risk**), Australian White Ibis (**High risk**) and Australasian Pipit (**Low risk**).

Diurnal bird activity peaked in the mornings when it was cooler (Figure 16). Bush-Stone Curlews (**High risk**) and Masked Lapwings were the predominant nocturnal risk (Figure 16). Surveys recorded them in grass but rarely in critical areas, although strikes recorded with these species at night suggest that they use the runways. Curlews and lapwings are abundant airside during breeding season (Jul-Jan for curlews and after rainfall for lapwings).

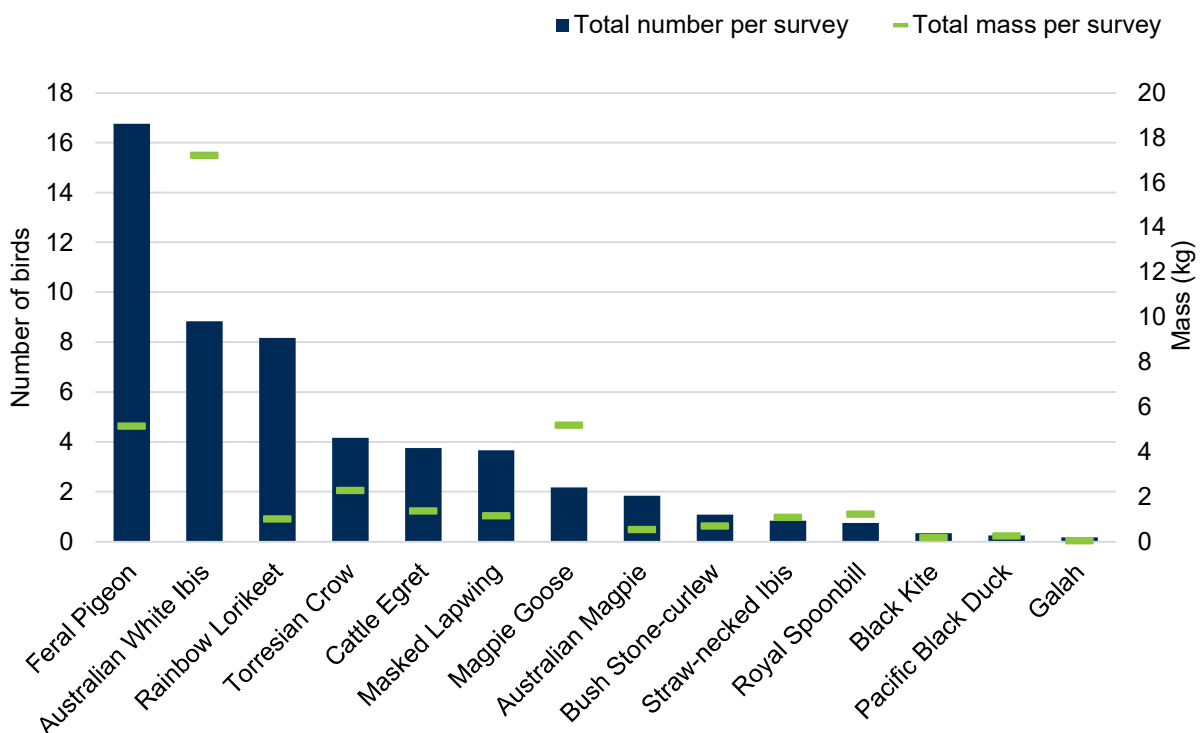


Figure 14. Average mass (kg) of high/moderate species (top 14 only) per diurnal survey, YBMK, 2020/21.

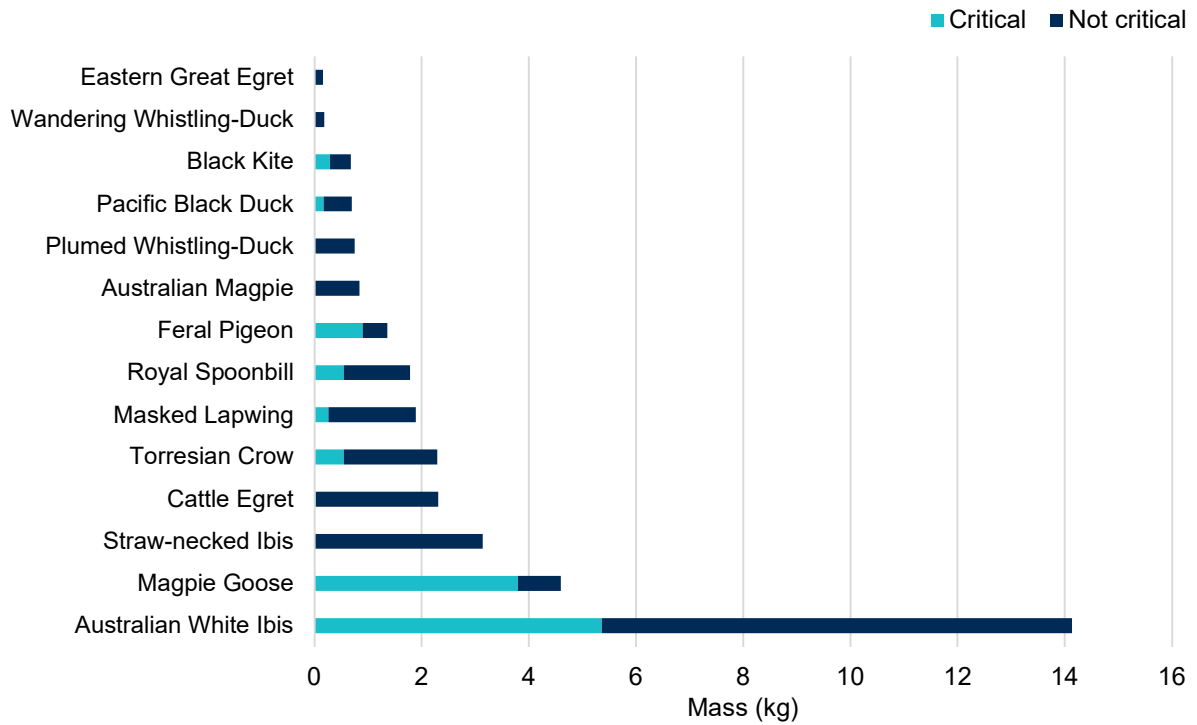


Figure 15. Average mass (kg) of high/moderate risk species (top 14 only) per diurnal survey and presence in critical areas, YBMK, 2020/21.

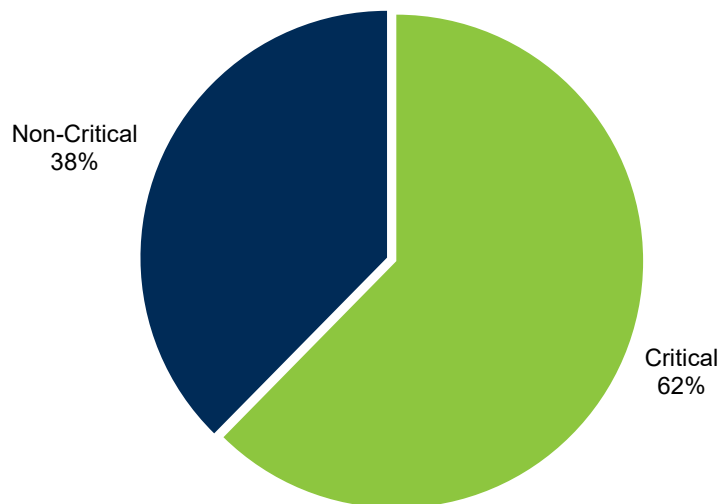


Figure 16. Proportion of diurnal species observed in critical areas, YBMK, 2020/21.

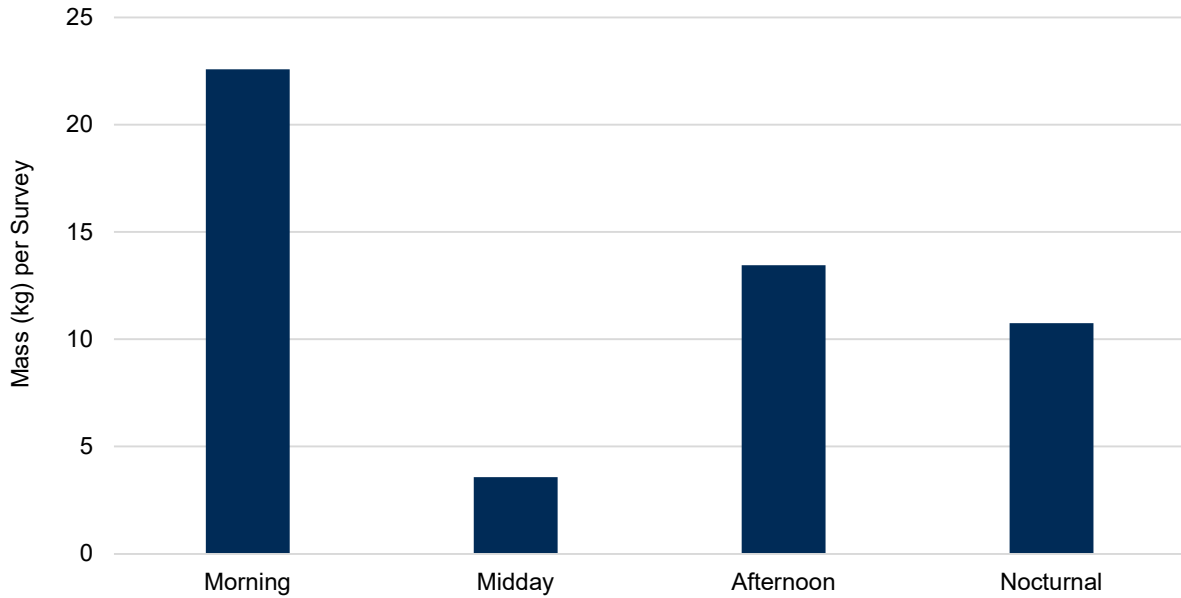


Figure 17. Average mass (kg) surveyed by time of day, YBMK, 2020/21.

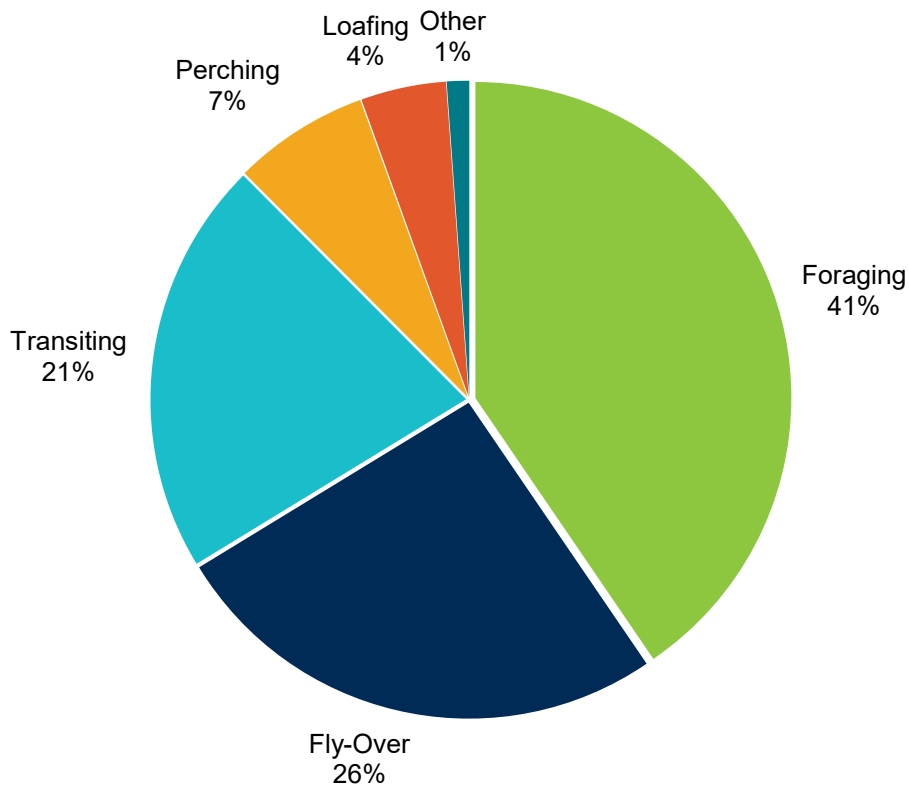


Figure 18. Proportion of species behaviour observed, YBMK, 2020/21.

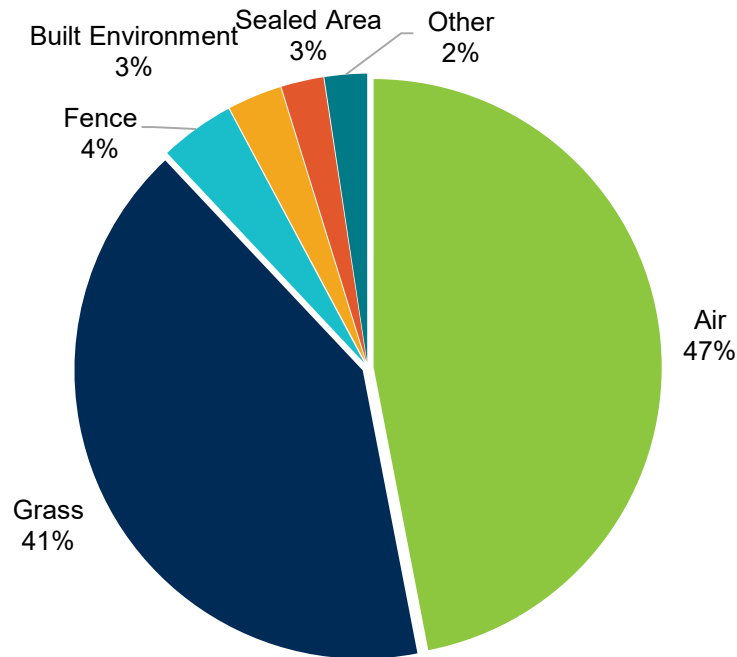


Figure 19. Proportion of habitat used by wildlife, YBMK, 2020/21.

6.5. Off-airport Surveys and Hazards

Part 139 MOS 2019 Section: 17.01

(2) The aerodrome operator, in consultation with the local planning authority, must attempt to monitor sites within 13km of the aerodrome reference point that attract wildlife.

Part 139 MOS 2019 Section: 17.04

(2) The Wildlife hazard management plan must at least:

(b) identify sources and locations of wildlife attraction:

(ii) in the vicinity of the aerodrome;

which are likely to cause wildlife to transit the take-off, approach and transitional surfaces;

Off-aerodrome wildlife populations can contribute significantly to the strike risk at an airfield. When assessing habitats that have the potential to attract hazardous wildlife it is important to analyse the impacts of potentially conflicting airspace between birds and aircraft. Their movements may intersect aircraft flight paths either over the airfield, in the approaches, or in areas used for low-level circuit operations. In addition, regional and local wildlife populations may fluctuate in response to seasonal, climactic, or other environmental variables, increasing the strike hazard.

Avisure monitored 21 off-aerodrome locations within 13km of YBMK (Figure 21). Fifteen of these are located within 3km of the airport, 5 within 8km, 1 within 13km, and 1 outside 13km radius. Figure 21 shows the average mass (kg) recorded at each off-aerodrome site per survey.

The potential risk posed to YBMK is based on each site's proximity to YBMK, the land use, the site's attractiveness to high and moderate risk species and the number observed in 2020/21. Quarterly and annual off-aerodrome surveys help understand the high and moderate risk species that use these sites.

Mackay Golf Club recorded the highest mass (kg) per survey, peaking in September. Avisure recorded 223 Magpie Geese foraging in grassed areas by ponded water on site, accounting for 75% of mass (kg) recorded in September. Magpie Goose activity increases between August and November in the region following sugar cane harvesting.

Magpie Goose also used:

- Adjacent Cane Paddocks (178/survey)
- Borthwicks Meatworks (169/survey)
- Botanical Gardens (53/survey)
- Manzelmann's Farm (34/survey)
- 63 Farrelly's Road Farm (28/survey)
- Racetrack (13/survey)
- North Mackay Goose Ponds (10/survey)
- Mackay Showgrounds (9/survey)
- West Mackay Goose Ponds (6/survey)

Ad hoc observations by Avisure recorded Australian White Ibis (**high risk**) nesting and Magpie Goose roosting in the mangroves with the flying-foxes at the Mackay Cemetery Flying-fox Camp. Quarterly ibis fly-in surveys are scheduled for the 2021/22 wildlife hazard management program.

Australian White Ibis (**high risk**) also used:

- Manzelmann's Farm (35/survey)
- Mackay Cemetery Flying-fox Camp (31/survey)
- Mackay Golf Club (30/survey)
- Thomas Borthwicks Meatworks (30/survey)
- Botanical Gardens (10/survey)
- West Mackay Goose Ponds (8/survey)
- North Mackay Goose Ponds (4/survey)
- Southwestern Drain (3/survey)
- Mackay North Water Recycling Facility (3/survey)
- Bakers Creek Golf Course (2/survey)

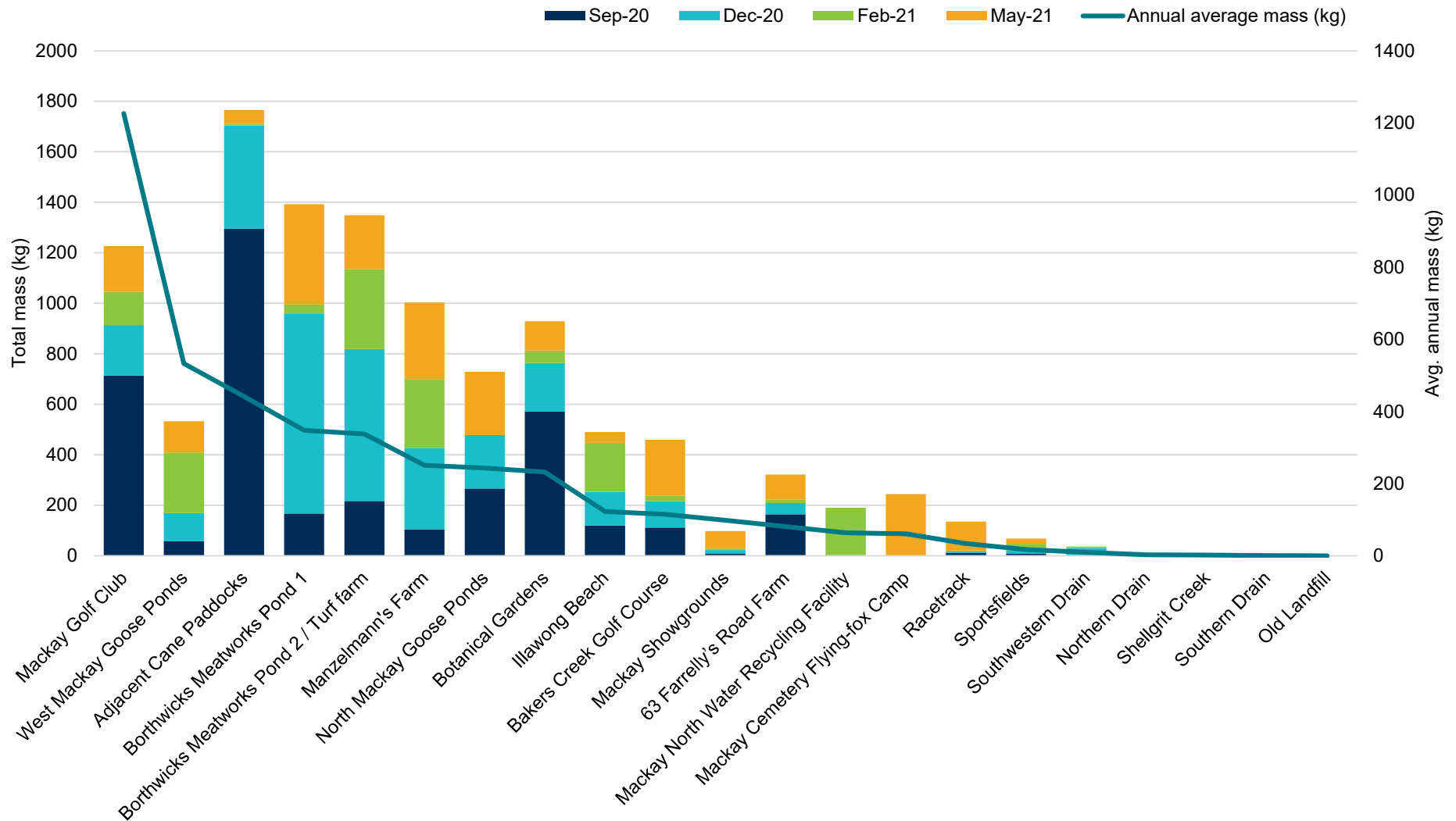


Figure 20. Mass per survey (kg) at off-aerodrome locations versus the annual average, YBMK, 2020/21 (Top 12 off-aerodrome sites only).

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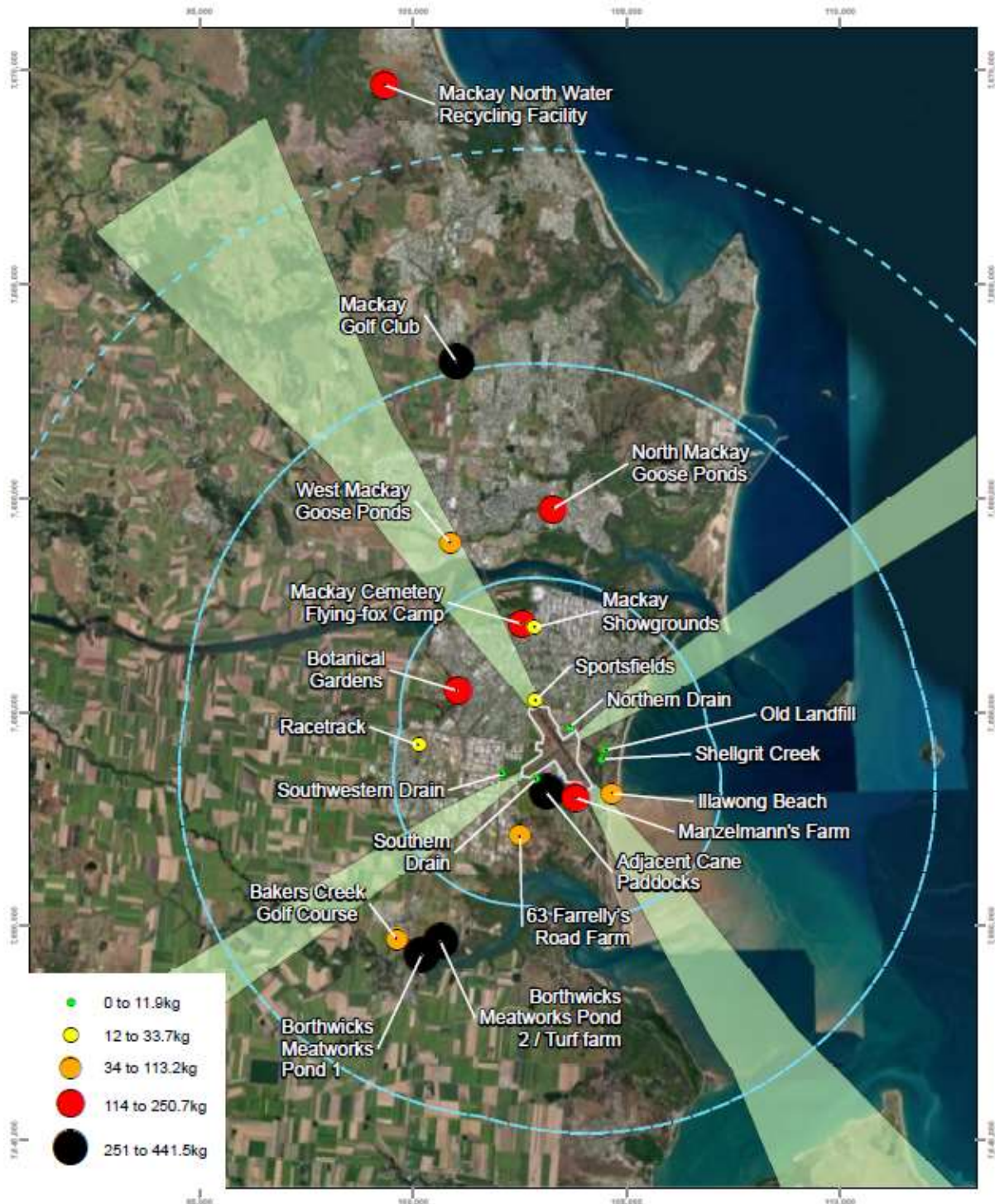


Figure 21: Average mass (kg) recorded per quarter during off-airport surveys

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Mackay Airport Bird Management Program 2020/21

3, 8 and 13km buffers
Mackay Airport boundary
Runway approach paths

6.6. Flying-foxes

Flying-foxes contribute to the strike risk as they transit between foraging and roosting sites. In November 2018, Avisure identified a Black Flying-fox camp at Mackay Cemetery which is located approximately 3 km from YBMK. Avisure complete quarterly monitoring of this camp and the Department of Environment and Science (DES) also monitors this site as part of the National Flying-fox Monitoring Program. Additional flying-fox camps are monitoring by Mackay Regional Council and DES. MAPL are liaising with Mackay Regional Council to receive this data. Table 13 details this camp's fly-out times and direction for 2020/21.

Table 13. Mackay Cemetery flying-fox camp fly-out, YBMK, 2020/21.

Date	Fly-out Start	Fly-out Finish	Number	Direction
22/09/2020	18:18	18:40	400	South
			720	East
02/12/2020	18:52	19:12	1,450	East
			450	South-east
16/02/2021	18:50	19:17	5,813	South
			2,380	South-east
19/05/2021	17:56	18:17	190	South
			54	East

7. Management

The section outlines the tactical framework for wildlife hazard management at YBMK, comprising of:

- Hazard Detection
- Hazard Monitoring
- Hazard Communication
- Wildlife Strike Reporting
- Data Management
- Hazard Mitigation.

Each element is detailed below.

7.1. Hazard Detection

Part 139 MOS 2019 Section: 11.11 The aerodrome manual must contain the procedures for preventing the unauthorised entry onto the movement area (airside) of persons, vehicles, equipment, mobile plant or animals (including land-based wildlife) or other things that may endanger aircraft safety, including procedures for the following:

(b) monitoring airside access control points and barriers, such as fencing.

Part 139 MOS 2019 Section: 12.03

(9) The serviceability inspection must check for damaged fences, unsecured gates, and signs of attempted entry onto the manoeuvring area by either land-based wildlife or unauthorised persons.

Part 139 MOS 2019 Section: 12.07

(7) The serviceability inspection must include the following:

the condition of aerodrome fencing and the security of access points to the movement area;

monitoring the presence and behaviour of any wildlife on, or likely to be on, the aerodrome, and identifying seasonal and environmental conditions which may act as an attractant;

monitoring evidence of wildlife shelter provided by aerodrome infrastructure, for example, buildings, equipment and gable markers;

checking for off-aerodrome wildlife attraction sources, observable from the aerodrome site, for example, mowing activities, seeding, standing water bodies, uncovered waste disposal, deceased wildlife or offal

the presence and operating condition of any wildlife hazard mitigating equipment incorporated into the wildlife hazard management procedures for the aerodrome

Part 139 MOS 2019 Section: 17.01

(1) As part of the aerodrome serviceability inspection, the aerodrome operator must monitor and record at least the following:

- (a) the presence and behaviour of wildlife on the aerodrome;
- (b) wildlife activity that is visible:
 - (i) in the vicinity of the aerodrome; or
 - (ii) from the aerodrome.

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

- (c) set out the procedures for the following in relation to wildlife hazards:
 - (i) detection;

Assessing the actual or potential wildlife hazard prior to aircraft movements advises aircrew of potential strike risks and informs decision-making to mitigate the risk. Routine hazard detection is achieved during serviceability inspections, perimeter fence inspections and runway and flight strip inspections (Table 14). This ensures early detection of wildlife hazards in airside areas, particularly inside critical aircraft movement areas.

Table 14. Hazard detection methods.

Task	Description	Frequency	Responsible	Procedure/Reference
Serviceability inspections	Inspect airside areas, including aircraft movement areas, for wildlife as part of mandatory serviceability inspections.	Daily: <ul style="list-style-type: none"> • at least 30 minutes before the first daily scheduled RPT movement; • at first light if initial inspection was carried out during hours of darkness; • at last light; • if requested or hazard identified. 	ASO	SOP: Daily Aerodrome Inspections SOP: Wildlife Patrols and Inspections
Perimeter fence inspections	Check for breaches that could allow airside access to terrestrial animals.	Daily: <ul style="list-style-type: none"> • at last light. • ad hoc intervals during the day. 	ASO	SOP: Daily Aerodrome Inspections SOP: Wildlife Patrols and Inspections
Wildlife patrols (routine)	Check airside areas for wildlife.	As required	ARO	Wildlife Patrol Procedure

Task	Description	Frequency	Responsible	Procedure/Reference
Wildlife patrols (post-strike)	Check airside areas for evidence of wildlife and associated hazards following a strike event.	As required	ARO	Wildlife Patrol Procedure
Post-strike Inspections	Check airside areas for evidence of wildlife and associated hazards following a strike event.	As required	ASO	SOP: Wildlife Strike Reporting
ATC hazard detection	ATC controllers to monitor airside movement areas for wildlife hazards and communicate to ASOs and pilots.	As required	ATC	Manual of Air Traffic Services 2017 – 12.2.2.1.1 SOP: Wildlife Hazard Communication

7.2. Hazard Monitoring

Part 139 MOS 2019 Section: 11.08

(1) The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following:

monitoring wildlife hazards at the aerodrome

assessing any wildlife hazard

(e) for proposed or actual sources of wildlife attraction outside the aerodrome boundary — liaising with the relevant planning authorities or proponents to facilitate wildlife hazard mitigation.

Part 139 MOS 2019 Section: 17.01

(2) The aerodrome operator, in consultation with the local planning authority, must attempt to monitor sites within 13 km of the aerodrome reference point that attract wildlife.

MOS Part 139 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(c) set out the procedures for the following in relation to wildlife hazards:

(ii) monitoring;

(iv) reporting to pilots through the AIP, NOTAM and ATC (if applicable);

(d) specify the liaison arrangements for local planning authorities within a radius of at least 13 km from the aerodrome reference point.

Hazard monitoring collects essential information to identify changes in hazards and risks. It also provides evidence of regulatory conformance and enables efficacy assessments of the WHMP.

MAPL regularly check the airside and landside areas for sources of wildlife attraction including drains, aerodrome infrastructure, grasslands, waste management practices, as well as proposed and existing landscaping. Developments on or in the vicinity of the aerodrome, which include construction or land use changes, are monitored for their wildlife attraction potential.

ASOs complete standardised airside bird counts which are used to monitor trends in bird numbers and hazards. The data is entered into TrackerAIRSIDE™ for further analysis. On behalf of MAPL, consultants perform quarterly off-airport bird counts. Data is entered into the Off-airport Survey Database for analysis, with the results presented in wildlife summary reports. MAPL and Avisure count data are sent to the NQA Business Analyst Programmer (BAP) for storage.

Table 15 outlines YBMK's hazard monitoring. Avisure assesses wildlife monitoring data to update species risk profiles and to assess the effectiveness of management actions.

A Memorandum of Understanding (MOU) is in place between MAPL and Manzelmann's Farm regarding wildlife hazard management and communicating wildlife hazards.

Table 15. Identifying and monitoring wildlife hazards.

Task	Description	Frequency	Responsible	Procedure/Reference
Airside bird counts	Regularly complete standardised bird counts.	Daily	ASO	SOP: Bird Counts
Airside wildlife surveys	Regularly complete standardised wildlife surveys for wildlife info-cards and quarterly summary reports.	Monthly Quarterly	ASO Wildlife Consultant	SOP: Monthly Wildlife Surveys
Off-aerodrome wildlife counts	Regularly complete standardised wildlife counts.	Quarterly	Wildlife Consultant	SOP: Monthly Wildlife Surveys WHMP section 6.4
Consultant wildlife surveys and risk assessment	Regularly complete standardised wildlife surveys and risk assessment.	Quarterly	Wildlife Consultant	SOP: Data Review WHMP section 6 Appendix D

Non-routine hazard monitoring is achieved through a review of on- and off-aerodrome development proposals and land-use changes. This monitoring helps to predict wildlife activity and how it will contribute to the YBMK strike risk.

Table 16. Other monitoring activities.

Task	Description	Frequency	Responsible	Procedure/Reference
Development on MAPL land	Applications for development on MAPL land are assessed for wildlife attraction.	As required	MAO	MAPL AOM Section 11.2.3 Attractions to Birds
Development in the vicinity of YBMK	Liaise with local authorities / landholders to ensure that MAPL (the aerodrome operator) is consulted in development applications or land use planning decisions within 13km of the aerodrome.	As required	MAO	SOP: Wildlife Hazard Management Committee WHMP section 7.2

7.2.1. Department of Environment and Science Flying-fox Surveys

The DES monitors the following flying-fox camps as part of the National Flying-fox Monitoring Program:

- Mackay Cemetery Flying-fox Camp
- Walkerston Flying-fox Camp
- Baker's Creek Island Flying-fox Camp
- Wines Creek Flying-fox Camp
- Eimeo Mangroves Flying-fox Camp.

7.2.2. Avisure Flying-fox Surveys

Avisure monitors of the following flying-fox camps each quarter to evaluate the risk flying-foxes pose to nocturnal operations at YBMK.

- Mackay Cemetery.

7.3. Hazard Communication

Part 139 MOS 2019 Section: 11.08

(1) The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following:

(d) reporting wildlife hazards to aircraft through one or more of the following as applicable: the AIP, NOTAM, air traffic control, UNICOM;

Part 139 MOS 2019 Section: 12.04

(1) Aerodrome operators must report the following reportable occurrences to the NOTAM Office:

any significant increase in, or concentration of, wildlife hazards on or near the aerodrome which constitute a danger to aircraft, unless the wildlife causing the hazard is dispersed immediately.

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(c) set out the procedures for the following in relation to wildlife hazards:

(iv) reporting to pilots through the AIP, NOTAM and ATC (if applicable);

(d) specify the liaison arrangements for local planning authorities within a radius of at least 13 km from the aerodrome reference point.

Part 139 MOS 2019 Section: 17.05 Wildlife hazard reporting

If the presence of wildlife is assessed as constituting an ongoing hazard to aircraft, the aerodrome operator must advise the AIS provider in writing to include an appropriate warning notice in the AIP-ERSA in accordance with Chapter 5 of this MOS.

Without affecting subsection (1), if a wildlife hazard is assessed as being:

- (a) at a higher risk than usual; and
- (b) of a short-term or seasonal nature;

then the aerodrome operator must ensure that a timely NOTAM warning of the hazard is given to pilots using the aerodrome.

Note See CASA Advisory Circular (AC) 139.C-16: Wildlife Hazard Management at aerodromes, as existing from time to time and freely available on the CASA website, for details on what information CASA recommends should be included in the NOTAM.

(3) Without affecting subsection (1) or (2), if a wildlife hazard is assessed as being a serious and imminent threat to aviation safety at an aerodrome, the aerodrome operator must ensure that pilots using the aerodrome are directly advised on CTAF or UNICOM.

Managing the wildlife strike risk requires a cooperative effort amongst key stakeholders communicating the hazard so that appropriate mitigation can be implemented. Communicating wildlife hazards to aircrew increases their awareness, which subsequently informs decision-making that can avoid a strike. In addition, communicating wildlife hazards to aerodrome operators helps inform their awareness, which improves wildlife management practices and provides a safer environment for aircraft operations. Refer to Table 17 for the methods used.

The ASO communicates hazards to ATC who forward the information to aircrew. NOTAMs, ATIS updates, and Wildlife Hazard Notifications (WHNs) are issued in response to significant short-term hazards, and the ERSA is used to communicate long-term, ongoing, and seasonal hazards.

If a wildlife hazard is assessed as being a serious and imminent threat to aircraft operations, ASOs directly advise ATC or via CTAF to communicate the hazards to pilots.

Wildlife hazards are a key agenda item in WHMC meetings. This committee aides the development and implementation of the YBMK WHMP and communication with on- and off-aerodrome stakeholders (refer to Section 7.3.1). Other communication tools include quarterly wildlife hazard reports, monthly wildlife info-cards, and WHMP updates.

Effective hazard communication requires two elements:

1. Clear channels of communication via processes that are efficient, timely and easy to access/receive.
2. Providing notifications that are well-informed, up-to-date, unambiguous, and provide useful information to the intended recipient (i.e. notifications must provide the recipient with sufficient

information to understand the hazards and make decisions. Notifications that simply state that a bird hazard exists do not provide sufficient detail about the hazard to avoid a strike).

Table 17. Hazard communication methods.

Task	Description	Frequency	Responsible	Procedure/Reference
Wildlife hazard notifications	Communicating the wildlife hazard to aircrew and airlines to inform pilots of changed risk levels through direct ATC-pilot communication, NOTAM and ERSA.	As required	ASO	SOP: Wildlife Hazard Communication
NOTAMs	Communicating the wildlife hazard to aircrew and airlines to inform pilots of changed risk levels through direct ATC-pilot communication, NOTAM and ERSA.	As required	ASO	SOP: Wildlife Hazard Communication
Updating ATIS	Communicating the wildlife hazard to aircrew and airlines to inform pilots of changed risk levels through direct ATC-pilot communication, NOTAM and ERSA.	As required	ASO	SOP: Wildlife Hazard Communication
Updating ERSA	Communicating seasonal or ongoing wildlife hazard to aircrew and airlines to inform pilots of changed risk levels through direct ATC-pilot communication, NOTAM and ERSA.	As required	ASO	SOP: Wildlife Hazard Communication
Wildlife quarterly reports	Providing stakeholders with an update of the wildlife strike trends and current wildlife hazard species.	Quarterly	Wildlife Consultant	SOP: Data Review WHMP Quarterly Reports
Wildlife Info-cards	Providing stakeholders with an update of the wildlife strike trends and current wildlife hazard species.	Monthly	Wildlife Consultant	SOP: Data Review Wildlife Monthly Info-cards
WHA reports	Providing stakeholders with an update of the wildlife strike trends and current wildlife hazard species.	5-yearly	Wildlife Consultant	SOP: Data Review WHMP section 8.1 Reviews WHA Report., December 2017

Task	Description	Frequency	Responsible	Procedure/Reference
WHMP update	Providing stakeholders with an update of the wildlife strike trends and current wildlife hazard species.	Annually	Wildlife Consultant	SOP: WHMP Review WHMP section 8

7.3.1. Meetings

Part 139 MOS 2019 Section: 11.08

(1) The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following:

(e) for proposed or actual sources of wildlife attraction outside the aerodrome boundary — liaising with the relevant planning authorities or proponents to facilitate wildlife hazard mitigation.

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(d) specify the liaison arrangements for local planning authorities within a radius of at least 13 km from the aerodrome reference point;

Input from various on- and off-aerodrome stakeholders helps YBMK to achieve an effective and integrated approach to wildlife hazard management. Where required, Mackay Airport's WHMC reviews development proposals on airport land and in the vicinity of the aerodrome for the possibility of creation of undesirable wildlife hazard or attraction as needed. The WHMC liaises with local councils and landowners to ensure the airport is consulted about land uses within the vicinity of the airport that may not be compatible with airport operations. Wildlife hazard management is a standing agenda item for the meetings outlined in Table 18.

Table 18. Meetings.

Task	Wildlife Agenda Description	Frequency	Responsible	Procedure/Reference
Wildlife Hazard Management Committee	WHMP review against Key Performance Indicators, annual report and issues.	Biannually	MAO ATL	SOP: Wildlife Hazard Management Committee WHMP section 2.5

7.4. Wildlife Strike Reporting

Part 139 MOS 2019 Section: 17.05 Wildlife hazard reporting

Note: Reports to the Australian Transport Safety Bureau following a wildlife strike event are also required in accordance with the Transport Safety Investigation Regulations 2003.

YBMK ASOs record wildlife strikes regardless of type (e.g. strike, near miss) or location (e.g. on-airport, off-aerodrome, remote from the aerodrome). YBMK enters all strikes into TrackerAIRSIDE™ and sends reports to the ATSB.

Efforts are made to identify the species involved in strikes. In cases when the collection of biological remains is required, staff strictly adhere to health and safety requirements. Carcasses are stored in a freezer for identification by a wildlife consultant. Stomach contents may be examined for indicators of food attractants on airport. Where only remnants of strike victims are available, material is collected for DNA analysis or feather identification using the Australian Centre for Wildlife Genomics (ACWG) service at the Australian Museum.

YBMK investigate all significant strike incidents.

Table 19. Wildlife Reporting Methods.

Task	Description	Frequency	Who	Procedure/Reference
Report and investigate strikes	Report all strikes, regardless of type or location.	As required	ASO	SOP: Wildlife Strike Reporting
Identify all strikes, process and handle strike remains	Collect struck remains when possible.	As required	ASO	SOP: Wildlife Strike Reporting SOP: Identification and Handling Wildlife Remains SWP: DNA Sampling
Store strike remains that require further analysis	Store strike remains in a designated freezer where further analysis of the remains is required (e.g. carcass evaluation, DNA analysis).	As required	ASO	SOP: Wildlife Strike Reporting SOP: Identification and Handling Wildlife Remains SWP: DNA Sampling

7.5. Data Management

Part 139 MOS 2019 Section: 17.02 (3)

(1) Any detected wildlife hazard must be assessed for its potential risk to aircraft operations.

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(c) set out the procedures for the following in relation to wildlife hazards:

(iii) risk assessment and analysis;

Wildlife strike and survey data are maintained electronically to easily identify trends in strikes and in wildlife activity. Strike and survey data are used to complete risk assessments to identify high and moderate risk species. This data is used in routine reporting which ensures all staff and managers are equipped with the information needed to adapt hazard management activities and the WHMP when required.

Table 20. Data management methods.

Task	Description	Frequency	Who	Procedure/Reference
Reporting	Report on wildlife strike and airside activity.	Monthly Quarterly Annually	Wildlife Consultant	SOP: Wildlife Hazard Communication WHMP section 2.6
Data management	Electronically store wildlife data (e.g. surveys, strikes, dispersal) to monitor program progress and identify trends.	Weekly Monthly	MAO, ATL, BAP and Wildlife Consultant	SOP: Data Review WHMP section 2.6
Review data and program trends	Review the data to analyse trends.	Annually	MAO, ATL and Wildlife Consultant	SOP: Data Review SOP: WHMP Review WHMP section 2.6 and section 8

7.6. Hazard Mitigation

Part 139 MOS 2019 Section: 11.08

(1) The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following:

(c) mitigating any wildlife hazard

Part 139 MOS 2019 Section: 11.11 The aerodrome manual must contain the procedures for preventing the unauthorised entry onto the movement area (airside) of persons, vehicles, equipment, mobile plant or animals (including land-based wildlife) or other things that may endanger aircraft safety, including procedures for the following:

controlling airside access;

MOS Part 139 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(e) set out the aerodrome operator's strategy for wildlife hazard reduction;

Part 139 MOS 2019 Section: 17.06 Wildlife hazard mitigation

The aerodrome operator must implement controls to mitigate wildlife hazard risks within the boundary of the aerodrome.

Note 1 For the management of hazards outside of the aerodrome boundary, see subsection 17.01 (2) and paragraph 17.04 (2) (d).

Note 2 For the management of hazards from land-based wildlife CASA recommends continuous fencing around the aerodrome boundary, or otherwise containing the movement area.

Strategies for managing wildlife hazards typically focus on managing populations on and surrounding the aerodrome. Management actions are classified as either:

1. Active management – directly removing or reducing the numbers of wildlife; and
2. Passive management – modifying habitats or other aspects of the environment to indirectly remove or reduce the number of wildlife.

7.6.1. Active management

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(c) set out the procedures for the following in relation to wildlife hazards:

(v) mitigation, including passive and active strategies; and

Active management methods employed at YBMK include wildlife dispersal and lethal control. Animals are not culled unless there is an immediate danger to essential facilities or to the safety of an aircraft. All care is taken to ensure that the lethal control of wildlife is a last resort, and this option is only used after all other non-lethal harassment measures have been ineffective.

Wildlife hazard levels and aircraft movements determine the frequency and intensity of active management. The overall objective is to separate aircraft and wildlife which is achieved by influencing wildlife or aircraft to minimise the likelihood of occupying the same airspace at the same time. Refer to Table 21 for the methods used.

Hazard removal actions and their outcomes are important sources of information. The ASO records all dispersal and lethal control actions and their outcomes in TrackerAIRSIDE™, as required by the MAO. This provides a historical record for comparison and analysis and may provide evidence of adequate wildlife hazard management in the event of litigation.

Table 21. Active management methods.

Task	Description	Frequency	Responsible	Procedure/Reference
Wildlife dispersal	Using tools and techniques to harass birds from the airside area, prioritising the critical aircraft movement areas.	In response to hazards	ASO	SOP: Wildlife Culling including Egg and Nest Removal SOP: Wildlife Dispersal SWP: Firearm Use SWP: Gas Cannon Operation
Wildlife lethal control	Using lethal control (under permit) to manage immediate and significant strike risks.	In response to hazards	ASO	SOP: Wildlife Culling including Egg and Nest Removal SWP: Firearm Use
Wildlife egg and nest removal	Under permit, destroy/relocate nests and use lethal control to manage immediate and significant risks.	As required	ASO	SOP: Wildlife Culling including Egg and Nest Removal
Handling wildlife carcasses and other remains	Safe handling practices to manage wildlife remains, and how to process for forensic analysis.	As required	ASO	SOP: Identification and Handling of Wildlife Remains
Airside vertebrate pest control	Shooting of vertebrate pests.	As required	ASO	SOP: Wildlife Dispersal SWP: Firearm Use
Safe use of firearms	Use and maintenance of firearms for dispersal and lethal control.	As required	ASO	SWP: Firearm Use

7.6.2. Passive management

Part 139 MOS 2019 Section: 6.22 (3) Effective drainage (but not involving open drains) must ensure that water does not pool or pond in the graded area of a runway strip.

Part 139 MOS 2019 Section: 17.04

(2) The wildlife hazard management plan must at least:

(c) set out the procedures for the following in relation to wildlife hazards:

(v) mitigation, including passive and active strategies;

Passive management aims to manage wildlife hazards by preventing access to food and other resources. YBMK uses a range of methods to passively manage risks, including a full security fence to prevent access by terrestrial threats such as wallabies. YBMK manipulates grass height and overall landscaping to reduce the availability of food and shelter.

Table 22. Passive management methods.

Task	Description	Frequency	Responsible	Procedure
Airside grass management	Mow grass	As required	Grounds Maintenance	SOP: Habitat and Land Management YBMK Mowing Plan Map (Figure 22)
	Inspect airside gates	As required	ASO	SOP: Wildlife Patrols and Inspections SOP: Daily Aerodrome Inspections YBMK Gate Map
Landscape management	Landscaped areas (e.g. gardens, trees, etc.) are managed to reduce the attraction to hazardous species.	As required	MAPL	SOP: Habitat and Land Management Landscaping Guidelines 2008
Vegetation management	Vegetated areas are managed to reduce the attraction to hazardous species.	As required	MAPL	SOP: Habitat and Land Management Landscaping Guidelines 2008

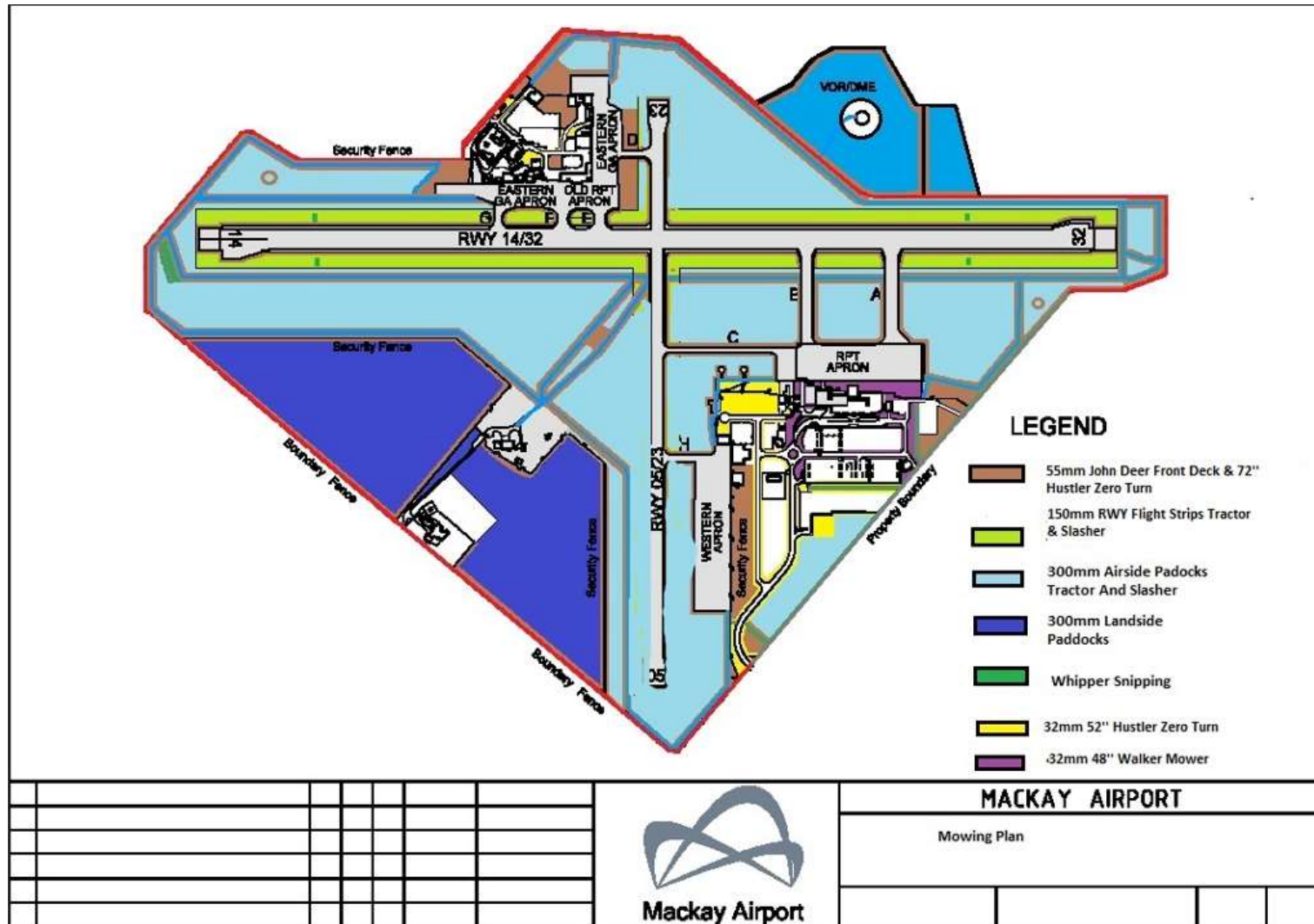


Figure 22. Mackay Airport grass mowing map.

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7.6.3. Species Action Plans

Species Action Plans (SAP) support the WHMP and provide the actions required by YBMK to manage the following high and moderate risk species identified in the annual wildlife risk assessment (refer to Section 6.1). SAPs for the following species are provided in a separate document:

1. Bush Stone-curlew
2. Australian White Ibis
3. Wandering Whistling-duck
4. Feral Pigeon
5. Magpie Goose
6. Royal Spoonbill
7. Masked Lapwing
8. Pacific Black Duck
9. Plumed Whistling Duck
10. Rainbow Lorikeet
11. Black Kite
12. Unidentified Flying-fox
13. Unidentified Snake
14. Australian Pelican
15. Unidentified Kite
16. Black Flying-fox
17. Torresian Crow
18. Straw-necked Ibis
19. Cattle Egret
20. Red-tailed Black-cockatoo
21. Whistling Kite
22. Australian Magpie
23. Eastern Great Egret
24. Galah
25. Channel-billed Cuckoo

8. Safety Assurance

Part 139 MOS 2019 Section: 17.01

(3) The aerodrome operator must:

- (a) implement the wildlife hazard management plan; and
- (b) keep the plan under continuous review.

(4) For subsection (3), a review of the wildlife hazard management plan must be conducted in each of the following circumstances:

- (a) if an aircraft experiences multiple wildlife strikes;
- (b) if an aircraft experiences substantial damage following any wildlife strike;
- (c) if an aircraft experiences an engine ingestion of wildlife;
- (d) if the ongoing presence of wildlife is observed on the aerodrome in size or in numbers reasonably capable of causing an event mentioned in paragraph (a), (b) or (c);
- (e) at least every 12 months, but if during a period of 12 months the plan was reviewed under paragraph (a), (b), (c) or (d), at least every 12 months after that review.

The MAO is responsible for ensuring successful WHMP implementation. This is achieved by managing change, continually improving the program and WHMP, and regularly assessing progress against the objectives to ensure it remains suitable and effective.

Mackay Airport continually evaluates compliance to legislation, policies, and procedures through quarterly and annual program assessments. Refer to Table 23 for methods used.

The WHMP is reviewed annually to ensure it remains effective and is updated to satisfy requirements. CASR Part 139 MOS requires an annual WHMP review as part of each aerodrome technical inspection. A suitably qualified aviation biologist with experience in aviation wildlife risk management undertakes the review. Refer to Table 23 for the methods used.

In addition to annual reviews, the WHMP review is triggered by:

- a) An aircraft experiences a multiple wildlife strike event;
- b) An aircraft experiences substantial damage following any wildlife strike;
- c) An aircraft experiences an engine ingestion of wildlife;
- d) If ongoing presence of wildlife observed on the aerodrome in size or numbers reasonably capable of causing a multiple strike, substantial damage, or an engine ingestion.

Reviews may also be triggered:

- By a significant change in wildlife activity or strike rate;
- By a strike or series of strikes involving rare, threatened or endangered species²⁵;
- Following a major weather event;
- In response to organisational restructure, or operational or personnel changes;
- At the request by DES, or other environment departments, or airlines;
- At the discretion of CASA or MAO.

Table 23. Review Methods.

Task	Description	Frequency	Responsible	Procedure
Program progress reports	Summary reports that overview current hazards, identify issues requiring attention, and comment of program progress.	Quarterly	Wildlife Consultant	SOP: Data Review SOP: WHMP Review WHMP section 6
WHMC reporting	Deliver a presentation to the WHMC summarising WHMP progress.	Biannually	MAO ATL ASO Wildlife Consultants	SOP: Wildlife Hazard Management Committee WHMP section 2.5 and section 8
WHMP update	Review and audit the WHMP.	Annually	MAO ATL ASO Wildlife Consultants	SOP: WHMP Review WHMP section 8
Major review	Review program against Key Performance Indicators, legislation and audit practices against procedures.	Every five years	MAO ATL ASO Wildlife Consultants	SOP: WHMP Review WHMP section 8

²⁵ The Environment Protection and Biodiversity Conservation Act 1999 establishes processes that help protect threatened species and promote their recovery. Within the context of wildlife hazard management on airports, of consideration is the effect that management actions may have on threatened species. If a threatened species is struck, a review of the WHMP and associated procedures and management actions is required as it may require departmental approval and consultation.

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8.1. Audits

8.1.1. Internal Audits

Internal audits form part of the YBMK audit program. These audits aim to evaluate and check all data, equipment, and procedures to ensure regulatory compliance and to identify any program gaps. A suitably qualified aviation biologist with experience in aviation wildlife risk management undertakes the review with the MAO. Based on the *CASA Advisory Circular (AC) 139-26 (0) Wildlife Hazard Management at Aerodromes*, audits focus on:

- evaluating the accuracy of identifying and monitoring of the wildlife hazard
- reviewing the hazard and rank of wildlife species risks
- evaluating the effectiveness of passive and active control measures
- reviewing the implementation of the WHMP and monitoring its effectiveness
- assessing the efficacy of the SOPs
- cross-checking program performance against benchmarks, objects, and targets
- reviewing the adequacy of training provided to wildlife management personnel.

Findings of these audits are used to modify practices and procedures to improve any deficiencies identified and incorporated into future WHMP reviews.

8.1.2. External Audits

In addition to internal audits, external audits are used as an independent evaluation of the program to improve any deficiencies or non-compliances.

Airlines, CASA, and/or aviation consultants may complete external audits. Audit findings help guide the wildlife management program.

8.1.3. Damage Mitigation Permit: Audit Reports

As a Strategic Airport listed under the Queensland State Planning Policy, YBMK does not require a Damage Mitigation Permit to take wildlife (in accordance with the Nature Conservation (Animals) Regulation 2020), and is required to submit Return of Operations reports to DES provided preconditions are met (refer to Section 2.1.1). YBMK collect all humane taking of wildlife activities in TrackerAIRSIDE™.

9. Procedures

MOS Part 139 2019 Section: 17.04

- (2) The wildlife hazard management plan must at least:
- (c) set out the procedures for the following in relation to wildlife hazards:
- (i) detection;
 - (ii) monitoring;
 - (iii) risk assessment and analysis;
 - (iv) reporting to pilots through the AIP, NOTAM and ATC (if applicable);
 - (v) mitigation, including passive and active strategies;

SOPs and SWPs detail the correct and safe implementation of WHMP tasks and responsibilities. These procedures are available through SharePoint. The following procedures are provided separately:

- Wildlife Patrols and Inspections SOP
- Wildlife Strike Reporting SOP
- Wildlife Culling including Egg & Nest Removal SOP
- Wildlife Dispersal SOP
- Identification and Handling of Wildlife Remains SOP
- Bird Counts SOP
- Daily Aerodrome Inspections SOP
- WHMP review SOP
- Wildlife Hazard Management Training and Competency Assessment
- Firearm Use SWP
- DNA Sampling SWP
- Wildlife Hazard Management Committee SOP
- Monthly Wildlife Surveys SOP
- Wildlife Hazard Communication SOP
- Data Review SOP
- Gas Cannon Operation SWP
- Habitat and Land Management SOP

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Appendices

Appendix A: Legal and Other Requirements

Appendix B: Roles and Responsibilities

Appendix C: Wildlife Hazard Management Committee Members

Appendix D: Risk Assessment Methods

Appendix E: Avisure Survey Methods

Appendix F: Off-aerodrome NASF Risks

Appendix A: Legal and Other Requirements

Australian Context

Australia's Civil Aviation Safety Authority (CASA) enacts and enforces the Civil Aviation Safety Regulations 1998. Managing wildlife on and around airports must consider a suite of legislative and regulatory requirements. The following tables summarises these requirements.

Table A1. Australian aviation legislation and standards.

Instrument	Body/Department	Description	Link
<i>Civil Aviation Act 1998</i>	CASA	Establishes CASA functions in relation to civil aviation, with a particular emphasis on safety.	https://www.legislation.gov.au/Details/F2021C00238
Civil Aviation Safety Regulations 1998	CASA	Details Commonwealth legislation regarding all aspects of civil aviation safety and establishes the regulatory framework. Part 139 (Aerodromes) contains specific requirements for wildlife hazard management.	
Part 139 Aerodromes Manual of Standards (MOS) (2019)	CASA	Part 139 prescribes the aerodrome requirements. Sections relevant to wildlife hazard management focus on: bird hazard information for the Aeronautical Information Package (AIP) (5.17, 17.05.1); bird hazard information for the Aerodrome Manual (AM) (11.08, 11.11); drainage and drains in the runway strip (6.22.3); requirements for serviceability inspections (12.03, 17.01); Notice to Airman (NOTAM) requirements for bird hazards (5.17, 12.04, 17.05.2); bird strike report (17.01.3, 17.05.3), Reporting Officer responsibilities and training (17.06, 17.07), animal hazard management requirements (17.01, 17.02, 17.06); requirements for the wildlife hazard management plan (17.02.3, 17.03, 17.04); and requirements for bird hazard information in the safety management system (17.02.2, 25.03.4).	https://www.legislation.gov.au/Details/F2020C00797

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Instrument	Body/Department	Description	Link
Advisory Circular (AC) 139-26(0) Wildlife Hazard Management at Aerodromes	CASA	The AC is intended to provide recommendations and guidance for Part 139 compliance, by providing interpretative and explanatory material to assist aerodromes.	https://www.casa.gov.au/files/139c26pdf
<i>Transport Safety Investigation Act 2003</i>	ATSB	Wildlife strikes are defined as reportable matters, of which written reports must be submitted within 72hrs.	https://www.legislation.gov.au/Details/C2016C00617
Transport Safety Investigation Regulations (Voluntary and Confidential Reporting Scheme) Regulation 2012	ATSB		https://www.atsb.gov.au/media/48094/tsi_act_regs.pdf
Transport Safety Investigation Regulations 2021	ATSB		https://www.legislation.gov.au/Details/F2021L01248
National Airports Safeguarding Framework Guideline C	Department of Infrastructure and Regional Development ²⁶	<p>Aims to develop informed land use planning decisions to safeguard airports and their adjacent communities from wildlife hazards based on the international and national regulatory framework.</p> <p>The NASF allocates risk categories to incompatible land uses (very low to high), adhering to ICAO guidelines relative to radial distances from aerodromes, and recommends actions (incompatible, mitigate, monitor, no action) for both existing and proposed developments.</p>	https://www.infrastructure.gov.au/sites/default/files/documents/3.1.4_Guideline_C.pdf

²⁶ Formerly the Department of Infrastructure and Transport.

Land Use	Wildlife Attraction Risk	Actions for Existing Developments			Actions for Proposed Developments/ Changes to Existing Developments		
		3 km radius (Area A)	8 km radius (Area B)	13 km radius (Area C)	3 km radius (Area A)	8 km radius (Area B)	13 km radius (Area C)
Agriculture							
Turf farm	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Piggery	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fruit tree farm	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fish processing /packing plant	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Cattle /dairy farm	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Poultry farm	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Forestry	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Plant nursery	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Conservation							
Wildlife sanctuary / conservation area - wetland	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Wildlife sanctuary / conservation area - dryland	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Recreation							
Showground	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Racetrack / horse riding school	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Golf course	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sports facility (tennis, bowls, etc)	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Park / Playground	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Picnic / camping ground	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Commercial							
Food processing plant	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Warehouse (food storage)	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Fast food / drive-in / outdoor restaurant	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Shopping centre	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Office building	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Hotel / motel	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Car park	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Cinemas	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Warehouse (non-food storage)	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Petrol station	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Utilities							
Food / organic waste facility	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - landfill	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - transfer station	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Non-putrescible waste facility - landfill	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Non-putrescible waste facility - transfer station	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sewage / wastewater treatment facility	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Potable water treatment facility	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action

Figure A1. NASF Guideline.

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Table A2. Australian legislation and standards.

Instrument	Body/Department	Description	Link
<p><i>Environment Protection and Biodiversity (EPBC) Act 1999</i></p>	<p>Commonwealth Department of Environment</p>	<p>The EPBC Act provides the framework for the protection of the Australian natural environment and its biodiversity and establishes processes that help to protect threatened species and ecological communities, and as well as promoting their recovery. Within the context of wildlife hazard management on airports, of principal consideration is the effect management actions, such as dispersal and lethal control, may have on threatened species. The management of species listed as either Critically Endangered, Endangered, Vulnerable or Conservation Dependent under the Act, may require Departmental approval and Airports may need to consult the Department for clarification.</p> <p>Whether an action is likely to impact upon animal species that are rare, endemic or otherwise valuable, such as listed threatened species and listed migratory species, either directly or on their feeding, nesting, breeding areas is of particular importance. Direct mortality of these species or removal of their habitat to remove or minimise hazards is undesirable but may be necessary where the risk to safety is deemed too significant. Each situation requires specific evaluation (see EPBC Referral Guidelines).</p> <p>The EPBC Act also identifies species protected under the various international migratory bird treaties (detailed next).</p>	<p>http://www.environment.gov.au/epbc</p> <p>https://www.legislation.gov.au/Details/C2018C00440</p>
<p>Japan-Australia Migratory Bird Agreement (JAMBA)</p>	<p>Commonwealth Department of Environment</p>	<p>Agreement between Australia and Japan to conserve migratory birds and their habitats. Wildlife species listed under international agreements afford them legislative protection in order to maintain populations and individuals.</p>	<p>http://www.austlii.edu.au/au/other/dfat/treaties/1981/6.html</p>

Instrument	Body/Department	Description	Link
China-Australia Migratory Bird Agreement (CAMBA)	Commonwealth Department of Environment	Agreement between Australia and China to conserve migratory birds and their habitats. Wildlife species listed under international agreements afford them legislative protection in order to maintain populations and individuals.	http://www.austlii.edu.au/au/other/dfat/treaties/1988/22.html
Korea-Australia Migratory Bird Agreement (ROKAMBA)	Commonwealth Department of Environment	Agreement between Australia and the Republic of Korea to conserve migratory birds and their habitats. Wildlife species listed under international agreements afford them legislative protection in order to maintain populations and individuals.	http://www.austlii.edu.au/au/other/dfat/treaties/2007/24.html
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Commonwealth Department of Environment	Wildlife species listed under international conventions afford them legislative protection in order to maintain populations and individuals.	http://www.cms.int/
<i>The Commonwealth Work Health and Safety Act 2011</i>	Commonwealth Department of Health	Identifies work health safety legislation and codes of practice relevant to wildlife hazard management, including in off-base locations. Depending on the nature and location of the wildlife hazard and the proposed response, the following may be relevant: <ul style="list-style-type: none"> • Work Health and Safety Act 2011 • Work Health and Safety Regulations 2011 • AS/NZS 4360 series (Risk Management) • AS/NZS 4801 series (Occupational Health and Safety Management) • SafetyMan series. 	http://www.agriculture.gov.au/animal/welfare/aaws
Australian Animal Welfare Strategy		Developed to ensure the humane treatment of all animals in Australia. The Strategy:	https://www.legislation.gov.au/Details/C2013C00130

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Instrument	Body/Department	Description	Link
		<ul style="list-style-type: none"> Provides an assessment of the relative humaneness of pest-animal control methods. Provides SOPs that detail animal welfare impacts for target and non-target species and describe techniques and their application, as well as considering health and safety. A model SOP for each of the key pest animal species provides general information on best practice management, control strategies, species biology and impact, and the humaneness of current control methods. 	

Table A3. Relevant Codes of Practice.

State	Code Name	Authority	Link
Commonwealth	National Codes of Practices (Commercial and Non-Commercial) for the Human Shooting of Kangaroos and Wallabies.	Department of the Environment	https://www.awe.gov.au/biosecurity-trade/wildlife-trade/publications/national-code-practice-humane-shooting-kangaroos-and-wallabies-non-commercial
	Model Codes of Practice and Standard Operating Procedures for the humane capture, handling or destruction of feral animals in Australia.	Department of the Environment	http://www.environment.gov.au/biodiversity/invasive-species/publications/model-codes-practice-feral-animals

Off-aerodrome Hazards

Table A4. Summary of Australian regulatory and legislative requirements and recommendations for managing off-aerodrome wildlife hazards.

Regulation / Standard	Requirement
CASA MOS Part 139 (2019). Section 11.08 (4)	The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for proposed or actual sources of wildlife attraction outside the aerodrome boundary – liaising with the relevant planning authorities or proponents to facilitate wildlife hazard mitigation.
CASA MOS Part 139 (2019). Section 17.01 (1) (b)	As part of the aerodrome serviceability inspection, the aerodrome operator must monitor and recorded wildlife activity that is visible in the vicinity of the aerodrome or from the aerodrome.
CASA MOS Part 139 (2019). Section 17.01 (2)	The aerodrome operator, in consultation with the local planning authority, must attempt to monitor sites within 13 km of the aerodrome reference point that attract wildlife.
CASA MOS Part 139 (2019). Section 17.04 (2) (b)	The wildlife hazard management plan must at least identify sources and locations of wildlife attraction on the aerodrome and in the vicinity of the aerodrome which are likely to cause wildlife to transit the take-off, approach and transitional surfaces.
CASA MOS Part 139 (2019). Section 17.04 (2) (d)	The wildlife hazard management plan must at least specify the liaison arrangements for local planning authorities within a radius of at least 13 km from the aerodrome reference point.
CASA AC 139:26 2011. Section 9.4.1	The monitoring of wildlife in the vicinity of the aerodrome should cover any obvious concentrations of wildlife and/or sources of wildlife attraction (i.e. habitat, migratory routes, feeding and breeding areas etc.) which contribute to the risk at the aerodrome.

Regulation / Standard	Requirement
CASA AC 139:26 2011. Section 6.1.1	<p>For wildlife hazards in the aerodrome vicinity which contribute to the risk but are outside the control of the aerodrome operator (i.e. on land located outside the aerodrome boundary), it is expected that the aerodrome operator will:</p> <ul style="list-style-type: none"> • advise the relevant landowner(s) or controlling authority of both the nature of the wildlife hazard and the resultant impact on the aerodrome • work with the relevant landowner(s) or controlling authority to manage the wildlife hazard.

International Context

Australia has international obligations as a contracting state to the International Civil Aviation Organization (ICAO). As a signatory of the Convention on International Civil Aviation, Australia is required to maintain aviation rules that align with the requirements of the Convention. This includes standards for wildlife hazard management at civilian airports in accordance with Annex 14, Volume 1 (Aerodrome Design and Operation), which establishes requirements for the management of collisions between wildlife and aircraft and requires authorities to take actions to reduce the prevalence of wildlife attracting sites in the vicinity of airports. ICAO's regulations and standards inform CASA regulations and recommendations for wildlife management at airports.

Table A5. International regulations and standards.

Instrument	Body/Department	Description	Link
ICAO Annex 14, Volume 1 (Aerodrome Design and Operation)	ICAO	Establishes requirements for the management of collisions between wildlife and aircraft and requires authorities to take actions to reduce the prevalence of wildlife attracting sites in the vicinity of airports.	Not available
ICAO Airport Services Manual Doc. 9184: Part 2 Land Use and Environmental Control	ICAO	Provides airport personnel with guidance on land use planning within the vicinity of aerodromes, and the need for good planning and control measures. It focusses on how the airport impacts on its surroundings, and vice versa, with regard to people, flora, fauna, the atmosphere, water courses, air quality, soil pollution, rural areas, and the environment in general. It frequently discusses the significance of how some land use in the vicinity of airports, such as landfills, can influence an airports strike risk profile. Appendix 2, Land-use Guidelines for the Avoidance of Bird Hazards, is particularly useful however it does remind readers that ... "Any land use that had the potential to attract birds in the airport vicinity should be subject of a study to determine the likelihood of bird strikes to aircraft using the airport".	Not available
ICAO Doc 9137 - Airport Services Manual Part 3, Wildlife Control and Reduction, (2012)	ICAO	Elaborates on the wildlife management responsibilities of airports, providing guidance on the development and implementation of effective airport wildlife management programs. It includes recommendations on hazard review and habitat management and identifies a recommended boundary for monitoring off-aerodrome wildlife hazards and land uses.	http://www.birdstrike.org/wp-content/uploads/2014/10/ICAO-AirportServicesManual-Part3-FourthEdition-2012.pdf
Bird Strike Guidelines	International Air Transport Association	Recommend the correct way to handle animal remains.	https://www.iata.org/whatwedo/safety/health/Documents/health-guidelines-bird-strike-2011.pdf

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Instrument	Body/Department	Description	Link
International Best Practice Standards for Airport Bird Control	World Birdstrike Association (previously the International Bird Strike Committee)	Provides a series of standards relevant to all aspects of integrated wildlife hazard management programs on- and off- airports.	http://worldbirdstrike.com/index.php/resources/publications/ibsc-best-practices-manual

ICAO and Off-aerodrome Hazards

Within the context of wildlife hazards, ICAO defines the airport vicinity into two radial distances from the Airport Reference Point (ARP); Area A being 3 km, and Area B being 8 km. These distances have been based in the known activity of birds, in general, aligned with standard aircraft flight paths around airports. Within these distances, ICAO provides land-use guidelines for acceptable and unacceptable land uses). ICAO also indicate that the placement of food waste landfills within 13km of and aerodrome is of concern.

Furthermore, the International Bird Strike Committee's Best Practice Standards (2006) recommend the establishment of a 13 km circle from the ARP, within which an inventory of wildlife hazards should be established, and risk assessments completed to determine the level of contribution to the strike risk.

Table A6. ICAO Land Use Guidelines for the Avoidance of Bird Hazards (Source: ICAO Doc 9184, Appendix 2).

Land Use	Area A	Area B	Land Use	Area A	Area B
Agriculture			Commercial*		
Landscape nurseries*	YES	YES	Offices	YES	YES
Tree farming*	YES	YES	Retail sales	YES	YES
Stock farming*	YES	YES	Hotels and motels	YES	YES
Dairy farming*	YES	YES	Restaurants	YES	YES
Sod farming	NO	YES	Parking lots	YES	YES
piggeries	NO	YES	Indoor theatres	YES	YES
Fruit tree farming	NO	YES	Warehouses	YES	YES
			Shopping centres	YES	YES
Wildlife Sanctuaries			Service stations	YES	YES
Bird sanctuaries	NO	NO	Cemeteries	YES	YES
Game reserves	NO	NO	Drive-in restaurants	NO	YES
			Food-processing plants	NO	YES
Recreational					
Golf courses*	YES	YES	Municipal Utilities		
Parks*	YES	YES	Water treatment	YES	YES
Playgrounds*	YES	YES	Non-food garbage landfill	YES	YES
Athletic fields*	YES	YES	Food garbage disposal	NO	NO
Riding fields*	YES	YES	Source: ICAO Doc 9184 (originally sources from Transport Canada Land use in the Vicinity of Airport) *These are general guidelines for planning and land-use zoning only. The avoidance of bird hazards during airport operations is another subject that can involve special controls to keep land free from food and shelter for birds		
Tennis, lawn bowling*	YES	YES			
Picnic and campgrounds	YES	YES			
Riding academies	NO	YES			
Racetracks	NO	YES			
Fair grounds	NO	YES			

Appendix B: Roles and Responsibilities

In order to facilitate effective management of the bird and wildlife risks, roles and responsibilities for the implementation and preparation of the WHMP are outlined in this section.

Table B1. WHMP roles and responsibilities, YBMK.

Position	Responsibilities
Manager Aviation Operations (MAO)	Endorse the final WHMP.
	Provide resources for implementing the WHMP.
	Attend the annual WHMC meetings or delegate a representative.
	Oversee the implementation and review of the WHMP.
	Ensure ASOs are trained and competent in the functions required for wildlife hazard management, including inspections, wildlife counts, wildlife identification, wildlife harassment and reporting techniques.
	Issue the WHMP and procedures to relevant staff and ensure implementation.
	Ensure ASOs and other relevant YBMK staff adhere to the procedures and actions detailed in the WHMP.
	Liase with aircraft operators, local government and other stakeholders to assist in identifying and managing wildlife issues. Invite relevant external stakeholders to WHMC meetings to assist with wildlife management at off-aerodrome sites.
	Ensure the YBMK Aerodrome Manual includes references to relevant sections of the WHMP.

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Position	Responsibilities
Manager Aviation Operations (MAO)	Provide information regarding wildlife hazards and their management at YBMK to regulatory authorities and operational publications as required.
	Coordinate interactions with WHMC stakeholders for the management of land use surrounding the airport.
Aviation Team Leader (ATL)	Ensure that all SOPs contained in the WHMP involving ASOs are implemented.
	Review of the WHMP at least annually, particularly the SOPs. Forward any recommended modifications to the MAO.
	Ensure ASOs monitor, inspect, assess, record and report as described in the WHMP.
	Ensure that the ASOs are trained and competent in the functions required for wildlife hazard management, including wildlife surveys, wildlife identification, and wildlife dispersal and reporting techniques.
	Ensure that ASO training records are maintained, up to date, and kept for at least three years.
	Provide technical presentations and advice to WHMC meetings.
	Coordinate training for personnel assigned to conduct wildlife harassment with appropriate firearms certification.
Aerodrome Safety Officers (ASO)	Provide live wildlife hazard notifications.
	Inspect, assess, record and report as described in the relevant sections of the WHMP and SOPs.
	Manage wildlife and their habitats as described in the relevant sections in the WHMP and adhere to SOPs.

Position	Responsibilities
Aerodrome Safety Officers (ASO)	Attend wildlife hazard management training as required.
	Use, store and maintain firearms and ammunition as required by YBMK's firearms policy and procedures.
	Record management actions as per SOPs.
	Report bird strikes.
	Maintain the database detailing species and number of wildlife culled.
	Collect and maintain dispersal data, including ammunition use.
	Coordinate with aircrews and ground support personnel the collection of all strike remains and assist with species identification.
	Collect and store wildlife carcasses from strikes for identification and arrange carcass disposal.
	Provide input in the revision of the WHMP and SOPs.
	Attend the WHMC meetings.
Grounds Maintenance	Ensure that all mowing practices align with the WHMP.
	Ensure all vegetated areas, drainage systems and any bird deterrent measures are maintained.
	Maintain all perimeter fences and gates.

Position	Responsibilities
Environment Manager	Provide advice regarding environmental matters.
	Prepare wildlife strike data and depredation data, and monitor species risk and hazards.
	Ensure that the WHMP's principles are consistent with the YBMK's Environmental Management System.
	Ensure compliance with permit conditions.
	Where necessary, assist with the management and control of birds and other wildlife in occupied buildings and hangars.
	Regularly review waste management practices at the airport to secure food and waste attractants away from wildlife.
Aircraft Operators	Require air and ground crews to promptly inform ASOs of all wildlife strikes or hazardous conditions.
	Require ground staff to relay evidence of strikes including damage, carcasses, feathers, or other material to ASOs for collection.
	Provide details of strikes to ATL.
	Maintain awareness of the WHMP and forward recommendations to MAO.
	Where appropriate, consider changing operations to avoid hazardous times and locations.
	Attend WHMC meetings.

Position	Responsibilities
Airport Tenants	Ensure waste is disposed of appropriately and bins and other waste storage facilities are maintained with closed lids or other suitable covering wherever practicable.
	Report observations of bird nesting in any infrastructure to ATL.
	Attend WHMC meetings.
Wildlife Hazard Management Committee (WHMC)	Meet biannually.
	Share information, identify risks and ensure stakeholders are engaged in collaborative management of these risks.
	Discuss relevant wildlife issues and management practices.
	Review and approve the WHMP.
	Review bird strike reports, cull reports, bird count reports, and overall strike statistics and discuss strategies for improvement as required.
	Review performance against Key Performance Indicators (KPIs).
	Discuss on- and off-aerodrome strategies to manage wildlife hazard.

Table B2. Qualifications and experience of personnel responsible for the development and implementation of the WHMP.

Name	Experience	Position	Qualifications, Licences etc.
YBMK staff responsible for the development and implementation of the WHMP			
Phillip Clark	39 years	Manager Aviation Operations	CASA DAMP Supervisor QLD Firearms Licence CAT A/B/C & H QLD Firearms Group Licence Holder CAT A/B/C & H Construction Industry Blue Card Aerodrome Radio Operators Certificate Aviation Safety Management Systems Course (South Pac Aerospace) Security Contact Officer (Mackay Airport) Relevant Experience: 9.5 years Air Traffic Services (NZ) 10 years Airport Reporting Officer / Works Safety Officer (Wellington Airport) 20 years Aviation Operations Management (Wellington New Zealand, Cairns and Mackay)
Shane Hokins	17 Years	ASO	Qualifications: Certificate of Attainment – ARO/WSO Course Trade Qualification – Boilermaker Certificate III in Horticulture QLD Firearms Licence CAT A/B/C & H QLD Drivers Licence, Class HC

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Name	Experience	Position	Qualifications, Licences etc.
Shane Hokins	17 Years	ASO	<p>Construction Industry Blue Card</p> <p>Relevant Experience:</p> <p>13 years Airport Reporting Officer / Works Safety Officer (Mackay Airport).</p> <p>16 years Mackay Airport.</p>
Brandon Ford	35 years	ASO	<p>Qualifications:</p> <p>Certificate IV Training and Assessment.</p> <p>Certificate III in Aquaculture.</p> <p>Trade Qualification - Electrician.</p> <p>QLD Firearms Licence CAT A/B/C & H</p> <p>QLD Drivers Licence, Class C</p> <p>Commercial Pilots Licence, Instructor, and Instrument Ratings.</p> <p>Construction Industry White Card</p> <p>Relevant Experience:</p> <p>8 years Airport Reporting Officer / Works Safety Officer (Mackay Airport).</p> <p>34 years General Aviation.</p> <p>16 years Air Services Australia</p>

Name	Experience	Position	Qualifications, Licences etc.
Dale Parker	11 years	ASO	<p>Qualifications:</p> <p>Certificate IV in Frontline Management BSB40807</p> <p>Certificate of Attainment – ARO/WSO Course</p> <p>QLD Firearms Licence CAT A/B/C & H</p> <p>QLD Drivers Licence, Class C</p> <p>Construction Industry White Card</p> <p>Relevant Experience:</p> <p>10 years Airport Reporting Officer / Works Safety Officer (Mackay, Hamilton Island Airport).</p>
Avisure Consultants involved in the development of the 2020/21 WHMP			
Alexandra Stone Wildlife Biologist	5 years	Author, Wildlife surveys, Data analysis and GIS mapping	<ul style="list-style-type: none"> • Bachelor of Applied Science (Wildlife Science), University of Queensland 2016 • Certificate II in Animal Studies, Australian Agricultural College Corporation 2011 • Certificate II in Information Technology, John Paul College 2010 <p>Relevant Experience</p> <p>Worked on projects for Changi International, Seletar, Gold Coast, Ballina-Byron Gateway, Sunshine Coast, Brisbane, Rockhampton, Mackay, Whitsundays, Hawke's Bay, Western Sydney and Sydney Airport's and the New Zealand Defence Force. Projects include wildlife hazard assessments and compliance audits, wildlife hazard management plan updates, delivering wildlife hazard management training, wildlife surveys, wildlife dispersal and GIS Mapping.</p>

Name	Experience	Position	Qualifications, Licences etc.
Will Jamieson Regional Manager, Principal Wildlife Biologist	16 years	Quality assurance	<ul style="list-style-type: none"> Bachelor of Science (Australian Environmental Studies), Griffith University, 2001 <p>Relevant Experience</p> <p>Worked on projects for Vancouver International, Gold Coast, Sunshine Coast, Brisbane, Auckland International and Sydney Airports, and the Royal Australian Air Force. Projects include wildlife hazard assessments and compliance audits, wildlife hazard management plans, wildlife surveys and dispersal, and delivering wildlife hazard management training.</p> <p>Plays an integral support role for many Avisure projects, provides technical input and quality assurance.</p>
Martin Ziviani Senior Wildlife Biologist	15 years	Wildlife surveys	<ul style="list-style-type: none"> Bachelor of Environmental Science, Griffith University, 1990 <p>Relevant Experience</p> <p>Worked on projects for Vancouver International, Gold Coast, Ballina-Byron Gateway, Rockhampton, Mackay, Brisbane, Western Sydney and Sydney Airports. Projects include wildlife and flora surveys, wildlife dispersal, wildlife hazard management plans, and delivering wildlife hazard management training.</p>
Jasmine Maftei Wildlife Biologist	4 years	Author and Data analysis	<ul style="list-style-type: none"> Bachelor of Science (Biology and Environment Science), University of South Australia, 2018 <p>Relevant Experience</p> <p>Worked on projects for Royal Australian Air Force Edinburgh, Point Cook, and Woomera. Projects include wildlife and flora surveys, wildlife dispersal, and wildlife hazard management plans.</p>

Appendix C: Wildlife Hazard Management Committee Members

Organisation	Position	Contact (email or phone)
Mackay Airport		
Phillip Clark	Manager Aviation Operations	Phillip.Clark@mackayairport.com
Mackay Regional Council		
Craig Shepherd	Manager Health & Regulatory Services	Craig.Shepherd@mackay.qld.gov.au
Airline and Aircraft Operators		
Kellie Banditt	Swissport	k.banditt@swissport.com.au
Lucy Friend	North Queensland Airports	lucy.friend@ Cairnsairport.com.au
Aviator Group	Aviator Group Operations	mackay.aviation@auriga.com.au
Alan Chen	Pel-Air Airlines	pelairops@pelair.com.au
Morteza Tehrani	Rex Regional Airlines	safety@rex.com.au
Keith Thompson	Aviator Group	Keith.Thompson@auriga.com.au
-	Alliance Airlines	safety@allianceairlines.com.au
Kartik Purohit	Skytrans Airlines	Kartik.purohit@skytrans.com.au
Brent Wise	Skytrans Airlines	brent.wise@skytrans.com.au
Will Whitham	Skytrans Airlines	will.whitham@skytrans.com.au
Airservices Australia		
Allan Maddison	Air Traffic Controller	allan.maddison@airservicesaustralia.com
CASA		
Danny Eatock	Civil Aviation Safety Authority Inspector	daniel.eatock@casa.gov.au
Contracted Consultants		
Martin Ziviani	Avisure Senior Wildlife Biologist	mziviani@avisure.com
Alexandra Stone	Avisure Project Manager	astone@avisure.com

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Organisation	Position	Contact (email or phone)
Off airport Facilities (non-Council operated)		
Tracy Simmons	Manzelmann's Farm	0403 693 468
Karina Tane	Thomas Borthwicks Meatworks	tbs-enviro@tbsmackay.com.au

Appendix D: Risk Assessment Methods

MOS Part 139 2019 Section: 17.02

(3) When conducting a wildlife hazard assessment, available data from the following must be considered:

- (c) wildlife observations;
- (c) reported aircraft strike events;
- (c) reported aircraft near miss events.

Definitions

(Source: AS/NZS 31000:2018 Risk Management).

Hazard	A source of potential harm or a situation with a potential to cause loss.
Risk	The chance of something happening that will have an impact (either positive or adverse) on objectives and is measured in terms of the probability (or likelihood) of an event and its consequences.
Likelihood	A qualitative description of probability or frequency.
Consequence	The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.

Wildlife hazard management at aerodromes requires an understanding of wildlife populations, their behaviour, and the risk management process. This assessment followed the process outlined in Australian and New Zealand Standard 31000:2018 Risk Management, Figure D1.

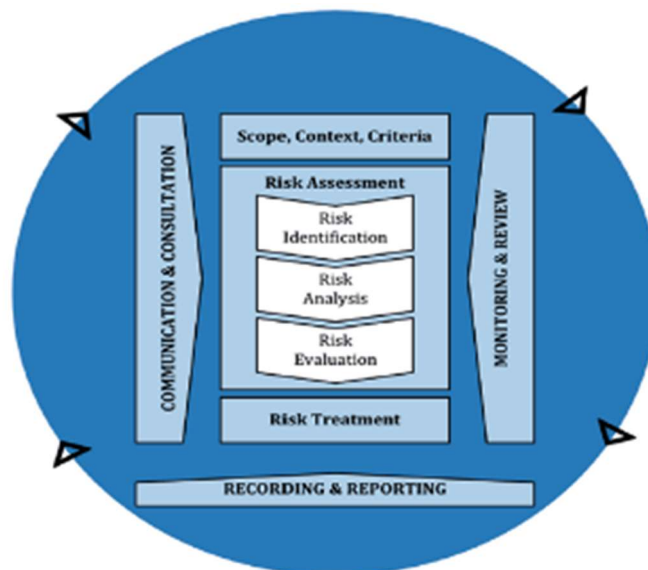


Figure D1. The risk management process (Source: AS/NZS 31000:2018 Risk Management).

Previous efforts to rank species according to risk level have involved one of the following:

- Using national databases to indicate risk level across a country (Dolbeer et al., 2000). This lacks the resolution required to determine risk at a particular aerodrome, although may be useful as a guide.
- Subjective assessment based on knowledge of bird species present, interpretation of the strike history and professional judgement. This is the primary method used by advisors to aerodromes worldwide.
- A more formalised, yet still subjective assessment of risk based on scoring a species for categories such as population size, bird mass, flock size, time of day, location on aerodrome, time spent in air, etc. (Carter, 2001; Morgenroth, 2003). This assessment is open to the vagaries of professional interpretation and cannot be easily used to compare one aerodrome with another, or objectively compare one year to the next.
- A determination of probability of strike based on bird strike history at the aerodrome over the previous five years to determine a yearly average for each species and using percentage of strikes causing damage for each species in a national bird strike database to determine consequence levels (Allan et al., 2003). This method does not consider the effect of differences in numbers of aircraft movements both between aerodromes and across the same Aerodrome for different time periods. It also cannot categorise species which have not been struck in the previous five year period but remain a significant risk. It is also dependent on effective bird strike reporting which is consistent over time.

Strike Risk Assessment (Allan, 2006)

The assessment phase of the risk management process involves categorising risks. To do this, a hazard needs to be measured in terms of its probability of occurring and the consequence should it occur. This allows it to be placed into a risk matrix as outlined below:

		Probability of Strikes (5yr average)				
		Very Low	Low	Moderate	High	Very High
Probability of damage	Very Low					
	Low		Species A			
	Moderate					
	High	Species B			Species C	
	Very High					

Figure D2. Strike risk assessment matrix (Allan 2006).

Risks which fall into the green section are ‘low’ and require no further action beyond current management; yellow is ‘moderate’ and requires a review of current management practices and options for additional action, and; red is ‘high’ and requires immediate action to reduce the current risk.

Risk assessment procedures based on historical strike data are limited, as they cannot easily accommodate real time changes in bird species composition or distribution.

Survey Risk Assessment (Shaw, 2004)

Avisure has developed a model for determining risk categories using professional bird survey data. The survey data is used to derive probability factors (population size, position on aerodrome, time spent in air and the species ability to avoid) and consequence factors (bird mass and flock size) for all species recorded. The combination of these probability and consequence factors give a numerical risk index, the Species Risk Index (SRI). This provides a real-time method of risk assessment as it is able to react to observed changes in airside bird assemblages and movement patterns.

The following tables outline the risk rating for wildlife species according to calculated SRI, and the risk ranking of an aerodrome.

Table D1. Species Risk Index and Aerodrome Survey Risk Index for determining risk categories based on survey data.

SRI ranges used to rate risk for each species		ASRI ranges used to rate risk of an Aerodrome	
SRI	Risk rating	ASRI	Risk rating
>1000	Very high	>10000	Very high
100 to 999.9	High	1000 to 9999.9	High
10 to 99.9	Moderate	100 to 999.9	Moderate
1 to 9.9	Low	10 to 99.9	Low
< 1	Very low	< 10	Very low

The process intends to provide a transparent, logical and systematic approach to the identification and treatment of wildlife related risks at the aerodrome.

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Appendix E: Avisure Survey Methods

Avisure complete surveys across four periods; early morning, middle of the day, late afternoon, and post-dusk. Each survey consists of eight sectors that cover the area inside the fence at YBMK. Each survey sector has an assigned observation point that overlooks the entire sector (Figure E1).

Diurnal On-airport Surveys

The observer travels from one observation point to the next following a set route through each sector making observations while en-route. The observer spends two-five minutes at each observation point, recording all wildlife observed within the sector during this time. Birds observed in transit or thermalling within the aerodrome boundary or on aircraft flight paths are recorded regardless of whether they are in the current sector or not. Binoculars are used to assist with identification of wildlife. Data recorded includes time, species, number sighted, position, estimated height above ground level, heading, activity (e.g. foraging, perching, transiting) and habitat used (e.g. grass, drain, fence). Survey records also include ambient conditions (e.g. rainfall, temperature, wind speed).

Nocturnal On-airport Surveys

The observer travels from one observation point to the next in a continuous motion, stopping when necessary to identify species. A spotlight and vehicle high-beams are used to illuminate as much of the airside habitat as possible. The vehicle is driven at or less than 15 km/h to allow the observer to scan with the spotlight. Binoculars are used to assist with identification of wildlife. Data recorded includes time, species, number sighted, position, estimated height above ground level, heading, activity (e.g. foraging, perching, transiting) and habitat used (e.g. grass, drain, fence). Survey records also include ambient conditions (e.g. rainfall, temperature, wind speed).

Off-aerodrome Surveys

The observer travels to each off-airport site (Figure E2) as outlined in the WHMP off-airport schedule (Appendix F). Depending on the site, the observer walks from one observation point to the next in a continuous motion, stopping when necessary to identify species, or spends ten minutes at one advantage point, recording all wildlife observed during this time. Birds observed in transit or thermalling within the site's boundary, or vacating the site, are recorded. Binoculars are used to assist with identification of wildlife. Information recorded in the database includes; time, species, number sighted, and position, estimated height above ground level, heading and activity (breeding, chasing, foraging, perching, sheltering, thermalling or transiting). Survey records also include ambient conditions (rainfall, temperature, air pressure, wind speed and direction).

Limitations:

- Sampling is not always from independent replicates: wildlife can be counted twice if they move between sectors with common boundaries, although this is avoided where possible.
- Visibility in areas such as drainage channels and reed beds is lower, so wildlife in these areas may be under-represented in the data.
- Nocturnal visibility is limited to the focus of the spotlight and/or high beam lights.
- Observations of transiting and thermalling birds regardless of whether they are inside the sector may increase the representation of some bird species which tend to transit or thermal. In some circumstances, transiting birds may be missed due to the position of the observer.
- The cryptic nature of some bird species may result in the under-representation of these species in the data.
- Ideally, simultaneous all-sector counts are required to get a true representation of species and numbers.

Despite its limitations, this method is satisfactory for good trend analysis so long as it is applied consistently.

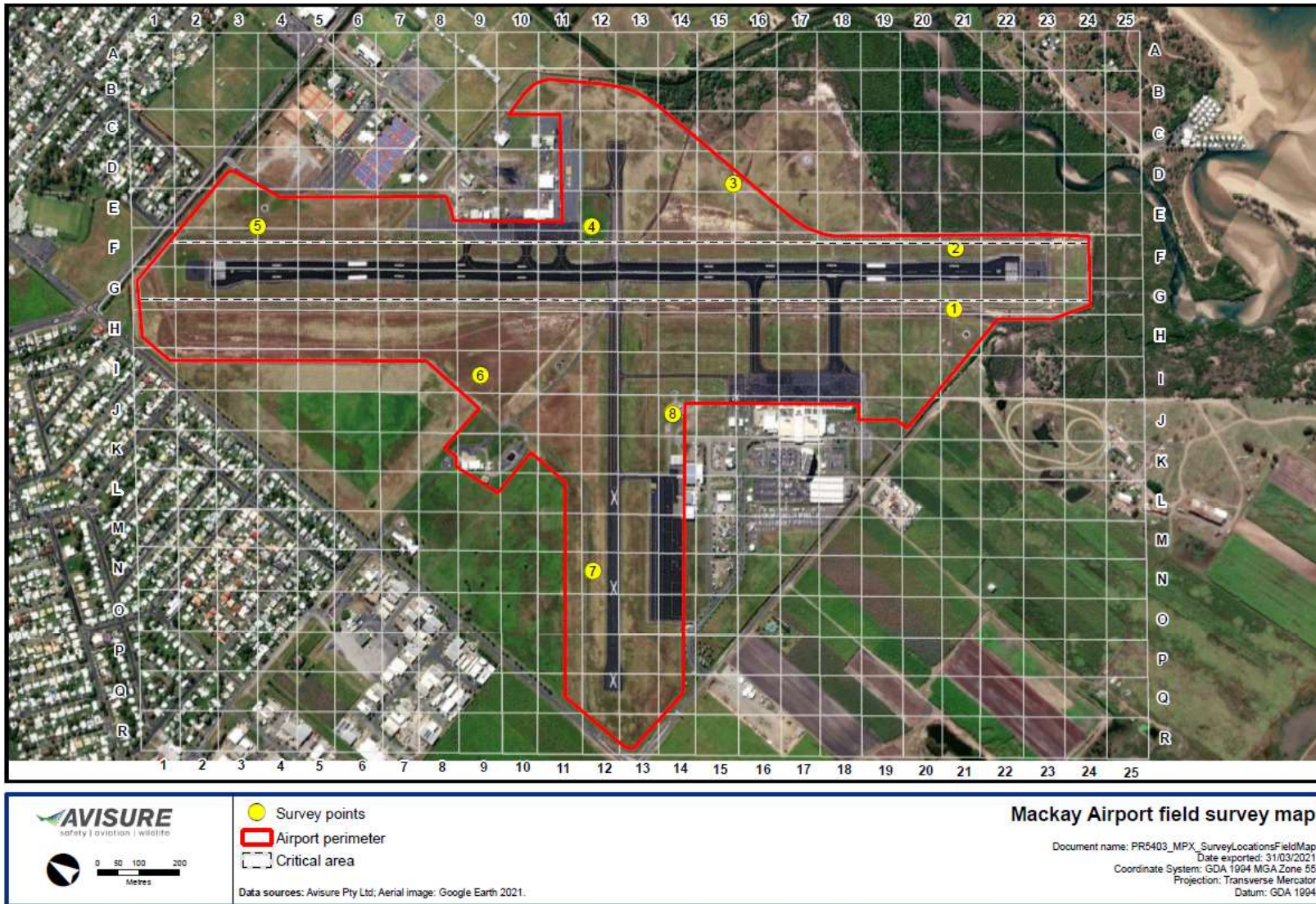


Figure E1. Avisure diurnal on-airport survey points.

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Figure E2: Off-airport survey locations

Mackay Regional Council
Mackay Airport Bird Management Program 2020/21

- Off-airport sites
- Approach and departure paths
- Aerodrome boundary
- 3, 8 and 13km wildlife buffers



Appendix F: Off-aerodrome NASF Risks

The National Airports Safeguarding Framework (NASF) Wildlife Attraction Risk is based on risk category allocation where incompatible land uses are ranked from very low to high. This acts as a safeguarding guide for airports and land use planning authorities in Australia.

Table F1. YBMK off-aerodrome site recommended monitoring actions based on NASF guidelines.

Location	Distance from ARP (km)	Description	NASF Land Use Description	NASF Wildlife Attraction Risk	NASF Action Recommended	Monitoring Actions
<3km						
Mackay Sports fields	0.37	Open irrigated grass area	Sports facility	Moderate	Mitigate	Monitor quarterly
Adjacent Cane Paddocks	0.82	Open irrigated grass area	N/A	N/A	N/A	Monitor quarterly
Off-aerodrome Drains	0.89	Stormwater drains	N/A	N/A	N/A	Monitor quarterly
Manzelmann's Farm	1.1	Open irrigated grass areas supporting livestock.	Cattle/dairy farm	Moderate	Mitigate	Monitor quarterly
Shellgrit Creek	1.22	Wetland with grass and vegetated surrounds	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Illawong Beach	1.66	Natural waterbody - beach	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Farm 63 Farrelly's Road	1.95	Open irrigated grass area	N/A	N/A	N/A	Monitor annually
Mackay Botanic Gardens	2.66	Botanical garden with open irrigated grass areas and manmade wetland	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly

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Location	Distance from ARP (km)	Description	NASF Land Use Description	NASF Wildlife Attraction Risk	NASF Action Recommended	Monitoring Actions
Paget Waste Management Centre	2.83	Putrescible waste facility	Putrescible waste facility – transfer station	High	Mitigate	Monitor annually
≥ 3km and ≤ 8km						
Racetrack	3.08	Racetrack	Racetrack / horse riding school	Moderate	Monitor	Monitor annually
Milton Street Oval Showgrounds	3.09	Open irrigated grass area showground	Showground	High	Mitigate	Monitor quarterly
Mackay Cemetery Flying-fox Camp	3.09	Grass and vegetated area surrounded by roads by a creek	N/A	N/A	N/A	Monitor quarterly
The Blue Water Trail	4.47	Man-made trail along the river for pedestrians	N/A	N/A	N/A	Monitor annually
Walz Road Pond 2	5.22	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor annually
Thomas Borthwick and Sons	5.48	Farm with open irrigated grass areas and man-made waterbodies, supporting livestock	Cattle / dairy farm	Moderate	Monitor	Monitor quarterly
West Mackay Goose Ponds	5.52	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Bakers Creek Golf Course	5.55	Open irrigated grass areas and man-made waterbodies	Golf course	Moderate	Monitor	Monitor annually
Walz Road Pond 1	5.65	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor annually

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Location	Distance from ARP (km)	Description	NASF Land Use Description	NASF Wildlife Attraction Risk	NASF Action Recommended	Monitoring Actions
North Mackay Goose Ponds	5.81	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Big 4 Holiday Park Wetland	7.99	Permanent waterbody located in Big 4 Holiday Park.	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor annually
≥ 8km and ≤ 13km						
Mackay Harbour	8.22	Marine harbour	N/A	N/A	N/A	Monitor annually
Mackay Golf Club	9.5	Open irrigated grass areas and man-made waterbodies	Golf course	Moderate	Monitor	Monitor quarterly
>13km						
Mackay North Water Recycling Facility	16.18	Wastewater treatment plant	Sewage / wastewater treatment facility	Moderate	Monitor	Monitor annually

Revision History

Rev. No.	Rev. Date	Details	Prepared by	Reviewed and approved by
00	23/02/2022	Mackay Airport Wildlife Hazard Management Plan 5.0 - Draft	Alexandra Stone Wildlife Biologist Jasmine Maftai Wildlife Biologist	Phil Shaw Managing Director
01	17/03/2022	Mackay Airport Wildlife Hazard Management Plan 5.0 - Final	Alexandra Stone Wildlife Biologist	Kylie Patrick Principal Consultant
02	31/03/2022	Mackay Airport Wildlife Hazard Management Plan 5.0 – Final Revision 1	Alexandra Stone Wildlife Biologist	Kylie Patrick Principal Consultant

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contact@avisure.com | www.avisure.com

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Head Quarters Level 4 McDonald House 10/37 Connor Street Burdleigh Heads QLD 4220	36A/11-13 Parkway Mawson Lakes SA 5095 PO Box 145 Pooraka SA 5095	Point Cook Rd Point Cook VIC 3030 P+61 1300 112 021	17801 International Blvd Seattle, Washington 98158 P +1 907 625 1027	PO Box 880 Surry Hills NSW 2010 P+61 1300 112 021	PO Box 32372 YVR Domestic Terminal RPO Richmond BC V7B1W2 P +1 855 758 5830

PO Box 404
West Burleigh QLD 4219
Australia

P +61 7 5508 2046
F +61 7 5508 2544

ABN 26 131 545 054



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