Mackay Airport

Wildlife Hazard Management Plan

Mackay Airport Proprietary Limited

December 2023

Mackay Airport

AVISURE
aviation | wildlife | safety

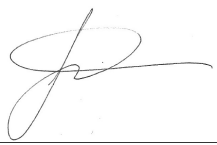
Authorisation

This Wildlife Hazard Management Plan has been prepared by Mackay Airport Pty Ltd, a business unit of North Queensland Airports Pty Ltd 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 on or near the aerodrome. The documented procedures are an accurate reflection of current actions and industry best practice. The organisation responsible for coordinating this plan is Mackay Airport Pty Ltd. The North Queensland Airports Chief Operating Officer is the accountable manager as defined by the Civil Aviation Safety Regulations Part 139 (Aerodromes) Manual of Standards 2019 and the Mackay Airport Safety Management System.

Any external references made to regulations, standards, and documents should be read in conjunction with this document. As these external references are in force from time to time and may be subject to change, the latest issues/amendments should be checked prior to using this document.

Mackay Airport Pty Ltd 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. Should any changes be found necessary, or where compliance with this policy becomes impractical or impossible, the Chief Operating Officer is to be advised immediately.



4 January 2024

Garry Porter
Accountable Manager
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 Risk assessment; Species action plans	Philip Clark Manager Aviation Operations
1.4	Sep. 2013	Updates to Culling and egg/nest removal; Risk assessments; Species actions plans	Philip Clark Manager Aviation Operations
1.5	Jul. 2014	Updates to Risk assessment; Species management table; Species action plans	Philip Clark Manager Aviation Operations
1.6	Jul. 2015	Updates to: Risk assessment; Risk characterisation; Landscaping Policy; Species action plans	Philip Clark Manager Aviation Operations
1.7	Jul. 2016	Updates to Risk assessment; Risk Characterisation; Species Action Plans; Wildlife Count Procedure	Philip Clark Manager Aviation Operations
1.8	Jul. 2017	Updates to Risk assessment; Risk Characterisation; Species Action Plans	Philip Clark Manager Aviation Operations
2.0	Jul. 2018	WHMP re-issue; Full document re-write; updates to Risk assessment; Risk characterisation	Philip Clark Manager Aviation Operations
3.0 Draft	Jul. 2019	WHMP re-issue; Full document re-write; updates to Risk assessment; Risk characterisation; Standard Operating Procedures; Species Action Plans	Philip Clark Manager Aviation Operations
3.0 Final	Jan. 2020	Minor amendments; created separate document for Species Action Plans and Standard Operating Procedures	Philip Clark Manager Aviation Operations
4.0 Draft	Aug. 2020	Updates to Legislation; Annual assessment 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 Legislation; Annual assessment including wildlife strike and survey trends; density maps and, risk assessment; Standard Operating Procedures; Species Action Plans	Philip Clark Manager Aviation Operations

Version	Year	Description of Change	Signed
5.0 Draft & Final	Mar. 2022	Updates to Section 5 Wildlife Strike Trends; Section 6 Wildlife Hazard Assessment; Standard Operating Procedures; Species Action Plans; Distribution; Appendix C	Philip Clark Manager Aviation Operations
6.0 Draft & Final	Feb. 2023	Updates to Section 5 Wildlife Strike Trends; Section 6 Wildlife Hazard Assessment; Species Action Plans; Standard Operating Procedures; Wildlife Dispersal; Wildlife Surveys; Flying-fox Survey	Philip Clark Manager Aviation Operations
7.0 Draft & Final	Dec. 2023	Updates to Section 5 Wildlife Strike Trends; Section 6 Wildlife Hazard Assessment; Appendix B Legal and Other Requirements; Species Action Plans; Standard Operating Procedures	Philip Clark Manager Aviation Operations

On receipt of this revision, please destroy all previous and now obsolete copies.

Distribution

An electronic copy of this Plan is available on MAPL SharePoint and on the Mackay Airport website (external). This Plan is made available to Civil Aviation Safety Authority for inspection upon request.

Copies of this Plan are further distributed as follows:

Held By	Organisation
Soft Copy	
Mackay Air Traffic Control	Airservices Australia
Matthew Cole	Airservices Australia
Daniel Holliday	Civil Aviation Safety Authority
Mackay Manager	Oceania Aviation
Safety Department	Rex
Tunui Wano	Flyon
David de Jager	Mackay Regional Council
Mel Power	Virgin Australia
Owen Davison	Swissport
Operations	Sharp Aviation
Nick Meara	Thomas Borthwicks & Son
Keith Thompson	Auriga Aviation
Steve Buchanan	Qantas
QantasLink Safety	Qantas
Operations	PelAir
JQ Operations	Jetstar
Alliance Operations	Alliance Airlines
Operations	Skytrans Airlines

Persons printing this Plan should be aware that any hard copies are uncontrolled.

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: (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 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/Aeroplane	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.
Airline Operator	The operator of a Regular Public Transport air service. See *Aircraft Operator*.
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 control service.
Apron	A defined area on an 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

Authorised Shooter	A civilian with a relevant firearms licence, who is required by, and has written authorisation to, use a firearm for the purpose of controlling birds and animal wildlife at Mackay Airport.
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	A wildlife strike that results in damage in accordance with one of the below definitions: 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 component[2].
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.
Habituation	The tendency for wildlife to become accustomed to certain stimulus when repeatedly exposed to it.
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.
Landside	Those areas of the airport that are not considered airside and include access roads, carparks, check-in areas etc.
Loafing	When animals rest.
Migratory	Animals that move periodically from one region to another.

2 Advisory circular 139.C-16 Wildlife Hazard management.

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.
Raptor	Birds of prey such as kites, eagles and falcons.
Risk	The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and probability.
Roosting	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: • 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 either originating from the airfield or landing on the airfield.
Undershoot	The area within the take off and approach splays preceding the runway threshold.
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 a bird[3] and a moving aircraft. 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; or 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. A **wildlife near miss** is deemed to have occurred whenever a pilot takes evasive action to avoid birds or animals[4,5].
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.

3 Transport Safety Investigation Regulations, 2021
4 Australian Airports Association, 2015.
5 Australian Airports Association, 2016.

Wildlife Strike Designation [4,5]	Wildlife strikes are designated as either occurring on-aerodrome, in the vicinity of an aerodrome, or remote from aerodrome. An **on-aerodrome 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. 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. 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.

Abbreviations

AC	Advisory Circular
ACFT	Aircraft
AEPF	Adverse Effect to Planned Flight
AGL	Above Ground Level
AIP	Aeronautical Information Package
AIS	Aeronautic Information System
AOM	Aerodrome Operations Manual
ARP	Aerodrome Reference Point
ASO	Airport Safety Officer
ASRI	Aerodrome Survey Risk Index
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATSB	Australian Transport Safety Bureau
BAP	NQA Business Analyst Programmer
CASA	Civil Aviation Safety Authority
CASC	Compliance and Airside Safety Coordinator
CASR	Civil Aviation Safety Regulation
COO	Chief Operating Officer
CTAF	Common Traffic Advisory Frequency
DEECA	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
DMP	Damage Mitigation Permit
EPBC	Environment Protection & Biodiversity Conservation Act
ERSA	En-route Supplement Australia
GA	General Aviation
ICAO	International Civil Aviation Organization
KPI	Key Performance Indicator
MAO	Manager Aviation Operations

MAPL	Mackay Airport Pty Ltd
MOS	Manual of Standards
MVTS	Aircraft Movements
NASF	National Airports Safeguarding Framework
NOTAM	Notice to Airmen
NQA	North Queensland Airports Group
PPE	Personal Protective Equipment
RPT	Regular Public Transport
RWY	Runway
SAP	Species Action Plan
SOP	Standard Operating Procedure
SRI	Survey Risk Index
SWP	Standard Work Procedure
TWY	Taxiway
WHA	Wildlife Hazard Assessment
WHMC	Wildlife Hazard Management Committee
WHMP	Wildlife Hazard Management Plan
WHN	Wildlife Hazard Notification
YBMK	Mackay Airport ICAO code

Table of Contents

1. Introduction

1.1. WHMP Background

Mackay Airport (YBMK)[6] 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 YBMK Aerodrome Operations Manual, the Safety Management System approach and the Civil Aviation Safety Regulations (CASR) Part 139 (Aerodromes) Manual of Standards (MOS) 2019[7], made under division 130.C.4 of the Civil Aviation Safety Regulations 1998.

1.2. 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 744 human fatalities and 664 aircraft losses since the beginning of aviation (Shaw et al, 2023). Wildlife strikes, which involve more than just the repair of damaged engines and airframes, cost the commercial civil aviation industry an estimated US$1.2 billion per annum (Allan, 2002). In Australia, annual estimates range from AUD$11.9 million per year (Parsons, 2022) to AUD$103 million per year (Avisure 2022, unpublished data). 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 inflight increase when operating at high speed below 5000’ above ground level (AGL), which is where the majority of birds operate (Civil Aviation Authority of New Zealand, 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 (Civil Aviation Authority of New Zealand, 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

6 International Civil Aviation Organization (ICAO) airport reference code.
7 Herein referred to as Part 139 MOS 2019.

consequence considerations, final impact speed is the most significant determinant as impact force varies exponentially with the square of closing speed (Civil Aviation Authority of New Zealand, 2020).

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 recognition of the stakeholders involved in terminal airspace management, this plan includes roles and responsibilities for aircrew and air traffic controllers to be engaged in strike risk assessment and mitigation processes. In addition, the plan recognizes the importance of external stakeholders, including wildlife authorities and local landholders, and outlines how they are engaged to monitor and communicate local wildlife movement activity, and that on- and off-aerodrome hazards are critically assessed.

1.3. 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).

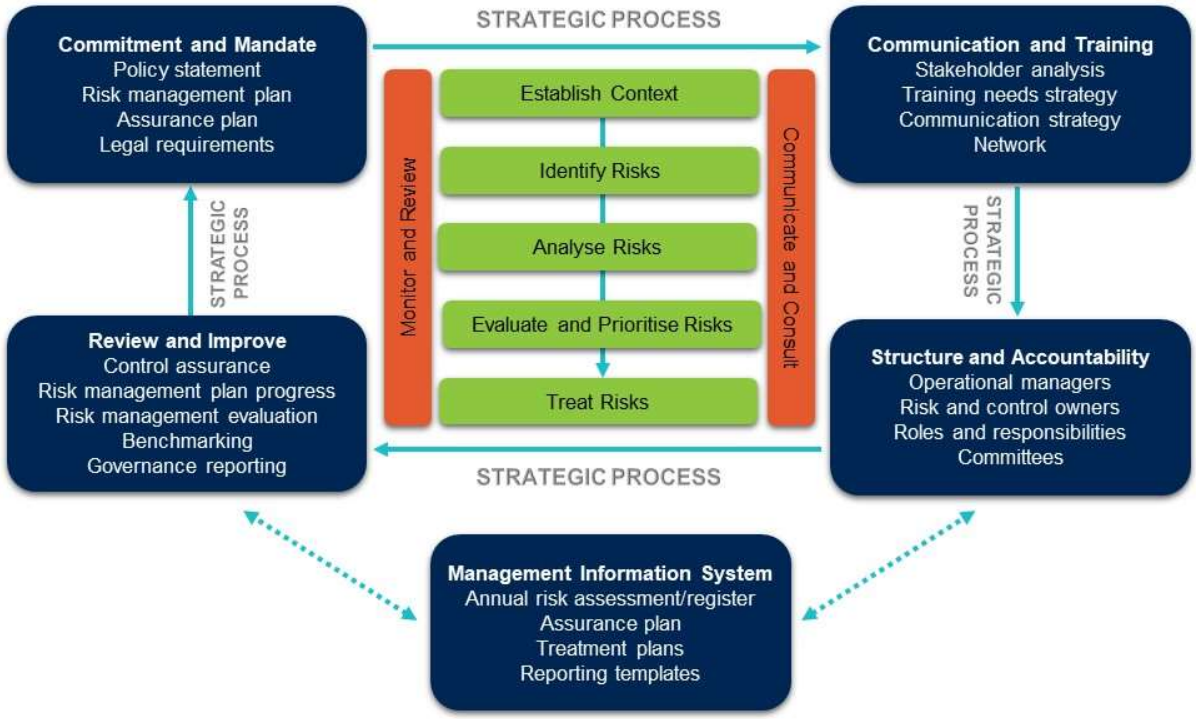


Figure 1. MAPL strategic approach to wildlife hazard management.

1.4. 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. The WHMP structure.

1.5. Aims

The MAPL wildlife management program implements this WHMP 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.

1.6. Objectives

Table 1 outlines the WHMP objectives and Appendix A outlines the targets and annual performance indicators.

Table 1. YBMK 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: • annually and reassess the risk • following serious incidents • in response to operational or legislative changes.
	To conduct regular internal and external audits.
	To clearly define accountabilities and responsibilities for all personnel, contractors, and stakeholders.
Culture	To develop, embed and continually encourage a positive culture where wildlife management is a priority and the WHMP is recognised and valued.
	To develop, embed and continually encourage a reporting culture supported by MAPL senior management.
Risk Management	To understand and minimise the risk of wildlife strike through a continuous process of identifying, recording, and reviewing risks, objectives, targets, and indicators.
	To reduce the costs of unscheduled maintenance associated with wildlife strike.
	To preserve life and aviation capability through reducing the risk of wildlife strike.
	To reduce wildlife mortality.
Communication	To develop, implement and maintain effective mechanisms that encourage open communication, delivery of key messages and awareness of responsibilities under the WHMP to all YMBK personnel, business partners and contractors.
Training	To ensure the availability of skilled and trained resources to develop, implement, maintain, and improve the WHMP.
	To ensure all personnel are trained and competent in their respective wildlife hazard management responsibilities.
	To have no firearm incidents.
Infrastructure and Facilities	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.

Area	Objectives
Participation and Action	To define roles, responsibilities, and procedures for managing wildlife risk.
	To actively encourage YBMK staff, aircraft operators, airlines and aircraft operators, visitors, business partners and contractors to help implement the WHMP.
	To encourage activities that promote and establish positive wildlife management on airport land.

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.
- Civil Aviation Safety Authority (CASA) Advisory Circulars (AC)[8]
    - AC 139.C-16 v1.0 Wildlife Hazard Management.
    - AC 139.C-01 v1.0 Aerodrome Manual.
    - AC 139.C-02 v1.0 Aerodrome Personnel.
    - AC 139.C-03. 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.*
- International Civil Aviation Organization (ICAO) Annex 14, Volume 1 (Aerodrome Design and Operation)[9].
- ICAO Annex 14, Volume 2 (Aerodromes - Heliports).
- ICAO Airport Services Manual Doc. 9184: Part 2 Land Use and Environmental Control.

8 Correct as of 13 September 2023 – noting CASA is currently updating ACs.
9 Australia aligns its rules, such as the CASR Part 139 MOS, with ICAO standards

- 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 B.

2.2. Control of Wildlife

The YBMK WHMP outlines a sustained integrated approach to wildlife control that includes a range of non-lethal and lethal methods (refer to Section 7.6.1: Active Management). Queensland's native wildlife is protected by the *Nature Conservation Act 1992* and regulations. Normally, a Damage Mitigation Permit (DMP) issued by the Department of Environment and Science (DES) is required to cull, disturb, or interfere with wildlife. YBMK is listed as a strategic airport as per the Queensland State Planning Policy (2020) and as such, under Section 41 and 42 of the Nature Conservation (Animals) Regulations 2020, is exempt from requiring a DMP to control wildlife on the airport provided pre-conditions are met (Appendix B).

Lethal control of animals is not considered an effective method for large-scale wildlife hazard management as an isolated management tool; however, it is effective as part of a broader integrated program. MAPL personnel lethally control wildlife, as required, under the *Weapons Act 1990* (Qld). The DMP exemption and valid firearms licence allows the lethal control of species that pose a threat to aircraft operational safety.

2.3. Firearms

All YBMK firearms, and personnel (Airport Safety Officers (ASO)), are licenced under *Weapons Act 1990*. MAPL complies with the requirements regarding the use, maintenance, storage, and transportation.

2.4. Documentation Governance

The WHMP is a subsidiary document of the Aerodrome Operations Manual (AOM). MAPL internal Standard Operating Procedures (SOPs) and Standard Work Procedure (SWP) support WHMP implementation by staff and contractors. SOPs and SWPs are available through SharePoint. The Wildlife Hazard Management Standard Operating Procedure manual includes the following SOPs and SWPs:

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

2.5. 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 C (Table C1) for experience and qualifications.

2.6. 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 Operating Officer assumes overall responsibility for WHMP implementation. The key personal for ensuring safe operations are:

- Manager Aviation Operations (MAO)
- ASOs
- Compliance and Airside Safety Coordinator (CASC)
- Environment Manager

Managing the wildlife strike risk requires a cooperative effort amongst various stakeholders. Appendix C (Table C1) outlines the roles and responsibilities of all the key aerodrome and stakeholder personnel. All records of the qualifications and experience of key personnel identified in the plan are stored on SharePoint by the Aerodrome Operations Manager. Refer Appendix C (Table C2) for experience and qualifications.

2.7. 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 MAPL 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. Stakeholder roles and responsibilities are outlined in Appendix C. The WHMC membership is listed in Appendix D.

2.8. 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.

MAPL provides wildlife hazard management training to all personnel charged with wildlife management responsibilities. Training focuses on identifying and managing wildlife hazards, assessing, and communicating risks, as well as strike reporting, bird identification and regulatory requirements. MAPL collates and maintains training records for at least three years. MAPL maintains training records and provides additional training as required. The CASC is responsible for monitoring and retaining the records.

MAPL delivers training and awareness programs at various levels to achieve the training objectives (Table 2). Additional training is conducted when required.

Table 2. Training programs completed by YBMK staff.

Training Area	**Position(s)**	**Frequency**	**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	All ASOs and nominated relief staff.	Every 24 months	External training course offered by suitably qualified provider.
Wildlife Identification	All ASOs and nominated relief staff.	Part of induction or as required	Internal training course. Field manual available to staff for species identification.

Training Area	**Position(s)**	**Frequency**	**Delivery**
WHMP	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 SAPs	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.
WHMC	Stakeholders and YBMK staff.	Meets biannually	Advisory committee.

3. Operations Profile

YBMK supports passenger traffic (tourists, business, and resource industry) and cargo. There are regular flights to and from Brisbane, Rockhampton, Townsville, Cairns, and Hamilton Island. Airservices Australia provide air traffic control (ATC) and Aviation Rescue Fire Fighting Service services. Further information is available in the YBMK Aerodrome Operations Manual and the En-Route Supplement Australia (ERSA). Table 3 summaries the YBMK site profile and operational characteristics.

Table 3. YBMK site profile and operational characteristics.

Aerodrome	Description		
Location	Mackay, Queensland, 21°10'33.43"S, 149°10'53.35"E		
Aerodrome type	Certified, Regular Public Transport (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
	Bonza	B737 Max 8	200
	Alliance Airlines	F70-100, E190	Up to 100
2022/23 aircraft movements[10]	29,468		
2022 passenger movements[11]	824,704		
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		
Navigation and landing aids	VHF Omnidirectional Radar, Distance Measuring Equipment, Non-directional Beacon, Precision Approach Path Indicator		
ATC	Monday – Friday: 2020-1020, Saturday – Sunday: 2020-0930 UTC Rescue and Firefighting Service on-site with hours of operation defined in Notice to Airman (NOTAM).		

10 Airservices Australia, 2023
11 Bureau of Infrastructure and Transport Research Economics, 2023 Note data only Available to January 2023.

Aerodrome	Description
Communication	Surface Movement Control 121.7 Mackay Airport Tower 124.5 Aerodrome Frequency Response Unit 124.5 Automatic Terminal Information Service (ATIS) 112.7 and 128.0

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;

(ii) in the vicinity of the aerodrome

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

Mackay has a tropical climate with hot wet summers and dry sunny winters. YBMK is bordered by coastal mangroves and beaches to the east, wetlands such as Shellgrit Creek to the south-east, sugarcane and agriculture to the south and urban development and industry to the west and north. YBMK land is partially within a Coastal management district with some lots included within the storm tide inundation area (Mackay Airport, 2022). Migratory shorebirds are found in the vicinity of the airport at certain times of the year including Eastern Curlew, Greater Sand Plover, Whimbrel, and Bar-tailed Godwit (Mackay Airport, 2022).

Table 4 and 5 outlines YBMK's environmental and ecological characteristics and Table 6 natural phenomena that can attract wildlife and influence the strike risk. This information helps understand how environmental conditions can influence wildlife activity which allows MAPL to proactively manage upcoming wildlife hazards.

Table 4. YBMK environmental characteristics.

Environment	Description
Elevation	19ft above mean sea level.
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 Environment and Science, 2023). 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.

Environment	Description
Surrounding land uses	Residential, industrial, agricultural, parklands, estuarine mangroves and coastal habitat.
Habitat	Grasslands that provide habitat for birds to forage for seeds and insects or hunt for prey. Adjacent areas include mangroves, salt marshes, estuaries, sugarcane, agriculture, and urban development. Siratro and Gomphrena weed on the western side of the airfield.
Habitat modification	Grass mowing: runway strip at 200mm; non-critical areas at 300mm
Artificial modification	Drains, fences, buildings, and other infrastructure such as gable markers provide perches and nesting sites.

Table 5. YBMK climate calendar[12].

	2022						2023					
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Total Rainfall mm	179.8	5.0	52.4	110.4	94.0	107.4	727.2	86.4	102.2	122.0	88.2	17.0
1950-2021/22 average Total Rainfall mm	40.9	31.9	23.6	36.5	86.7	141.3	311.7	320.3	251.6	165.2	88.1	57.7
Mean number of days of rain ≥1mm (1950-2021/22)	4.0	3.2	2.6	3.9	6.1	8.9	12.8	14.0	12.5	10.7	7.7	6.0
Mean Temperature High °C	20.9	23.6	26.7	28.8	30.5	30.1	29.8	30.9	31.0	28.9	24.7	25.1
1950-2021/22 average Mean Temperature High °C	22.7	23.9	26.0	28.5	29.7	30.8	30.4	30.2	29.5	27.7	25.3	23.3
Mean Temperature Low °C	10.6	12.8	16.3	19.9	20.9	21.2	22.3	23.4	22.4	20.2	13.3	15.1
1950-2021/22 average Mean Temperature Low °C	11.4	12.0	14.8	18.3	20.6	22.2	23.1	23.2	22.1	19.6	15.7	12.9

12 Bureau of Meteorology, 2023a and Bureau of Meteorology, 2023b.

Table 6. Natural phenomenon that can attract wildlife on and around YBMK.

Phenomena[13]	Species attracted	Attraction
Wet season (Nov-Mar) Cyclone season (Dec-Apr)	Migratory Waders, Cattle Egrets, Fairy Martin, Tree Martin, Straw-necked Ibis, Australian White Ibis, Masked Lapwing.	Drains and water bodies on airport. Waterlogged soils can bring soil invertebrates closer to surface where they are more easily accessible to ground foraging birds.
Dry season (Apr-Oct)	Australian White Ibis, Straw-necked Ibis, Bush Stone-curlew, Fairy Martin, Welcome Swallow, wading birds and ducks: Hardhead, Pacific Black Duck, Cattle Egret, White-Faced Heron, and ibis.	Airside grassed areas on-airport and surrounding the aerodrome. Airside infrastructure, such as drains and baggage makeup areas, provide a nesting habitat for Fairy Martin and Welcome Swallow. Consistent resource availability, particularly permanent water bodies on and around the airport can attract waders particularly during drought conditions.
Heatwaves and bush fire.	Various raptors and opportunistic feeders such as Black Kite, Torresian Crow, Butcherbird, and Australian Magpie.	Exposed and fleeing animals during fires. Carrion and grass shoots after the fire.
Fruiting, flowering, and seeding.	Little Red Flying-fox, Black Flying-fox, Grey-headed Flying-fox, honeyeaters, Rainbow Lorikeet, Little Corella, Galah, Wood Duck and Pacific Black Duck.	Paperbark *(Melaleuca quinquenervia)* and gum tree (*Eucalyptus* spp.) flowers. Flowering herbaceous plants and weeds (e.g., Dandelion Weed). Grass seed (high protein food source for insects).
Atmospheric convection (thermals).	Various risk species, mainly raptors.	Thermals over the sealed surfaces on days experiencing high atmospheric convection.
Wind velocity.	Various risk species.	Wind speed influences bird behaviour, transit direction, flight energetics, flight speed, and general foraging behaviour.
Rainfall events.	Various water birds and migratory waders.	Regular rain fills rivers, creeks, drains, and low-lying land providing water for a number of birds and mammals. Poorly drained soils attract flocks of birds, in particular water birds such as ducks and wading species.
Invertebrate abundance.	Martins and swallows, Nankeen Kestrel, Whistling Kite, Black Kite and Masked Lapwing.	The emergence of flying ants during low pressure conditions can attract large flocks of aerial foraging species. Grasshoppers and locust eruptions can significantly increase bird populations.

13 The species listed can be a strike risk at other times however the phenomena noted in the table can elevate their risk.

5. Wildlife Strike Profile

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 (on-airport and vicinity strikes) for July 2022 to June 2023 and compares current data against historical results (averages for the past 5 years 2017/18-2021/22). MAPL and Australian Transport Safety Bureau (ATSB) provided strike data and Airservices Australia provided aircraft movement data. Table 7 summarises the annual strike and risk assessment trends.

The current confirmed on-airport and airport vicinity rate is 7.13 strikes per 10,000 aircraft (ACFT) movements (MVTS), an increase since 2021/22 (Table 7). Despite this, confirmed strikes per 10,000 ACFT MVTS have trended downwards since 2018/19 (Figure 3).

The mass struck per 10,000 aircraft movements (4.54 kg/10,000 MVTS) remain similar to last year's result as did the total number of aircraft movements (Table 7).

Table 7. YBMK wildlife strike[14] hazard summary and trend 2017/18 to 2022/23.

Scorecard	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Total strikes	19	33	19	27	21	23
Confirmed strikes	17	26	14	20	20	21
Suspected strikes	2	6	5	2	1	2
Near miss strikes	0	1	0	5	0	0
Damaging strikes	1*	1*	1	1	0	0
Multiple strikes	1	2	0	1	3	3
Adverse effect to planned flight strikes	0	6	3	8	2	5
Total mass reported struck (kg)	11.64	12.19	4.15	6.32	13.48	13.38
Total ACFT movements	27,276	26,882	24,292	25,130	29,052	29,468
Total strikes/10K ACFT MVTS	6.97	12.28	7.82	10.74	7.23	7.47
Confirmed strikes/10K ACFT MVTS	6.23	9.67	5.76	7.96	6.88	7.13
Suspected strikes/10K ACFT MVTS	0.73	2.23	2.06	0.80	0.34	0.34
Damaging strikes/100K ACFT MVTS	3.67	3.72	4.12	3.98	0	0
Adverse effect strikes/100K ACFT MVTS	3.67	22.32	12.35	31.83	6.88	16.97
Total mass (kg) struck/10K ACFT MVTS	4.27	4.54	1.71	2.52	4.64	4.54
% mass (kg) surveyed in critical areas	67%	66%	51%	63%	56%	59%
No. very high-risk species	1	1	0	0	0	0
No. high-risk species	3	7	7	7	11	9
No. moderate-risk species	16	17	18	19	12	12

*Strike location unknown

14 On airport and airport vicinity strikes

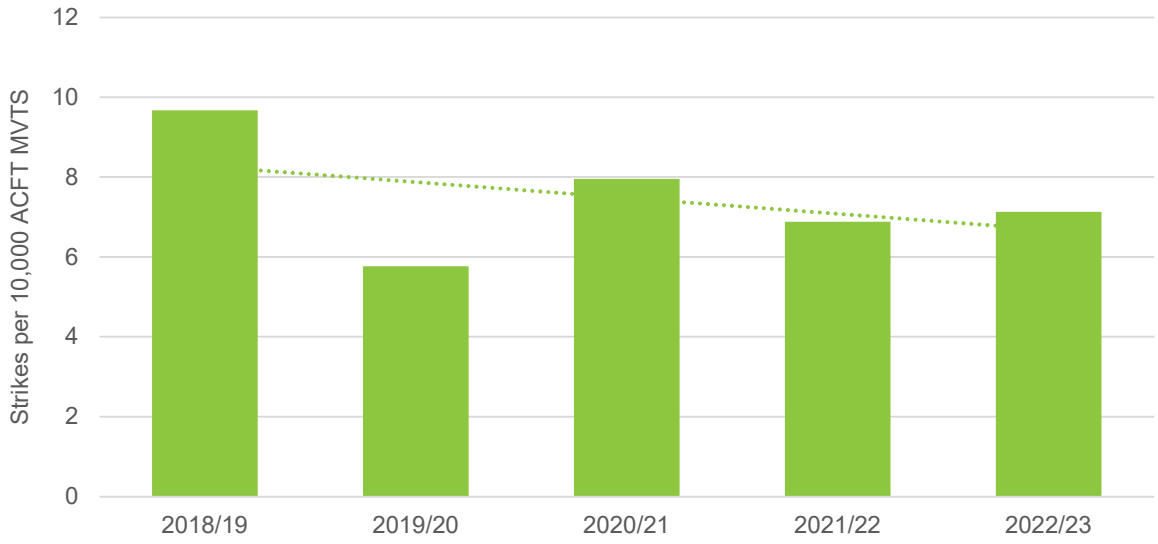


Figure 3. Total confirmed on-airport and airport vicinity strikes per 10,000 ACFT MVTS by year, 2018/19-2022/23.

YBMK reported 21 confirmed on-airport and airport vicinity strikes in 2022/23 (Figure 4), consistent with the previous two years. Confirmed on-airport and vicinity strikes remains similar to the five-year average (19.4 strikes) (2017/18-2021/22).

Total on-airport and airport vicinity mass struck (13.4 kg) decreased slightly compared to 2021/2022 but has trended upwards since 2019/20 (Figure 4) and exceeded the average (10.7 kg) due to a multiple strike with Plumed Whistling-Duck, and several strikes with Bush Stone-curlew and Masked Lapwing. Other notable strikes with other high mass species (>0.7 kg), including Australian White Ibis, Pacific Black Duck and Wandering Whistling-duck, reduced compared to 2021/22.

High and moderate risk species (refer to section 6) accounted for 62% of confirmed on-airport and airport vicinity strikes and 80% of AEPF strikes this year.

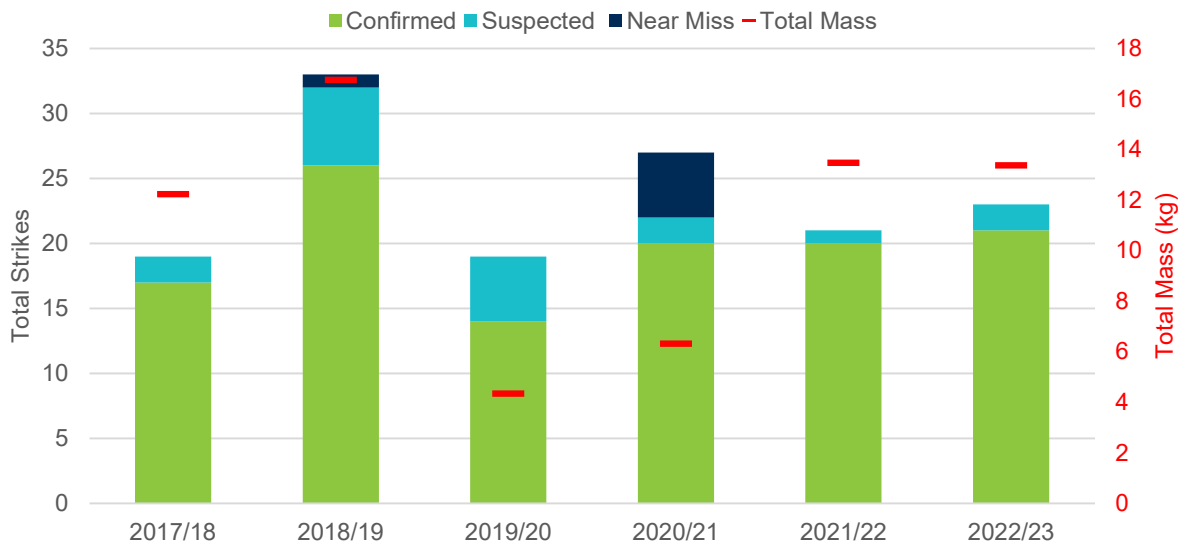


Figure 4. On-airport and vicinity wildlife strikes by strike type and year vs mass struck, 2017/18 – 2022/23.

Confirmed on-airport and airport vicinity strikes per month (Figure 5) peaked in August 2022 due to an increase in night time strikes (Masked Lapwing, Bush Stone-curlew and Masked Owl), and April 2023 due to strikes with Masked Lapwing, Bush Stone-curlew, Torresian Crow and Unidentified Species. Mass struck peaked in June due to a strike with six Plumed Whistling-Duck (Figure 5).

Very high rainfall in January 2023 (727.2 mm Bureau of Meteorology, 2023) resulted in widespread regional flooding which increased foraging opportunities for ducks, waterbirds, and insectivorous species.

May 2023 recorded low strikes compared to average with only one strike (Magpie Lark). Typically, Bush Stone-curlew strikes and Masked Lapwing strikes are high in May.

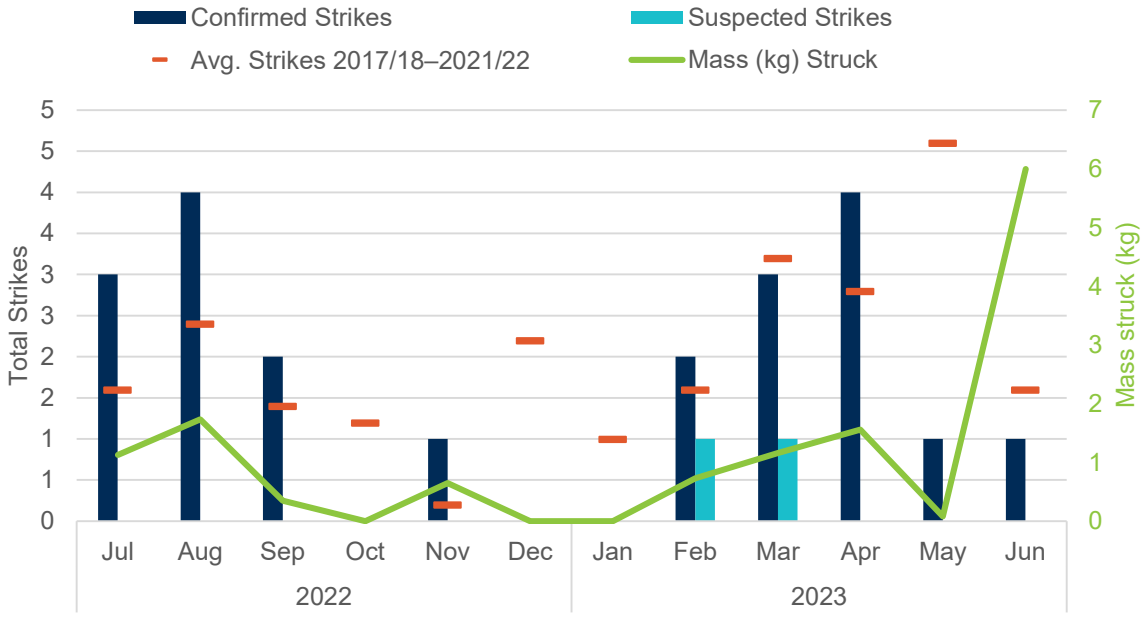


Figure 5. On-airport and vicinity wildlife strikes by month, strike type and mass struck (2022/23) vs the five year average (average strikes per month 2017/18-2021/22).

Bush Stone-curlew (5 strikes, avg. 3.2) and Masked Lapwing (5 strikes, avg. 2.2) strikes were above average for 2022/23 (Figure 6). They accounted for 48% of confirmed on-airport and airport vicinity strikes and 38% of the mass struck. One multiple strike was reported Plumed Whistling-Duck contributed 79% of the total mass struck for 2022/23.

Unidentified Bird[15] (2 strikes) was below average (3 strikes) and have trended downwards since 2018/19.

MAPL reported a strike in May 2023 where remains were found on the landing gear of a Qantas B737 after landing from Brisbane. A RWY inspection found nothing, and DNA analysis performed on a sample collected from the aircraft confirmed the species as a Nankeen Kestrel. Strike location remains unknown.

15 Where species cannot be identified, Unidentified Bird (0.2 kg) is used to define risk.

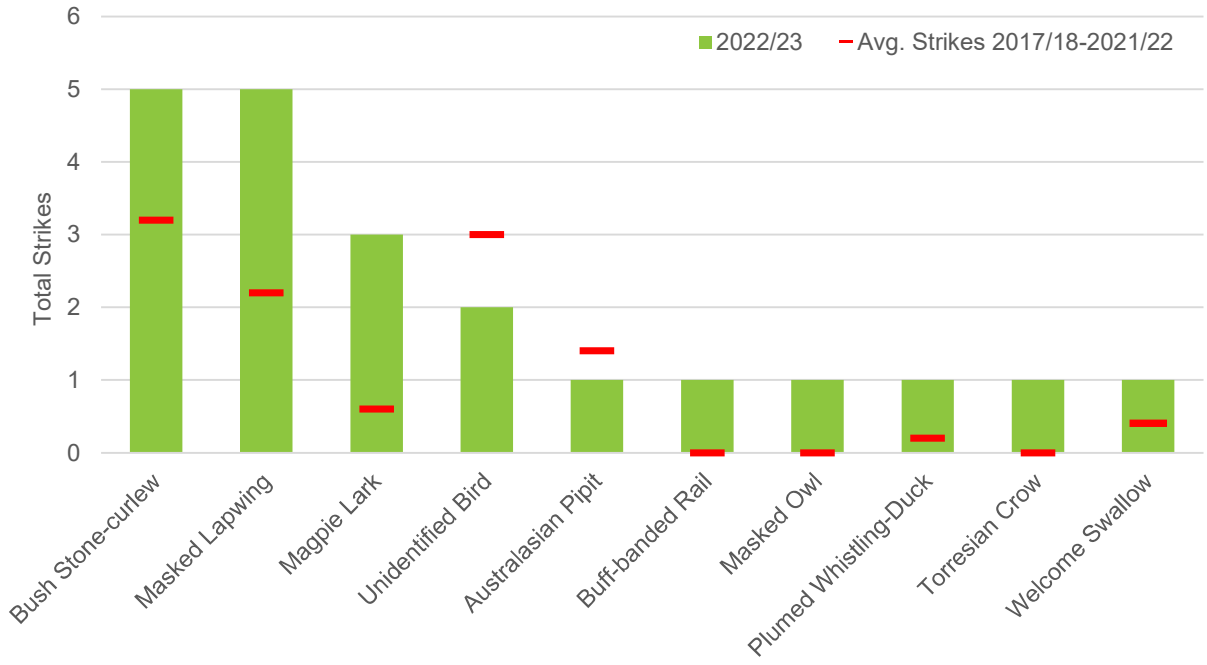


Figure 6. Species struck in confirmed strikes (on-airport and vicinity) (2022/23) vs the five-year average (2017-18-2021/22).

Strike times generally follow passenger aircraft movements with 81% of strikes in 2022/23 involving RPT aircraft.

Masked Lapwing and Bush Stone-curlew accounted for 75% of strikes occurring between 1700 and 2200 hours (Figure 7). Their activity peaks from late afternoon as flocks search for foraging habitat at night.

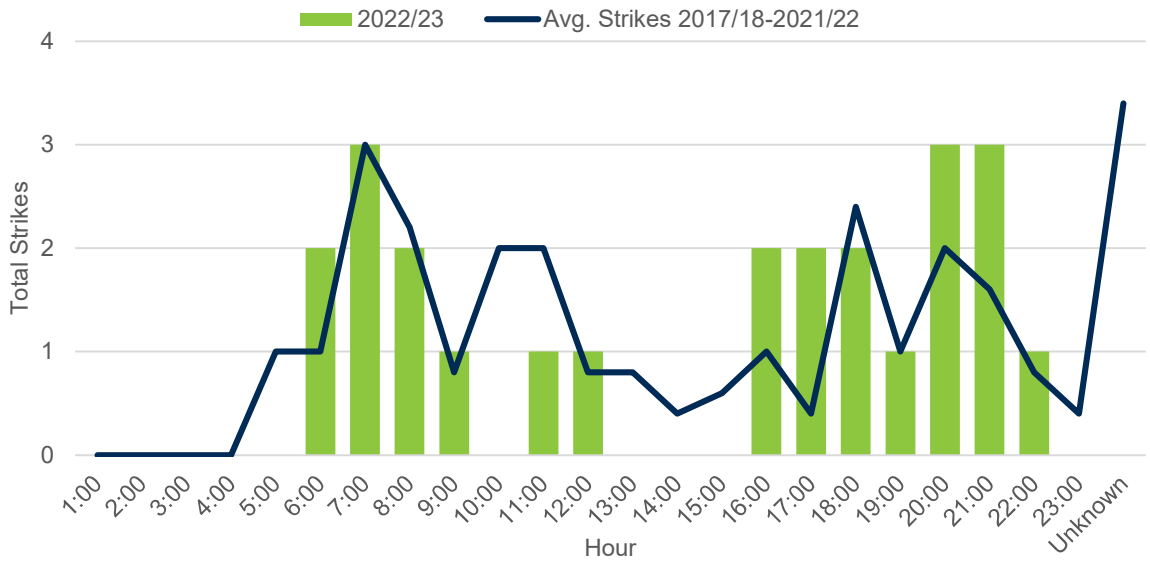


Figure 7. Total strikes[16] by time-of-day 2022/23 vs 5-year average strikes (2017/18 – 2021/22).

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

5.1. Strikes Affecting Flight

No strikes damaged aircraft in 2022/23 however five strikes delayed (Table 8) aircraft resulting in an Adverse Effect to Planned Flight (AEPF) strike rate of 16.97 strikes per 100,000 aircraft movements. MAPL have reported 24 AEPF strikes in the past five years. The average AEPF strike rate of 18.07 strikes per 100,000 movements (past five years) ranks YBMK above the industry average of 1.07 (Dolbeer & Begier, 2012). This is an indicator for airports to measure consequences to operators, however it may not be possible due to location, species and other environmental factors, to achieve a rate below this benchmark (note - this measure includes near misses where aircraft held before take-off to allow wildlife activity to subside which although had an operational impact is considered an indicator of good risk management and likely prevented strike events from occurring).

There are limited to no aircraft engineers based at Mackay Airport so strikes that require an engineering assessment will result in a delay to fly engineers from Brisbane.

Table 8. Adverse effective strikes summary, YBMK, 2022/23.

Date	Operator	Species	No.	Strike Type	Designation	Effect Type
02/03/2023	Qantas	Bush Stone-curlew	1	Confirmed	On-airport	Delay
13/03/2023	Jetstar	Unidentified Bird	1	Confirmed	Airport Vicinity	Delay
12/04/2023	QantasLink	Torresian Crow	1	Confirmed	On-airport	Delay
01/05/2023	Qantas	Magpie Lark	1	Confirmed	On-airport	Delay
05/05/2023	Qantas	Nankeen Kestrel	1	Confirmed	Unknown	Delay
15/06/2023	Qantas	Plumed Whistling-Duck	6	Confirmed	On-airport	Delay

5.2. Wildlife Hazard Assessment

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.

5.3. Safety Management System Risk Assessment

Part 139 MOS Section: 17.02 (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

MAPL's risk register identifies wildlife risks and control actions as they relate to the key areas of operation, financial, reputation, regulatory, safety, environmental, and business interruption. The wildlife strike risk has been ranked as High residual risk (Mackay Airport, 2023).

6. Wildlife Hazard Review

6.1. Wildlife Risk 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;

Avisure assessed the wildlife risk using strike data from MAPL and ATSB, and on-airport survey data collected during quarterly site visits. Refer to Appendix E for risk assessment methods, Appendix F for survey methods and Appendix G for Wildlife Hazard Analysis. Table 9 summarises the combined results to provide the overall risk ranking of high and moderate risk wildlife species.

This risk assessment identified 9 high risk species and 12 moderate risk species, including three new species: Masked Owl, Red-tailed Black-Cockatoo, and Unidentified Flying-fox.

The following species increased in risk since 2021/22:

- Straw-necked Ibis (from moderate risk to high risk)
- Unidentified Flying-fox (from low risk to moderate risk)
- Little Pied Cormorant (from low risk to moderate risk)
- Masked Owl (from N/A to moderate risk)
- Red-tailed Black-Cockatoo (from N/A to moderate risk)

Table 9. Overall species risk rankings, high and moderate risk species only, 2022/23.

Species	Overall Risk	Survey Risk		Strike Risk
		Diurnal	Nocturnal	
Australian White Ibis	High	High	-	High
Masked Lapwing	High	Moderate	Moderate	High
Bush Stone-curlew	High	Low	Moderate	High
Plumed Whistling-duck	High	-	Moderate	High
Pacific Black Duck	High	Low	Low	High
Unidentified Bird	High	-	-	High
Wandering Whistling-duck	High	-	-	High
Feral Pigeon	High	High	-	Low
Straw-necked Ibis	High	High	-	-
Black Flying-fox	Moderate	-	-	Moderate
Pied Cormorant	Moderate	-	-	Moderate
Masked Owl	Moderate	-	-	Moderate
Unidentified Snake	Moderate	-	-	Moderate
Torresian Crow	Moderate	Moderate	-	Low
Rainbow Lorikeet	Moderate	Moderate	-	Low
Australian Bustard	Moderate	Moderate	-	-
Black Kite	Moderate	Moderate	-	-
Cattle Egret	Moderate	Moderate	-	-
Little Pied Cormorant	Moderate	Moderate	-	-
Red-tailed Black-Cockatoo	Moderate	Moderate	-	-
Unidentified Flying-fox	Moderate	-	Moderate	-

Due to a decrease in survey observations or strikes, the following species reduced in risk since 2021/22:

- Magpie Goose
- Australian Pelican
- Little Black Cormorant
- Pied Imperial-Pigeon
- Glossy Ibis
- Little Corella

Morning surveys ranked as high risk due to the following species: Feral Pigeon (high risk) (539 SRI) Australian White Ibis (high risk) (334 SRI), Australian Bustard (moderate risk) (102 SRI) and Cattle Egret (moderate risk) (77 SRI) (Figure 8). These species all represent a significant hazard due to high mass individuals and/or flocking behaviour.

Afternoon surveys ranked as moderate risk (Figure 8) due to Straw-necked Ibis (high risk) (295 SRI), Australian White Ibis (high risk) (211 SRI) and Feral Pigeon (high risk) (74 SRI).

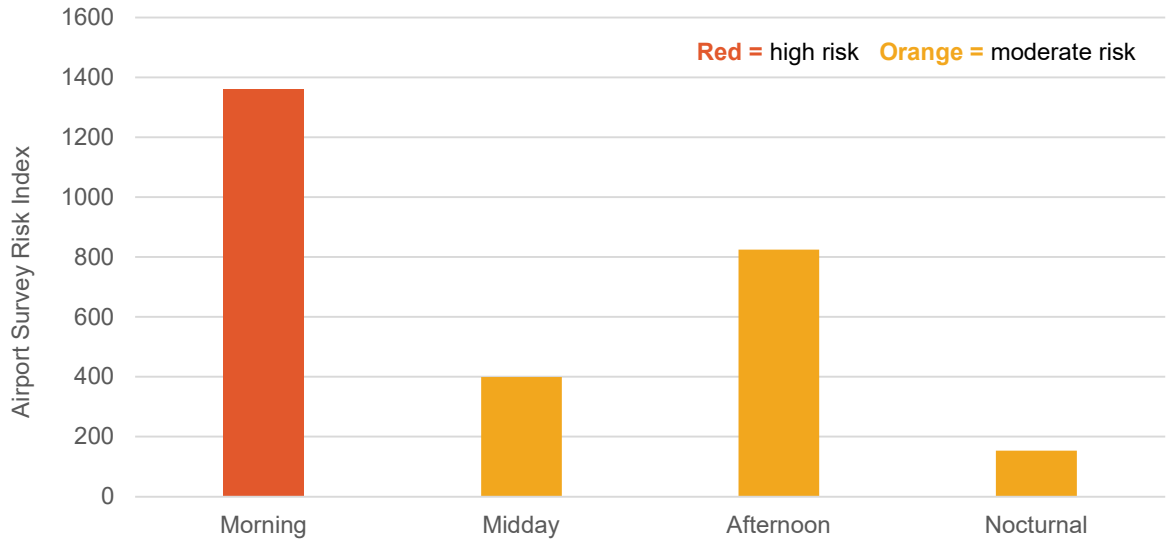


Figure 8. Airport Survey Risk Index (ASRI) by time of day, 2022/23.

6.2. On-airport Attractants

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;

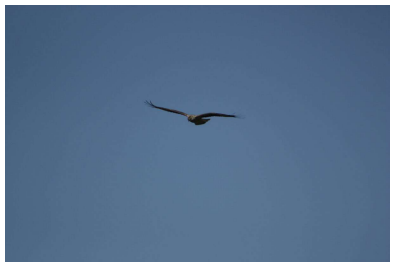
which are likely to cause wildlife to transit the take-off, approach and transitional surfaces;

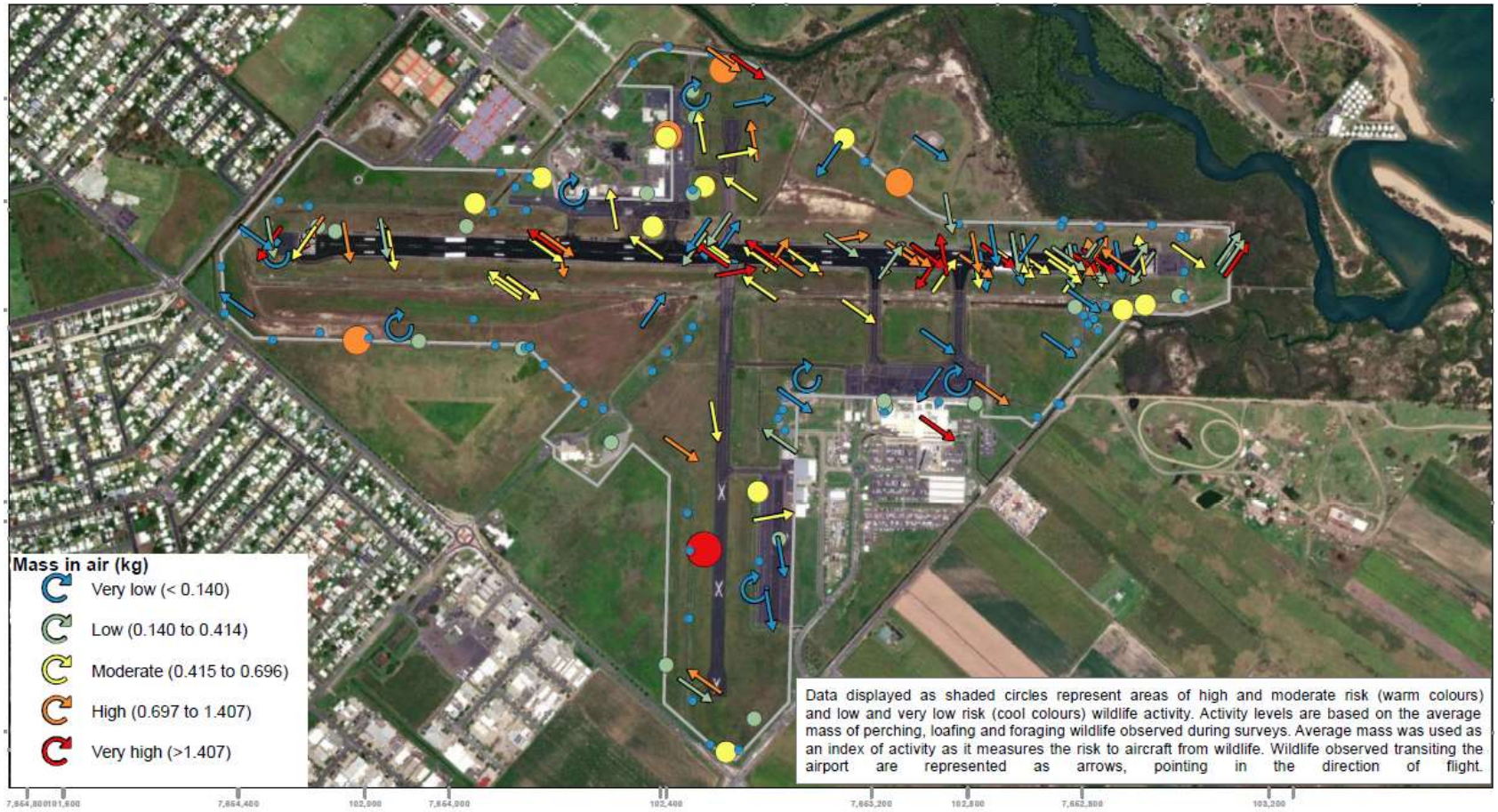
Table 10 outlines on-airport attractants and the high and moderate risk species attracted to that area. Refer to Appendix F for Avisure survey methods.

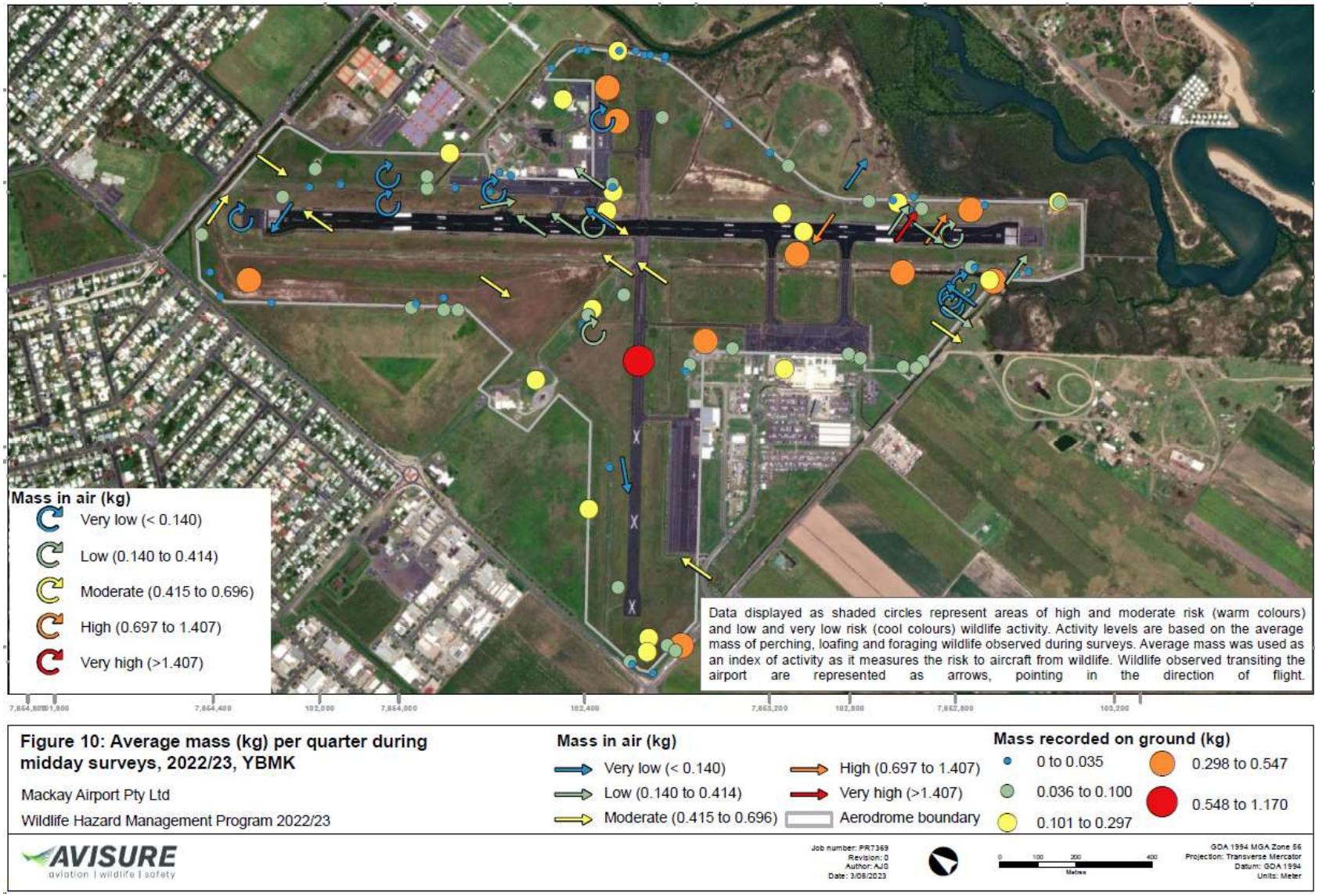
Table 10. On-airport and landside wildlife hazard attractant and the high and moderate risk species attracted, YBMK.

Area	Hazard Description	High and Moderate Risk Species (2022/23)	
Drains and Depressions 	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. Hazardous waterbirds are present after rain when the ground remains moist. Areas of retained water also provide frog-breeding habitat.	Australian White Ibis Straw-necked Ibis Masked Lapwing Bush Stone-curlew Unidentified Snake	Pacific Black Duck Wandering Whistling-Duck Plumbed Whistling-duck Cattle Egret
Grass Areas 	Grass areas attract a variety of wildlife species including birds, insects and small mammals. Seeds and flowers from grasses and weeds provide a food source. Prey items are easily accessible to raptors and other opportunistic species following mowing and heavy rain.	Australian White Ibis Black Kite Bush Stone-curlew Cattle Egret Feral Pigeon Masked Lapwing	Straw-necked Ibis Torresian Crow Wandering Whistling-Duck Australian Bustard Unidentified Snake
Sealed Areas 	Aircraft manoeuvring areas provide high ground for ground dwelling invertebrates during rain which attracts foraging birds. Ponding provides water source for drinking. Hot air rising from sealed surfaces creates updrafts for thermalling birds and can provide wildlife to keep warm.	Bush Stone-curlew Masked Lapwing Straw-necked Ibis Torresian Crow	Unidentified Snake Black Kite Australian White Ibis Australian Bustard

Area	Hazard Description	High and Moderate Risk Species (2022/23)	
Perimeter Fence 	Gaps in gates and underneath fence lines may allow airside access for medium to large sized terrestrial mammals. Fencing also provides perching opportunity for various moderate and high-risk birds. Barbed wire may pose a risk of entanglement particularly for flying-foxes.	Feral Pigeon Black Kite Unidentified Flying-fox	Torresian Crow Rainbow Lorikeet
Built Environment 	Structures such as buildings, hangars, air traffic control tower, runway/taxiway/apron lights, hangars, windsocks, and antennas. Anything constructed that could provide perching, roosting or nesting habitat for wildlife.	Black Kite Feral Pigeon	Rainbow Lorikeet Torresian Crow
Landside Vegetation 	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 have the potential to attract hazardous species such as Rainbow Lorikeets and flying-foxes when in bloom (March to May).	Unidentified Flying-fox Australian White Ibis Feral Pigeon Little Pied Cormorant Black Kite	Rainbow Lorikeet Torresian Crow Straw-necked Ibis

Area	Hazard Description	High and Moderate Risk Species (2022/23)
Airspace 	Birds take flight to transit between foraging or roosting sites, flee an area or actively hunt for food. Most wildlife strikes occur in the air with birds moving around on an airport.	All flying animals
Construction Work 	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 established nests in these materials. Lighting may attract insects that attract hazardous birds.	Pacific Black Duck Bush Stone-curlew Australian White Ibis Plumed Whistling-duck Feral Pigeon Cattle Egret Unidentified Snake Masked Lapwing Black Kite Rainbow Lorikeet Torresian Crow Australian Bustard Straw-necked Ibis


Mass in air (kg)
Very low (< 0.140)
Low (0.140 to 0.414)
Moderate (0.415 to 0.696)
High (0.697 to 1.407)
Very high (>1.407)
Data displayed as shaded circles represent areas of high and moderate risk (warm colours) and low and very low risk (cool colours) wildlife activity. Activity levels are based on the average mass of perching, loafing and foraging wildlife observed during surveys. Average mass was used as an index of activity as it measures the risk to aircraft from wildlife. Wildlife observed transiting the airport are represented as arrows, pointing in the direction of flight.
Figure 9: Average mass (kg) per quarter during morning surveys, 2022/23, YBMK
Mackay Airport Pty Ltd
Wildlife Hazard Management Program 2022/23
Mass in air (kg)
Very low (< 0.140)
Low (0.140 to 0.414)
Moderate (0.415 to 0.696)
High (0.697 to 1.407)
Very high (>1.407)
Aerodrome boundary
Mass recorded on ground (kg)
0 to 0.087
0.088 to 0.190
0.191 to 0.400
0.401 to 1.186
1.187 to 3.249
AVISURE
aviation | wildlife | safety
Job number: PR7369
Revision: 0
Author: AJS
Date: 3/08/2023
Metres
GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter


Mass in air (kg)
Very low (< 0.140)
Low (0.140 to 0.414)
Moderate (0.415 to 0.696)
High (0.697 to 1.407)
Very high (>1.407)
Data displayed as shaded circles represent areas of high and moderate risk (warm colours) and low and very low risk (cool colours) wildlife activity. Activity levels are based on the average mass of perching, loafing and foraging wildlife observed during surveys. Average mass was used as an index of activity as it measures the risk to aircraft from wildlife. Wildlife observed transiting the airport are represented as arrows, pointing in the direction of flight.
Figure 10: Average mass (kg) per quarter during midday surveys, 2022/23, YBMK
Mackay Airport Pty Ltd
Wildlife Hazard Management Program 2022/23
Mass in air (kg)
Very low (< 0.140)
Low (0.140 to 0.414)
Moderate (0.415 to 0.696)
High (0.697 to 1.407)
Very high (>1.407)
Aerodrome boundary
Mass recorded on ground (kg)
0 to 0.035
0.036 to 0.100
0.101 to 0.297
0.298 to 0.547
0.548 to 1.170
AVISURE aviation | wildlife | safety
Job number: PR7369
Revision: 0
Author: AJS
Date: 3/08/2023
GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

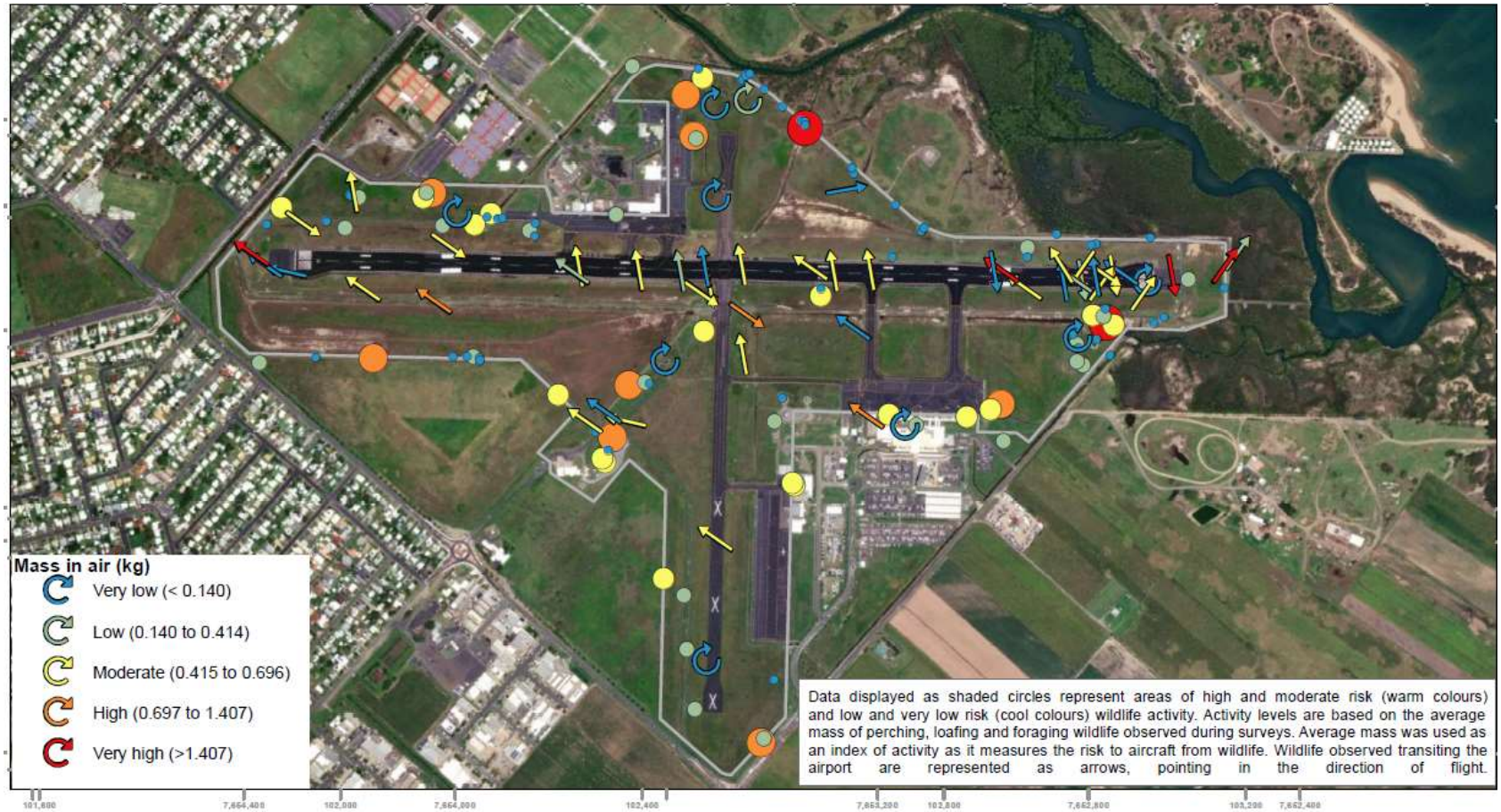


Figure 11: Average mass (kg) per quarter during afternoon surveys, 2022/23, YBMK

Mackay Airport Pty Ltd

Wildlife Hazard Management Program 2022/23

Mass in air (kg)

- Very low (< 0.140)
- Low (0.140 to 0.414)
- Moderate (0.415 to 0.696)
- High (0.697 to 1.407)
- Very high (>1.407)
- Aerodrome boundary

Mass recorded on ground (kg)

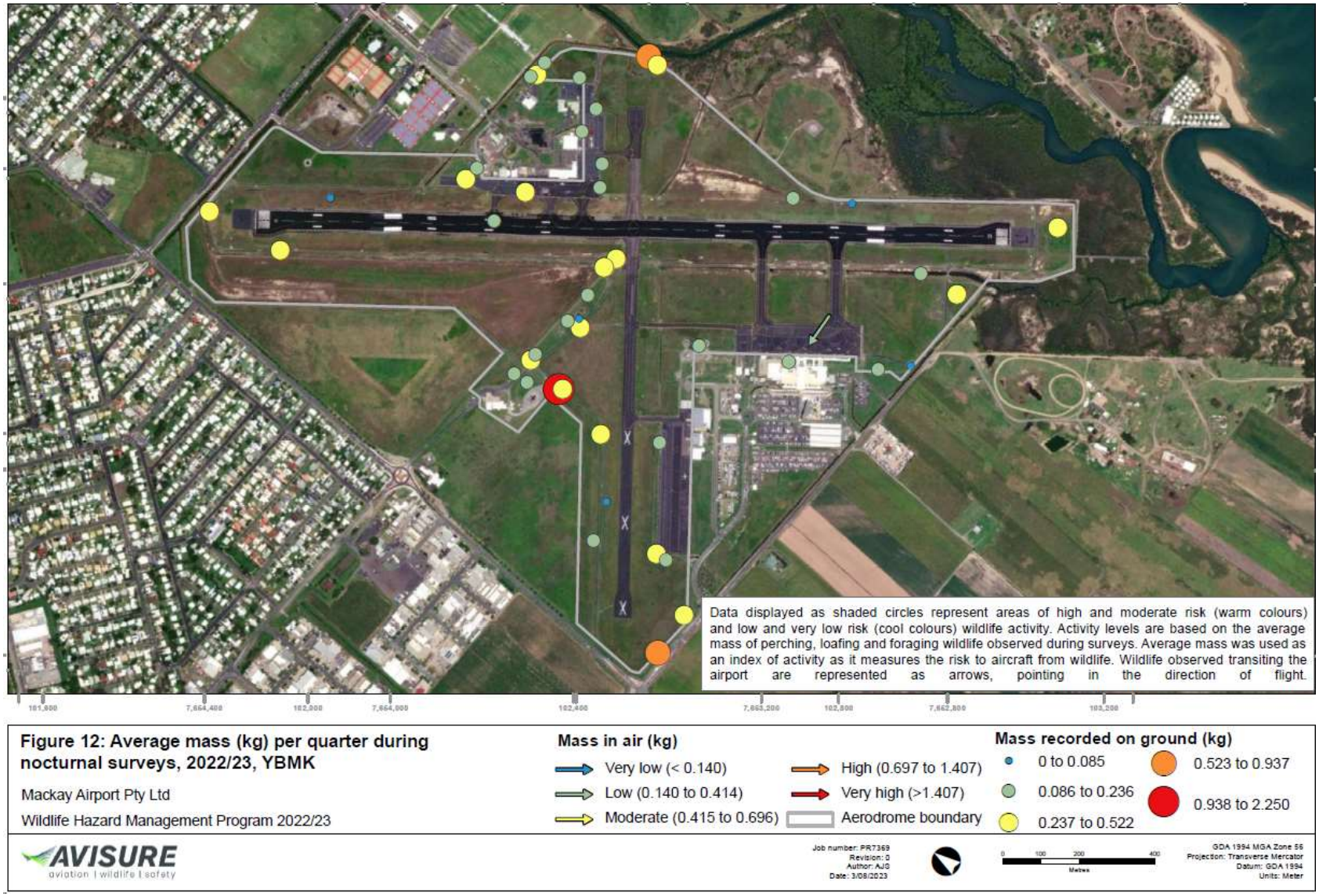
- 0 to 0.035
- 0.036 to 0.100
- 0.101 to 0.237
- 0.238 to 0.487
- 0.488 to 1.463

AVISURE aviation | wildlife | safety

Job number: PR7369
Revision: 0
Author: AJ0
Date: 3/08/2023

0 100 200 400
Metres

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter


Data displayed as shaded circles represent areas of high and moderate risk (warm colours) and low and very low risk (cool colours) wildlife activity. Activity levels are based on the average mass of perching, loafing and foraging wildlife observed during surveys. Average mass was used as an index of activity as it measures the risk to aircraft from wildlife. Wildlife observed transiting the airport are represented as arrows, pointing in the direction of flight.
Figure 12: Average mass (kg) per quarter during nocturnal surveys, 2022/23, YBMK
Mackay Airport Pty Ltd
Wildlife Hazard Management Program 2022/23
Mass in air (kg)
Very low (< 0.140)
Low (0.140 to 0.414)
Moderate (0.415 to 0.696)
High (0.697 to 1.407)
Very high (>1.407)
Aerodrome boundary
Mass recorded on ground (kg)
0 to 0.085
0.086 to 0.236
0.237 to 0.522
0.523 to 0.937
0.938 to 2.250
AVISURE
aviation | wildlife | safety
Job number: PR7369
Revision: 0
Author: AJG
Date: 3/08/2023
0 100 200 400
Metres
GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

6.3. Off-airport Attractants

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-airport 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 34 off-airport locations in the vicinity of YBMK (Figure 13). Twenty-one of these sites are located within 3km of the airport, 12 within 8km, one within 13km, and one outside the 13km radius. Figure 13 shows the average mass per survey per site for 2022/2, and Appendix H outlines the off-airport schedule. Refer to Appendix G for Wildlife Hazard Analysis.

The potential risk posed to aircraft is influenced by site's proximity to YBMK, the land use, the site's attractiveness to high and moderate risk species and the number of wildlife observed. Quarterly and annual off-aerodrome surveys help understand the high and moderate risk species that use these sites.

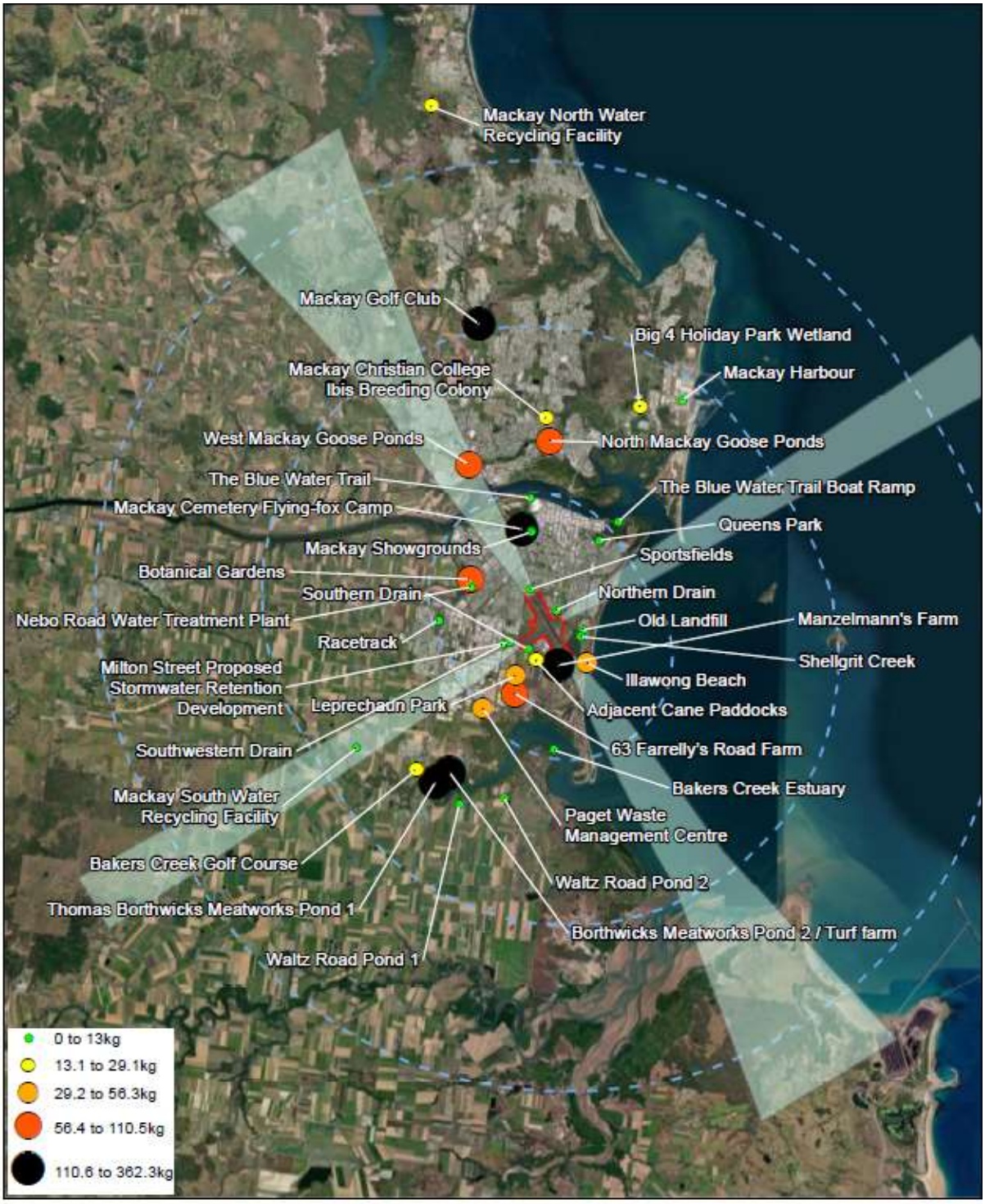


Figure 13: Average mass (kg) recorded during off-airport surveys per site, 2022/23

Ma aein a Cun i

Ma aAptBiMa n a e m e nta2022/23

Approach and departure paths

3, 8 & 13km buffers from runway

Aerodrome boundary

6.4. Flying-fox Surveys

Flying-foxes contribute to the strike risk as they transit between foraging and roosting sites. Avisure complete quarterly monitoring of the Mackay Cemetery flying-fox camp and DES also monitors this site as part of the National Flying-fox Monitoring Program. Mackay Regional Council and DES monitor several flying-fox camps and MAPL are liaising with Mackay Regional Council to receive this data. Table 11 details the Mackay Cemetery flying-fox camp fly-out times and direction for 2022/23.

Table 11. Mackay Cemetery flying-fox camp fly-out, 2022/23.

Date	Fly-out Start	Fly-out Finish	Number	Direction
12/09/2022	18:18	18:41	2183	South-east
12/09/2022	18:18	18:41	1010	East
15/11/2022	18:26	18:41	1450	East
15/11/2022	18:26	18:41	1590	South-west
15/11/2022	18:26	18:41	470	South
14/02/2023	18:36	19:22	1447	South-east
14/02/2023	18:36	19:22	3180	North-east
16/05/2023	17:56	18:20	240	East
16/05/2023	17:56	18:20	797	West

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 12). This ensures early detection of wildlife hazards in airside areas, particularly inside critical aircraft movement areas.

Table 12. Wildlife 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: • 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: • 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	ASO	SOP: Wildlife Patrol

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	ASO	SOP: Wildlife Patrol
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 monitors airside movement areas for wildlife hazards and communicates to ASOs and pilots.	As required	ATC	Manual of Air Traffic Services 2023 – 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 13 outlines MAPL'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 is in place between MAPL and Manzelmann's Farm regarding wildlife hazard management and communicating wildlife hazards.

Table 13. 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 5 & 6 Appendix E

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 14. Other wildlife 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 3.11.8 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

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. Mackay Regional Council Flying-fox and Ibis Surveys

Mackay Regional Council monitors the following flying-fox camps and ibis roosts quarterly and communicates numbers to YBMK and Avisure:

- Sarina Flying-fox Camp
- Walkerston Flying-fox Camp
- Eungella Flying-fox Camp
- Mackay Cemetery Flying-fox Camp
- Mackay Showground Flying-fox Camp
- Mackay Golf Club Ibis Roost
- Mackay Christian College Ibis Roost

7.2.3. Avisure Flying-fox Surveys

Avisure monitors the following flying-fox camps each quarter to evaluate the risk flying-foxes pose to 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 15 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.

The WHMC 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.

Table 15. Wildlife 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		As required	ASO	SOP: Wildlife Hazard Communication
Updating ATIS		As required	ASO	SOP: Wildlife Hazard Communication
Updating ERSA		As required	MAO	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
WHMC meetings	Providing stakeholders with an update of the wildlife strike trends and current wildlife hazard species.	Semi-annual	Wildlife consultant	SOP: Data Review WHMP section 8.1 Reviews WHMC meeting minutes
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 MAPL to achieve an effective and integrated approach to wildlife hazard management. Where required, the 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 16.

Table 16. Wildlife hazard management 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 CASC	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). MAPL 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 service at the Australian Museum.

MAPL investigate all significant strike incidents.

Table 17. 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. 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.

7.5.1. 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 18 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 18. Active wildlife hazard 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

7.5.2. 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. MAPL uses a range of methods to passively manage risks, including a full security fence to prevent access by terrestrial threats such as wallabies. MAPL manipulates grass height and overall landscaping to reduce the availability of food and shelter.

Table 19. Passive wildlife hazard management methods.

Task	Description	Frequency	Responsible	Procedure
Airside grass management	Mow grass	As required	Grounds Maintenance	SOP: Habitat and Land Management
	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

7.6. Species Action Plans

Species Action Plans (SAP) support the WHMP and provide the actions required by MAPL 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:

Australian White Ibis	Feral Pigeon	Rainbow Lorikeet
Masked Lapwing	Straw-necked Ibis	Australian Bustard
Bush Stone-curlew	Black Flying-fox	Black Kite
Plumed Whistling-duck	Pied Cormorant	Cattle Egret
Pacific Black Duck	Masked Owl	Little Pied Cormorant
Unidentified Bird	Unidentified Snake	Red-tailed Black-Cockatoo
Wandering Whistling-duck	Torresian Crow	Unidentified Flying-fox

7.7. Measurement and Analysis

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;

MAPL continually measure and analyse the performance of the WHMP through data reviews. Refer to Table 20 for methods used.

MAPL recognises the strength of its monitoring program is in good record keeping. Records of the monitoring activities are kept in TrackerAIRSIDE™ entries, spreadsheets, and databases. 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. 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. Dispersal and culling data are reviewed to evaluate for effectiveness and to ensure compliance to wildlife protection legislation.

Table 20. Wildlife management program 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, CASC, BAP and Wildlife consultant	SOP: Data Review WHMP section 2.6
Review data and program trends	Review the data to analyse trends.	Annually	MAO, CASC and Wildlife consultant	SOP: Data Review SOP: WHMP Review WHMP section 2.6 and section 8

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 COO 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.

The airport, in consultation with a suitably qualified aviation biologist with experience in aviation wildlife risk, in accordance with the CASR Part 139 MOS, reviews the WHMP as follows:

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.

WHMP reviews are also triggered:

- If there is a significant change in wildlife activity or strike rate occurs;
- If there is a strike or series of strikes involve rare, threatened, or endangered species[17],
- In response to a major weather event;
- If there is significant changes to organisational structure, operational or personnel;
- At the request by DES, or other environment departments, or airlines.
- At the discretion of CASA or AOM.

Table 21. WHMP 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 CASC ASO Wildlife consultants	SOP: Wildlife Hazard Management Committee WHMP section 2.5 and section 8
WHMP update	Review and audit the WHMP.	Annually	MAO CASC 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 CASC ASO Wildlife consultants	SOP: WHMP Review WHMP section 8

8.1. External Audits

In addition to reviews, external audits are used as an independent evaluation of the program to improve any deficiencies identified. Audit results are incorporated into the wildlife hazard management program.

17 *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 department consultation.

Airlines, CASA, and/or aviation consultants may complete external audits.

8.2. Damage Mitigation Permit: Audit Reports

As of 22 August 2020, under the Nature Conservation (Animals) Regulation 2020, YBMK is exempt from a DMP to lawfully take or relocate wildlife from airport property (refer to Section 2.1).

8.3. Research, Trials, and Initiatives

If MAPL identifies the need to research various aspects of wildlife hazard management, the targeted research provides information to improve WHMP implementation and allows for more effective hazard management. Refer to Appendix I for a summary of the key research and initiatives undertaken.

References

Airservices Australia 2023, *Manual of Air Traffic Services*, [ONLINE]. Available at https://www.airservicesaustralia.com/mats/docs/nos-saf-2000.pdf. [Accessed 20 October 2023].

Airservices Australia. 2023. *Movements at Australian Airports* [ONLINE]. Available at: https://www.airservicesaustralia.com/aviation-reporting/movements-at-australian-airports/ [Accessed 7 August 2023].

Allan, J. 2002. *The Costs of Bird Strikes and Birdstrike Prevention*. Pages 147–153 in L. Clark, editor. Human conflicts with wildlife: economic considerations. Proceedings of the National Wildlife Research Centre special symposium, Fort Collins, Colorado, USA.

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

Bureau of Infrastructure and Transport Research Economics, 2023, *Airport traffic data,* [ONLINE]. Available at https://www.bitre.gov.au/publications/ongoing/airport_traffic_data. [Accessed 15 September 2023].

Bureau of Meteorology. 2023a. *Daily Rainfall – Mackay Aero* [ONLINE]. Available at: http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2022&p_c=-218396137&p_stn_num=033045. [Accessed 10 September 2023].

Bureau of Meteorology. 2023b. *Daily maximum temperature – Mackay Aero* [ONLINE]. Available at: http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=122&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=033045. [Accessed 10 September 2023].

Civil Aviation Authority of New Zealand. 2020. *Bird Hazards*, Wellington, New Zealand, October 2020.

Department of Environment and Science 2023, *Central Mackay Coast (CMC) IBRA bioregion*, [ONLINE]. Available at: https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/ibra-bioregion-central-mackay-coast-cmc/. [Accessed 21 September 2023].

Department of Infrastructure, Local Government and Planning 2017, *State Planning Policy*, Department of Infrastructure, Local Government and Planning, Brisbane Queensland. Available at https://dsdmipprd.blob.core.windows.net/general/spp-july-2017.pdf.

Dolbeer, R. 2011. *Increasing Trend of Damaging Bird Strikes with Aircraft Outside the Airport Boundary: Implications for Mitigation Measures*. Human-Wildlife Interactions 5(2):235-248, Fall 2011.

Dolbeer, R., and Begier, M. 2012. *Comparison of Wildlife Strike Data Among Airports to Improve Aviation Safety*. International Bird Strike Conference. Stavanger, Norway.

Mackay Airport, 2022, *Mackay Airport Land Use Plan*, [ONLINE] https://www.mackayairport.com.au/assets/Uploads/Mackay-Land-Use-Plan-2022-Final-2.pdf. [Accessed 13 September 2023].

Mackay Airport, 2023, *Cairns Airport Company Risk Register*, Mackay, Queensland.

Parsons, D., 2022, Using Machine Learning to Estimate Wildlife Strike Costs in Australia. Proceedings of the Australian Aviation Wildlife Hazard Group 2022 Forum, Adelaide, Australia.

Shaw, P., and Dolbeer R., 2023. *Database of Human Fatalities and Destroyed Civil Aircraft Due to Wildlife Strikes, 1912 to Present* [ONLINE]. Available at: https://avisure.com/wp/serious-accident-database/ [Accessed 02 August 2023].

Appendices

Appendix A: WHMP Key Performance Indicators

Appendix B: Legal and Other Requirements

Appendix C: Roles and Responsibilities

Appendix D: Wildlife Hazard Management Committee Members

Appendix E: Risk Assessment Methods

Appendix F: Avisure Survey Methods

Appendix G: Wildlife Hazard Analysis

Appendix H: Off-aerodrome NASF Risks

Appendix I: Research, Reviews, Trials, and Initiatives

Appendix A: WHMP Key Performance Indicators

WHMP Key Performance Indicators				
Legislation and Regulatory Requirements				
Objective: To develop, implement and maintain procedures and systems to ensure operations at comply with applicable legislation, regulations, standards and industry best practice.				
Target	**Performance Indicator**	**Type**	**Evidence**	**Procedure**
Continual improvement to meeting legislative compliance.	Compliance to legal requirements is conducted at least annually.	Leading	Record of review	WHMP Review
Assurance				
Objectives: 1. To review the WHMP: a. Annually and reassess the risk following serious incidents b. In response to operational or legislative changes 2. To conduct regular internal and external audits. 3. To clearly define accountabilities and responsibilities for all personnel and contractors.				
Target	**Performance Indicator**	**Type**	**Evidence**	**Procedure**
Regular reviews of YBMK wildlife hazard management program.	Review of WHMP and Wildlife Hazard Management Procedures conducted at least annually.	Leading	Record of review	WHMP Review
Culture				
Objectives: 1. To develop, embed and continually encourage a positive culture where wildlife management is a priority and the WHMP is recognised and valued. 2. To develop, embed and continually encourage a reporting culture.				

WHMP Key Performance Indicators				
Target	Performance Indicator	Type	Evidence	Procedure
Develop an awareness program, highlighting the importance of multiple stakeholder involvement in managing the strike hazard.	Awareness campaign developed and rolled out to pilots, ATC, aerodrome maintenance staff, environment managers and wildlife managers.	Leading	Awareness campaign	Wildlife Strike Reporting Wildlife Hazard Notification (WHN)
Risk Management				
Objectives: 1. To understand and minimise the risk of wildlife strike through a continuous process of identifying, recording and reviewing risks, objectives, targets and indicators. 2. To reduce the costs of unscheduled maintenance associated with wildlife strike. 3. To preserve life and aviation capability through reducing the risk of wildlife strike. 4. To reduce wildlife mortality.				
Target	Performance Indicator	Type	Evidence	Procedure
To understand the daily risk posed by wildlife at YBMK.	Wildlife patrols (routine) recorded in TrackerAIRSIDE™.	Leading	YBMK Operations Log entries	Serviceability Inspections and Wildlife Patrols
	Wildlife surveys undertaken.	Leading	Annual wildlife surveys	WHMP Review YBMK Wildlife Surveys
	Scorecard performance conducted monthly.	Leading	Scorecard	WHMP Review

WHMP Key Performance Indicators				
To understand the wildlife hazard risk posed by wildlife at YBMK following a strike.	Wildlife strikes reported.	Leading	Wildlife database	Serviceability Inspections and Wildlife Patrols Wildlife Strike Reporting Identifying and Handling Wildlife Remains
To reduce the risk of wildlife strike by undertaking runway inspections prior to the arrival and departure of aircraft and checking fence lines.	Wildlife patrols (routine) and fence line inspections recorded in TrackerAIRSIDE™.	Leading	YBMK Operations Log entries	Serviceability Inspections and Wildlife Patrols Aerodrome Inspection Checklist
Disperse all hazardous wildlife posing a risk.	Dispersal conducted.	Leading	Wildlife dispersal data	Serviceability Inspections and Wildlife Patrols Wildlife Dispersal
To understand the effectiveness of the dispersal effort.	Dispersal conducted, and data recorded.	Leading	Wildlife dispersal data	Serviceability Inspections and Wildlife Patrols Wildlife Dispersal
Yearly strike rate reductions.	Reduced wildlife strikes per 10,000 movements.	Lagging	Wildlife strike database	Wildlife Strike Reporting
Yearly mass struck reductions.	Reduced mass struck per 10,000 movements.	Lagging	Wildlife strike database	Wildlife Strike Reporting
Yearly strike rate reductions involving high risk wildlife strikes.	Reduced high risk wildlife strikes per 10,000 movements.	Lagging	Wildlife strike database	Wildlife Strike Reporting
Yearly strike rate reductions involving damaging wildlife strikes.	Reduced damaging wildlife strikes per 100,000 movements.	Lagging	Wildlife strike database	Wildlife Strike Reporting
Yearly strike rate reductions involving strikes where species is unidentified.	Reduced number of strike reports that do not identify wildlife species.	Leading	Wildlife strike database	Wildlife Strike Reporting

WHMP Key Performance Indicators				
Establish a process for collection and assessment of aircraft movement data by type, time, aerodrome and runway used.	Database developed for input of accurate aircraft movement data.	Leading	Movement database	
Communication				
Objective: 1. To develop, implement and maintain successful tools that encourage open communication, delivery of key messages and awareness of responsibilities under the WHMP to all personnel, business partners and contractors.				
Target	Performance Indicator	Type	Evidence	Procedure
Timely reporting of wildlife strikes.	Strikes reported to the ATSB within 72 hours.	Leading	ATSB	Wildlife Strike Reporting
All strikes to be reported.	All strikes reported.	Leading	ATSB	Wildlife Strike Reporting
All serious incidents and damaging strikes to be investigated.	Strike investigated.	Leading	ATSB Strike investigation	Wildlife Strike Reporting
Develop standardised phraseology and a mechanism for communicating wildlife hazards.	Wildlife Hazard Notification (WHN) process developed and in use.	Leading	WHNs. ERSA entry. NOTAM use.	Wildlife Hazard Notification
Effective Communication	Real time wildlife hazards issued on Air Traffic Information Service (ATIS) and operationally relevant information in hands of pilots.	Leading	Communications during the exercise when wildlife hazard exists	Wildlife Hazard Notification Serviceability Inspections and Wildlife Patrols
	Standardised phraseology adopted for communication between pilots, ATC, wildlife officers and others relaying wildlife information.	Leading	Communications during the exercise when wildlife hazard exists	Wildlife Hazard Notification

WHMP Key Performance Indicators

Training

Objectives:
1. To ensure there are sufficient skilled and trained resources available to develop, implement, maintain and improve the WHMP.
2. To ensure personnel are competent, provided with adequate information and training appropriate to their duties.
3. To have no firearm incidents.
4. To improve operational responses to wildlife hazards through appropriate training of engineers, air traffic controllers (ATC) and wildlife managers.

Target	Performance Indicator	Type	Evidence	Procedure
Improved understanding of the wildlife hazard.	Ground engineers receive information on safe collection of strike remains.	Leading	Information sheet developed and distributed.	N/A
	All visiting aircraft operators are briefed on the wildlife hazard at the aerodrome and the procedures implemented.	Leading	Induction records	N/A
Develop and implement a training program for ASO or their equivalent.	Syllabus developed.	Leading	Competency evaluation	Wildlife Hazard Management Training and Competency Assessment
	Trainee ASO (or equivalent) provided suitable training during initial training.	Leading	Competency evaluation	
	Experienced ASO (or equivalent) received refresher training.	Leading	Competency evaluation	

Infrastructure and Facilities

Objective:
1. 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.

WHMP Key Performance Indicators				
Target	Performance Indicator	Type	Evidence	Procedure
On-aerodrome wildlife attraction reduction.	Appropriate habitat management with reduced utilisation of habitats by wildlife.	Leading	Wildlife surveys conducted by specialists Habitat management projects – e.g. grass height	Habitat/Land Management WHMP Review
Off-aerodrome wildlife attraction reduction.	Increased awareness, assessment and management of sites that are attracting, or have the potential to attract, wildlife.	Leading	Planning Liaison/Community Group Minutes	WHMP Review
Participation and Action				
Objectives: 1. Define roles, responsibilities, and procedures for managing wildlife risk at YBMK. 2. To actively encourage aircraft operators, visitors, business partners and contractors to participate in the WHMP. 3. To encourage activities that promote and establish positive wildlife management on airport.				
Target	Performance Indicator	Type	Evidence	Procedure
Ongoing consultation with YBMK stakeholders.	Facilitation of regular meetings with relevant stakeholders and delineation of responsibilities.	Leading	Agenda developed that includes Wildlife Hazard Management	WHMP Review
	Meetings completed.	Leading	Meeting Minutes	WHMP Review

Appendix B: Legal and Other Requirements

Australian Context

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 B1. Australian aviation legislation and standards.

Instrument	Body/Department	Description	Link
Civil Aviation Act 1988	CASA	Establishes CASA functions in relation to civil aviation, with a particular emphasis on safety.	https://www.legislation.gov.au/Details/C2021C00060
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.	https://www.legislation.gov.au/Details/F2023C00499
CASR Part 139 (Aerodromes) 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 (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

Instrument	Body/Department	Description	Link
CASA AC 139.C-16 v1.0 (2023). Wildlife Hazard Management	CASA	The AC is intended to provide general information and guidance for the management of wildlife hazards at aerodromes. Aerodrome operators should use the guidance in this circular to inform their decision-making process to meet the requirements of the Part 139 of the Civil Aviation Safety Regulations.	https://www.casa.gov.au/sites/default/files/2023-06/advisory-circular-139.c-16-wildlife-hazard-management.pdf
Transport Safety Investigation Act 2003	ATSB	Bird strikes are defined as reportable matters, of which written reports must be submitted within 72hrs.	https://www.legislation.gov.au/Details/C2016C00617
National Airports Safeguarding Framework Guideline C	Department of Infrastructure, Transport, Regional Development and Communications[18]	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. 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.	https://www.infrastructure.gov.au/sites/default/files/documents/3.1.4_Guideline_C.pdf

18 Formerly the Department of Infrastructure and Transport.

Table B2. NASF Guideline.

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

Table B3. Australian legislation and standards.

Instrument	Body/Department	Description	Link
Environment Protection and Biodiversity (EPBC) Act 1999	Commonwealth Department of Environment	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. 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). The EPBC Act also identifies species protected under the various international migratory bird treaties (detailed next).	https://www.legislation.gov.au/Details/C2023C00225
Nature Conservation (Animals) Regulations 2020	Department of Environment and Science (QLD)	YBMK is listed as a strategic airport as per the State Planning Policy (2020) and as such, under Section 41 and 42 of the Nature Conservation Regulations 2020, is exempt from requiring a Damage Mitigation Permit to control wildlife on the airport provided pre-conditions are met: The standing authorisation applies to strategic airports identified in the Queensland State Planning Policy.	https://www.legislation.qld.gov.au/view/pdf/asmade/sl-2020-0136

Instrument	Body/Department	Description	Link
		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 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.	
		The taking will not adversely affect the survival of the animal in the wild.	
		The proposed way of taking the animal is humane.	
		The owner of an airport must keep a record of an animal taken, removed or relocated, under this authorisation.	
Nature Conservation Act 1992	Department of Environment and Science (QLD)	Conservation of nature in Queensland through dedication, declaration and management of protected areas and the protection of native wildlife and its habitat.	https://www.legislation.qld.gov.au/view/html/inforce/current/act-1992-020
Japan-Australia Migratory Bird Agreement (JAMBA)	Department of Climate Change, Energy, the Environment and Water (DEECA)	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.	http://www.austlii.edu.au/au/other/dfat/treaties/1981/6.html
China-Australia Migratory Bird Agreement	DEECA	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	DEECA	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

Instrument	Body/Department	Description	Link
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	DEECA	Wildlife species listed under international conventions afford them legislative protection to maintain populations and individuals.	http://www.cms.int/
Australian Animal Welfare Strategy	Department of Agriculture and Water Resources	Developed to ensure the humane treatment of all animals in Australia. The Strategy: • 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 code of practice 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.	http://www.agriculture.gov.au/animal/welfare/aaws
Damage by Aircraft Act 1999	Department of Infrastructure, Regional Development and Cities	• Imposes strict and unlimited liability. • Applies if a person or property on land or water suffers personal injury, loss of life, material loss, damage or destruction caused by: ○ Impact with aircraft in flight ○ Impact with aircraft that damaged or destroyed while in flight ○ Impact with persons, animal or thing that dropped or fell from aircraft in flight ○ Something that is a result of (1), (2) or (3). • If the act is applied, the owner or operator of the aircraft are jointly and severally liable. • Damages are recoverable under the Damage by Aircraft Act without proof of intention or negligence.	https://www.legislation.gov.au/Details/C2013C00130

Table B4. 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.dcceew.gov.au/environment/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 B5. 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 (1)	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 record 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.

Regulation / Standard	Requirement
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.C-16 v1.0 (2023). Section 3.1.6	The wildlife hazard management plan must, as a minimum, include: f) specific liaison arrangements for local planning authorities within a radius of at least 13 km from the aerodrome reference point.
CASA AC 139.C-16 v1.0 (2023). Section 3.2.1	For effective wildlife hazard management processes, wildlife activities, including bird activities, should be continuously monitored within and in the vicinity of the aerodrome.
CASA AC 139.C-16 v1.0 (2023). Section 3.2.4	For aerodromes, where wildlife hazard management is established, the aerodrome operator must monitor and record the following as part of the aerodrome serviceability inspection: b) wildlife activity that is visible in the vicinity of the aerodrome and from the aerodrome.
CASA AC 139.C-16 v1.0 (2023). Section 3.2.6	The aerodrome operator, in consultation with the local planning authorities, must attempt to monitor sites within 13 km of the aerodrome that do or could attract wildlife.
CASA AC 139.C-16 v1.0 (2023). Section 3.2.11	Monitoring practices in the vicinity of an aerodrome: a) the aerodrome operator should establish a process to monitor and record the presence of wildlife activity that is visible within the vicinity of the aerodrome, or visible from the aerodrome. b) aerodrome operators, in consultation with the local planning authorities should conduct an inventory of sites that attract wildlife within a defined radius around the aerodrome, paying particular attention to sites close to the airside and the approach and departure paths.

Regulation / Standard	Requirement
	c) the radius for monitoring sites that attract wildlife should be 13km around the aerodrome reference point. However, the radius may be extended or reduced, based on a wildlife evaluation of the aerodrome vicinity. d) monitoring in the vicinity of the aerodrome may include but is not limited to: i. areas used for waste, recycling, offal, or sewage ii. wetlands, marshes, areas of water discharge and open waterways; areas containing significant food sources for high-risk species iii. national parks, wildlife reserves and other significant wildlife corridors. e) the identification of these areas can be achieved by: i. the observation of wildlife transiting across the aerodrome between separate sources of attraction ii. the physical observation of land uses in the aerodrome environment iii. any wildlife hazard reports received from pilots, authorities and/or the public. f) offsite aerodrome attraction sources (such as animal sale centres, picnic areas, aeration facilities, waste disposal and landfill areas etc.). g) climatic or seasonal considerations, such as the presence of wildlife at certain times of year.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.3	For hazards identified in the vicinity of the aerodrome, the aerodrome operator should endeavour to engage with the local planning authorities to highlight the problem sources and implement mitigation measures.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.2	Aerodrome operators should develop an inventory of sites, both within and in the vicinity of the aerodrome, which attract wildlife.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.4	Off-aerodrome management may often require the support of local authorities and hazard mitigation measures should be initiated in associated with such agencies.

Regulation / Standard	Requirement
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.5	The factors contributing to off-aerodrome wildlife activities depends on how the land use planning is implemented in those regions. The concept of compatible land use planning emphasises the relationship between airports and their neighbouring communities. It involves careful study and coordinated planning to ensure that land use around airports does not negatively impact aircraft safety.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.6	Aerodrome operators should engage with local planning authorities and relevant stakeholders, to plan and implement compatible land use around aerodromes. Effective communication between aerodrome operators and local authorities is encouraged to raise awareness of safety concerns. Incompatible land use should be prevented or addressed through risk assessment processes.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.7	Where necessary, local planning authorities may also be involved in the wildlife hazard management program. The strategies for compatible land use surrounding the aerodrome may be included in the WHMP or program.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.8	Regular monitoring of sites with hazardous wildlife and periodic comprehensive land use surveys are recommended. Modern technology, such as satellite detection, can aid in registering and monitoring different land use types.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.9	Engaging with neighbourhood groups may also prove beneficial in wildlife hazard management. For instance, collaboration with local farmers is important to encourage agricultural practices that are less attractive to hazardous species.
CASA AC 139.C-16 v1.0 (2023). Section 3.5.7.9	A list of types that should be prevented, eliminated or mitigated includes: a) fish processing b) agriculture c) cattle feed lots d) garbage dumps and landfill sites e) factory roofs and parking lots, or other infrastructure f) theatres and food outlets g) wildlife refuges h) artificial and natural lakes i) golf or polo courses, etc. j) animal farms k) slaughterhouses

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 B5. 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.	https://store.icao.int/en/annex-14-aerodromes
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 airport's 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".	https://store.icao.int/en/airport-planning-manual-land-use-and-environmental-management-doc-9184-part-2

Instrument	Body/Department	Description	Link
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.icao.int/APAC/Documents/APAC%20Guidance%20on%20National%20Procedures%20for%20Recording%20and%20Reporting.docx.pdf
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.	https://www.birdstrike.co.uk/ibsc-standards

ICAO and Off-aerodrome Hazards

ICAO recognise a 13km radius from the airfield where land uses should be assessed with regard to wildlife hazard management. 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 (refer to Table B5).

Appendix C: 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 C1. Qualifications and experience of personnel responsible for the development and implementation of the WHMP.

Name	Experience	Position	Qualifications, Licences etc.	Relevant Experience
YBMK staff responsible for the development and implementation of the WHMP				
Phillip Clark	40 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) Wildlife Hazard Management Training at Mackay Airport (Avisure August 2023) Security Contact Officer (Mackay Airport)	9.5 years Air Traffic Services (NZ) 10 years Airport Reporting Officer / Works Safety Officer (Wellington Airport) 21 years Aviation Operations Management (Wellington New Zealand, Cairns and Mackay)

Name	Experience	Position	Qualifications, Licences etc.	Relevant Experience
Shane Hokins	18 Years	ASO	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 Construction Industry Blue Card Wildlife Hazard Management Training at Mackay Airport (Avisure August 2023)	14 years Airport Reporting Officer / Works Safety Officer (Mackay Airport). 17 years Mackay Airport.
Brandon Ford	36 years	ASO	Certificate IV Training and Assessment. Certificate III in Aquaculture. Trade Qualification - Electrician. QLD Firearms Licence CAT A/B/C & H QLD Drivers Licence, Class C Commercial Pilots Licence, Instructor, and Instrument Ratings. Construction Industry White Card Wildlife Hazard Management Training at Mackay Airport (Avisure August 2023)	9 years Airport Reporting Officer / Works Safety Officer (Mackay Airport). 36 years General Aviation. 16 years Air Services Australia

Name	Experience	Position	Qualifications, Licences etc.	Relevant Experience
Dale Parker	12 years	ASO	Certificate IV in Frontline Management BSB40807 Certificate of Attainment – ARO/WSO Course QLD Firearms Licence CAT A/B/C & H QLD Drivers Licence, Class C Construction Industry White Card Wildlife Hazard Management Training at Mackay Airport (Avisure August 2023)	12 years Airport Reporting Officer / Works Safety Officer (Mackay, Hamilton Island Airport).
Stephen Chant	2 years	ASO	Certificate III in Aerodrome Operations Certificate of Attainment – ARO/WSO Course QLD Firearms Licence CAT A/B/C & H Construction Industry White Card Wildlife Hazard Management Training at Mackay Airport (Avisure August 2023)	2 years Airport Reporting Officer / Works Safety Officer at Mackay Airport 1.5 years in Infrastructure and Maintenance Crew at Mackay Airport
Avisure Consultants involved in the development of the 2022/23 WHMP				
Alexandra Stone Senior Wildlife Biologist	7 years	Author, Wildlife surveys, Data analysis and mapping	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	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 mapping.

Name	Experience	Position	Qualifications, Licences etc.	Relevant Experience
Will Jamieson Principal Biologist	19 years	Author, Data analysis	Bachelor of Science (Australian Environmental Studies), Griffith University, 2001	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. Plays an integral support role for many Avisure projects, provides technical input and quality assurance.
Martin Ziviani Senior Wildlife Biologist	17 years	Wildlife surveys	Bachelor of Environmental Science, Griffith University, 1990	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.
Kylie Patrick	20 years	Quality assurance	Bachelor of Applied Science (Environmental Management), Southern Cross University, 1996 Bachelor of Applied Science (Ecology), Queensland University of Technology, 2003	Wildlife biologist and project manager for numerous airport wildlife hazard management projects (20 years). Experienced in wildlife hazard assessments and compliance audits, wildlife hazard management plans, wildlife surveys and dispersal, off-airport wildlife hazard assessments, and wildlife hazard management training.

Table C2. WHMP roles and responsibilities, YBMK.

Position	Responsibilities
Chief Operating Officer	Endorse the final WHMP.
	Provide resources for implementing the WHMP.
Manager Aviation Operations (MAO)	Review all proposed developments on YBMK controlled land that has the potential to increase the risk of wildlife strikes or select a delegate to review all proposed developments. Request modifications to proposals where a risk increase is likely.
	Ensure landowners within 13 km of CNS advise CNS of land use changes or developments that have potential to influence wildlife hazards at YBMK. Request modifications to proposals where a risk increase is likely.
	Attend the semi-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.
	Liaise 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.
	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.

Position	Responsibilities
Compliance and Airside Safety Coordinator (CASC)	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.
	Attend WHMC meetings or delegate a representative.
Airport Safety Officers	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.
	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.

Position	Responsibilities
	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.
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 CASC.
	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 CASC.
	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.

Appendix D: Wildlife Hazard Management Committee Members

Organisation	Position	Contact (email or phone)
Mackay Airport		
Phillip Clark	Manager Aviation Operations	Philip.Clark@mackayairport.com
Mackay Regional Council		
David de Jager	Manager Health & Regulatory Services	David.dejager@mackay.qld.gov.au
Airline and Aircraft Operators		
Owen Davison	Swissport	owe.davison@swissport.com.au
Lucy Friend	North Queensland Airports	lucy.friend@cairnsairport.com.au
Nicolas Plenty	Auriga Aviation Pty Ltd	nick.plenty@auriga.com.au
Steve Buchanan	Qantas Group Compliance	SteveBuchanan@qantas.com.au
Rex Operations	Rex Regional Airlines	safety@rex.com.au
Keith Thompson	Auriga Aviation Pty Ltd	Keith.Thompson@auriga.com.au
Alliance Operations	Alliance Airlines	safety@allianceairlines.com.au
Lisa Martin	CQ Rescue General Manager	lisa.martin@cqrescue.org.au
Brent Wise	Skytrans Airlines	brent.wise@skytrans.com.au
Mackay Manager	Oceania Aviation (Regional Ground Services Manager)	babel@oceaniaaviation.com
Dallas Michael	Safety & Security Specialist	dallas.michael@flybonza.com
Airservices Australia		

Organisation	Position	Contact (email or phone)
Matthew Cole	Unit Tower Supervisor	Matthew.Cole@AirservicesAustralia.com
CASA		
Daniel Holliday	Civil Aviation Safety Authority Inspector	Daniel.Holliday@casa.gov.au
Contracted Consultants		
Martin Ziviani	Avisure Senior Wildlife Biologist	mziviani@avisure.com
Alexandra Stone	Avisure Project Manager	astone@avisure.com
Off airport Facilities (non-Council operated)		
Tracy Simmons	Manzelmann's Farm	0403 693 468
Nick Meara	Thomas Borthwicks Meatworks	nmeara@tbsmackay.com.au

Appendix E: 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 E1.

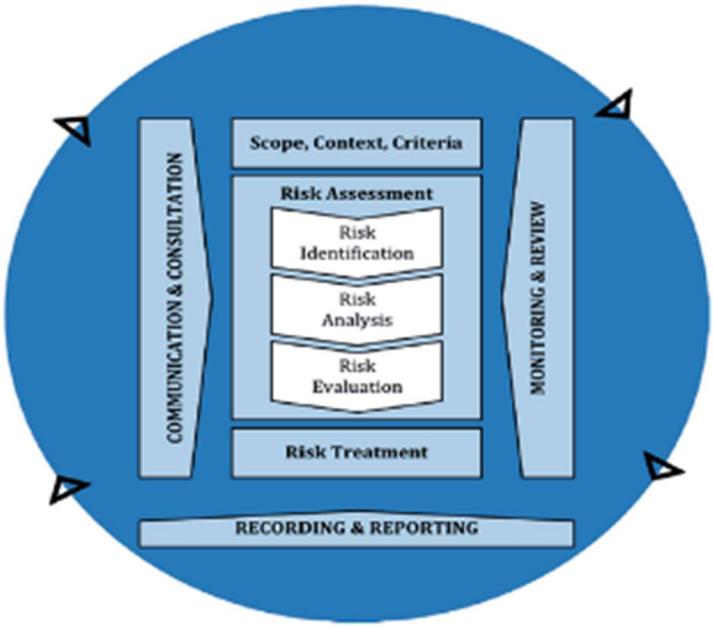


Figure E1: The risk management process (Source: AS/NZS 31000:2018 Risk Management).

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 E2: 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 E1: 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.

References

Allan, J. (2006) *A Heuristic Risk Assessment Technique for Birdstrike Management at Airports. Risk Analysis*. Vol. 26, No. 3, pp. 723-729, June 2006.

Allan, JR, Orosz, A, Badham, A and Bell, J. (2003) *The Development of Birdstrike Risk Assessment Procedures, Their Use on Airports, and the Potential Benefits to the Aviation Industry.* In Proceedings of the 26th International Bird Strike Committee Meeting, 5–9 May 2003, Warsaw, Poland.

Carter, NB. (2001) *All Birds are not Created Equal: Risk Assessment and Prioritisation of Wildlife Hazards at Airfields.* In Bird Strike 2001. Calgary, Canada.

Dolbeer, RA, Wright, SE and Cleary, EC. (2000) *Ranking the Hazard Level of Wildlife Species to Aviation*. Wildlife Society Bulletin 28:372–378.

Morgenroth, C. (2003) *Development of an Index for Calculating the Flight Safety Relevance of Bird Species for an Assessment of the Bird Strike Hazard at Airports*. Bird and Aviation 23.

Shaw, P. (2004) *A Model for Determining Risk Categories for Birds at Airports Using Bird Survey Data*. Bird Strike Conference 2004, Baltimore, USA.

Standards Australia/Standards New Zealand (2009) *Risk Management – Principles and Guidelines*. Sydney, New South Wales, Australia.

Appendix F: 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 F1).

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 F2) as outlined in the WHMP off-airport schedule (Appendix G). 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).

Flying-fox Camp Fly-out Counts

Four flying-fox roosts are monitored each month (Figure G4). Two observers position themselves at two separate advantage points. Surveys begin 30 minutes before last light and end once all flying-foxes have vacated the roost. Observers record the number of flying-foxes and their direction. Surveys also record ambient conditions (first and last light, 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.

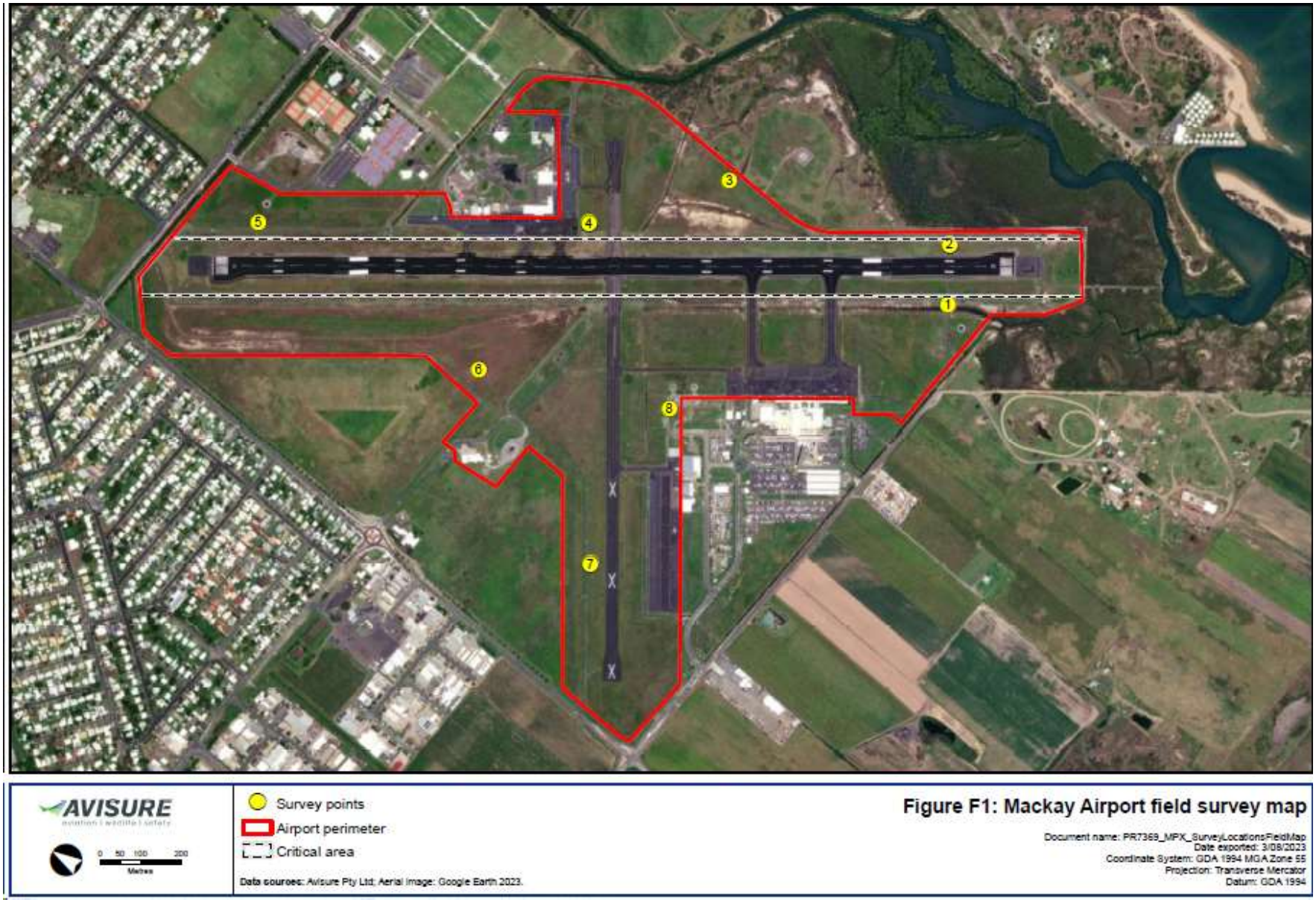


Figure F1: Mackay Airport field survey map

Document name: PR7369_MPX_SurveyLocationsFieldMap
Date exported: 3/08/2023
Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Figure F2: Off-airport survey locations in the vicinity of YBMK

Mackay Regional Council

Mackay Airport Bird Management Program 2022/23

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

AVISURE aviation | wildlife | safety

Appendix G: Wildlife Hazard Analysis

On-airport Surveys

An observation of nine Straw-necked Ibis flying through the critical area during the September afternoon survey increased their risk to high.

Australian White Ibis and Feral Pigeon were high risk (Figure G1) due to flocks flying through critical areas mostly during the morning when flocks move between roost and foraging sites. Numbers of both species have increased over the past five years. Due to their flocking tendency and mass, they pose a damaging strike risk to aircraft operations.

A flock of four Red-tailed Black-Cockatoo flew over the airfield during the September morning survey, accounting for their moderate risk (Figure G1).

Little Pied Cormorant (Figure G1) risk (moderate risk) was due to birds flying through critical areas in November and May surveys.

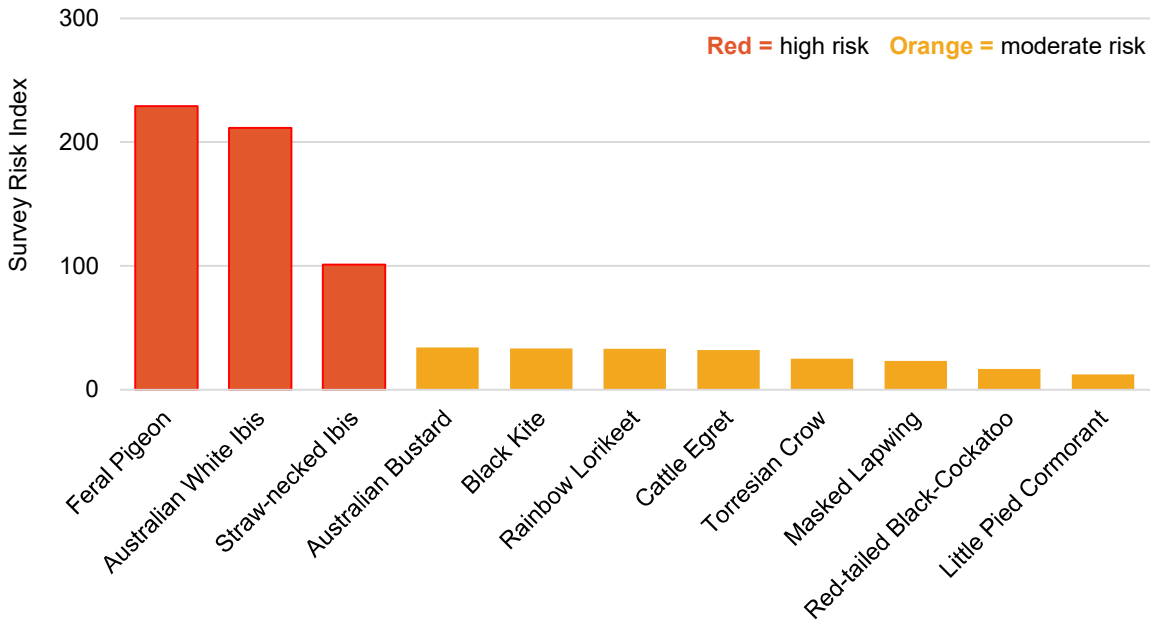


Figure G1: Average diurnal survey risk index, 2022/23.

Unidentified Flying-fox ranked as moderate risk (Figure G2) due to observations in nocturnal surveys in February 2023.

Masked Lapwing remain a moderate risk in both diurnal and nocturnal surveys (Figure G1 & G2), this species can be active day or night, highest activity was recorded in May with birds feeding in ponded water, grains and grassed areas.

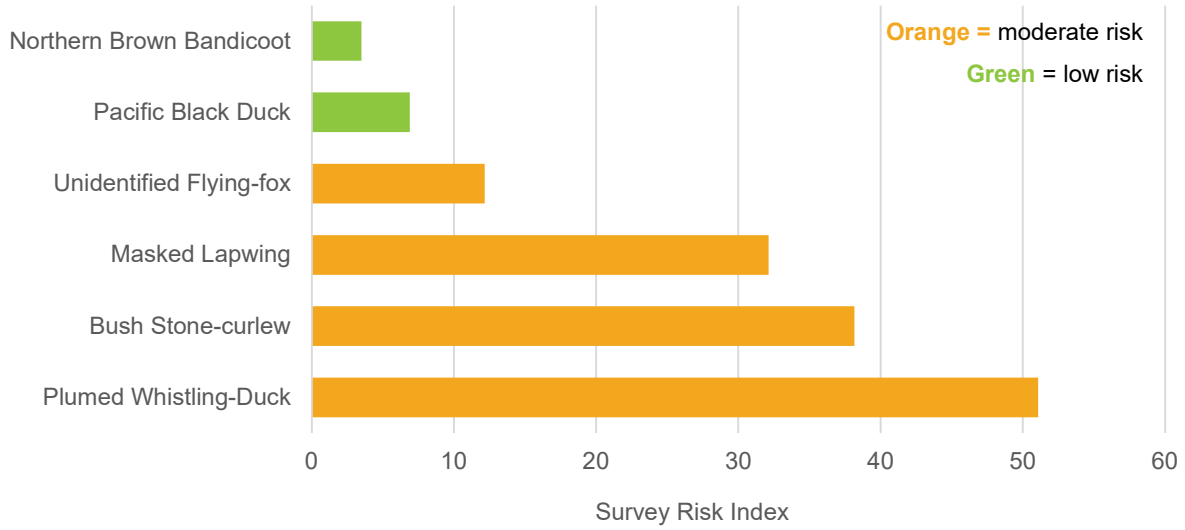


Figure G2: Average nocturnal survey risk index, 2022/23.

Feral Pigeon (high risk) remain the most observed species during diurnal surveys and Australian White Ibis (high risk) recorded the highest mass (Figure G3).

Morning surveys recorded the highest activity by number and mass. Surveys frequently recorded Australian White Ibis and Feral Pigeon in the air flying through critical airspace mostly during the morning when flocks moved between roost and foraging sites.

Cattle Egret (moderate risk) and Masked Lapwing (high risk) were the most common hazardous species recorded foraging in airside grassed areas, numbers were highest in September and May surveys which coincided with high numbers of other insectivorous species at these times.

Masked Lapwing (high risk) and Australian White Ibis (high risk) were recorded foraging in airside drains throughout 2022/23.

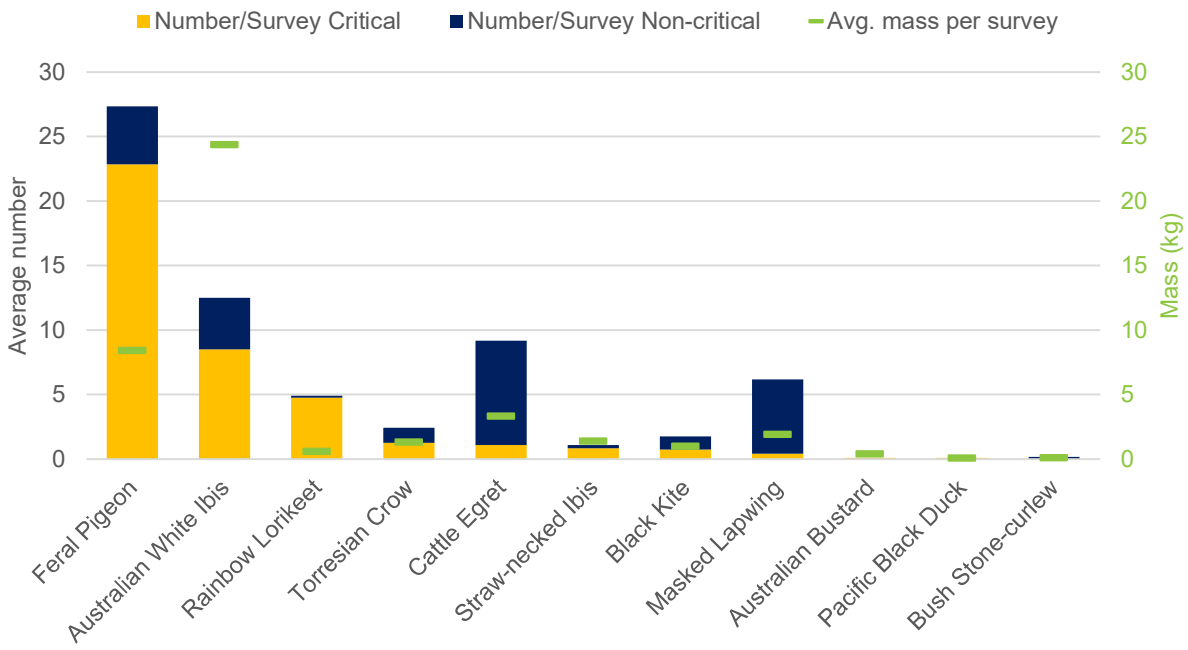


Figure G3: Average number of high/moderate species per diurnal survey shown with proportion in critical areas and average mass (kg), 2022/23.

Masked Lapwing (high risk) and Bush Stone-curlew (high risk) were the most observed species during nocturnal surveys (Figure G4). Most of the nocturnal observation of these species were birds foraging in grass and sealed areas.

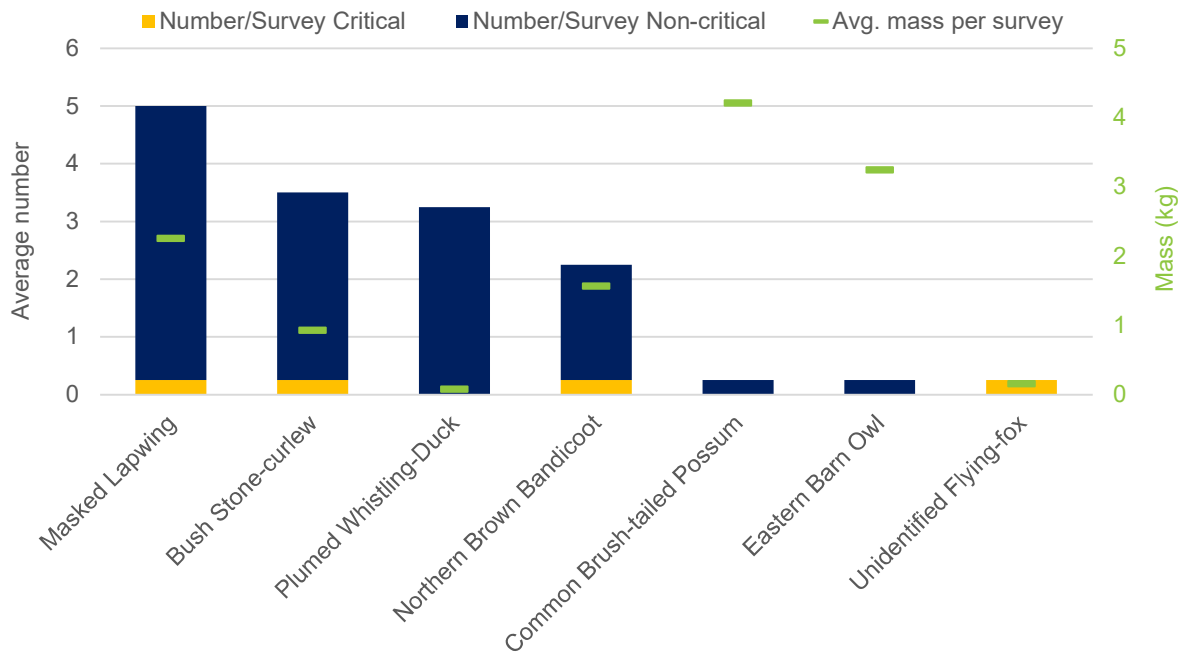


Figure G4: Average number of per nocturnal survey shown with proportion in critical areas and average mass (kg), 2022/23

Sixty-two percent of hazardous species observed were in critical areas (Figure G5). Feral Pigeon (high risk), Australian White Ibis (high risk), and Rainbow Lorikeet (moderate risk) were the most common.

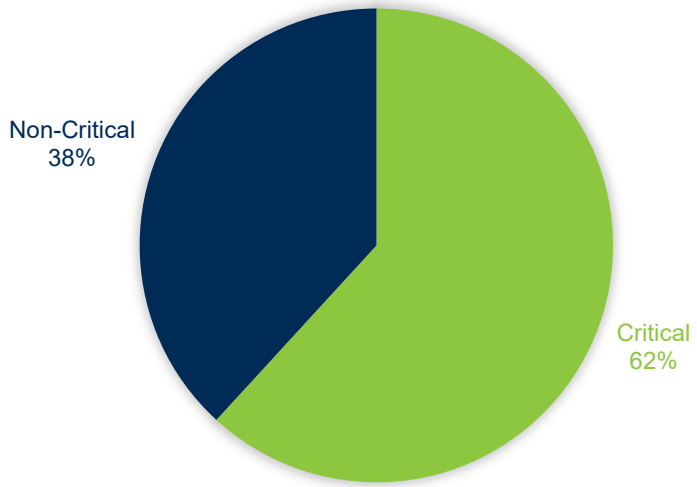


Figure G5: Proportion of high/moderate risk species observed in critical areas, 2022/23.

Wildlife activity peaked in the mornings with transiting and foraging behaviours most common (Figure G7 and G8).

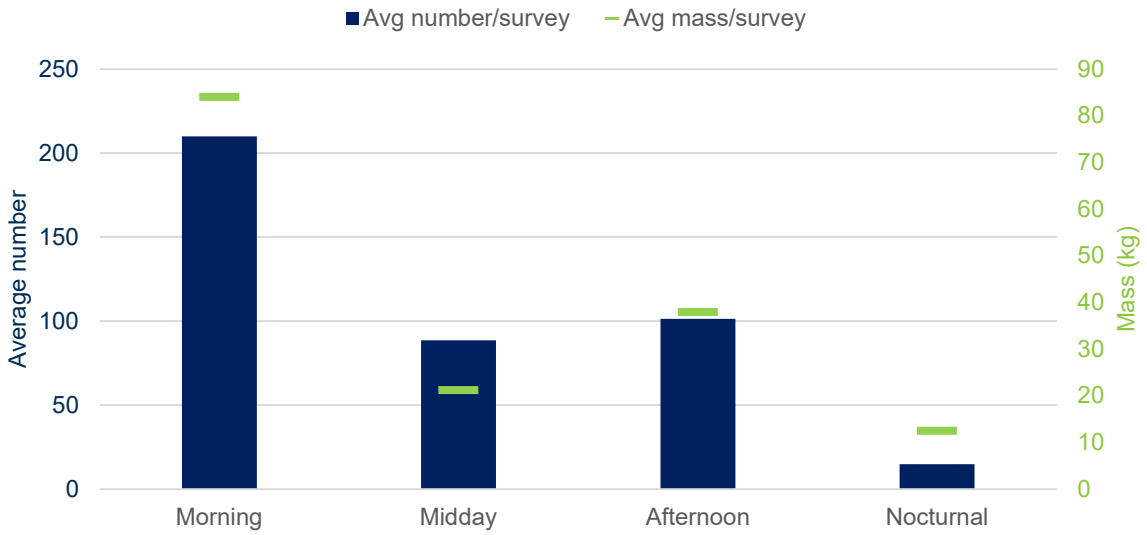


Figure G6: Average number of per diurnal survey and average mass (kg) per survey by time of day, 2022/23.

Figures G7 and G8 show how the wildlife used the airfield during 2022/23 surveys. Australasian Pipit (low risk) and Magpie Lark (low risk) accounted for 67% of all birds recorded foraging in grass during on-airport surveys. Activity increases during and post mowing when opportunities increase. When allowed to seed, grass will attract granivorous species such as sparrows, mannikins, and Galahs, posing a multiple strike risk.

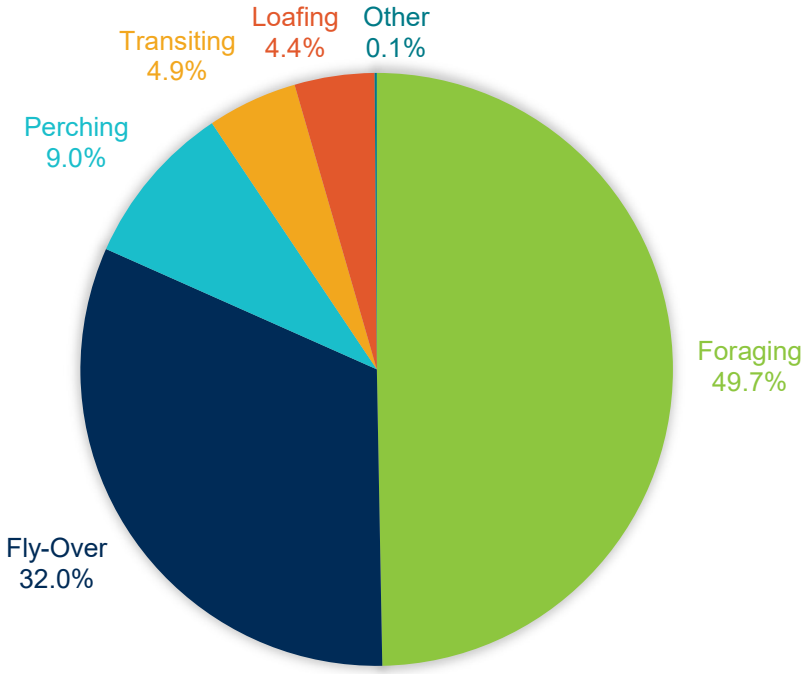


Figure G7: Proportion of species behaviour observed during airside surveys (*other includes nesting and fighting), 2022/23.

Feral Pigeon (high risk) and Australian White Ibis (high risk) accounted for 64% of wildlife recorded in the air (Figure G8) as flocks moved between foraging sites. Their flocking tendency poses a multiple strike risk particularly in the morning when activity peaks.

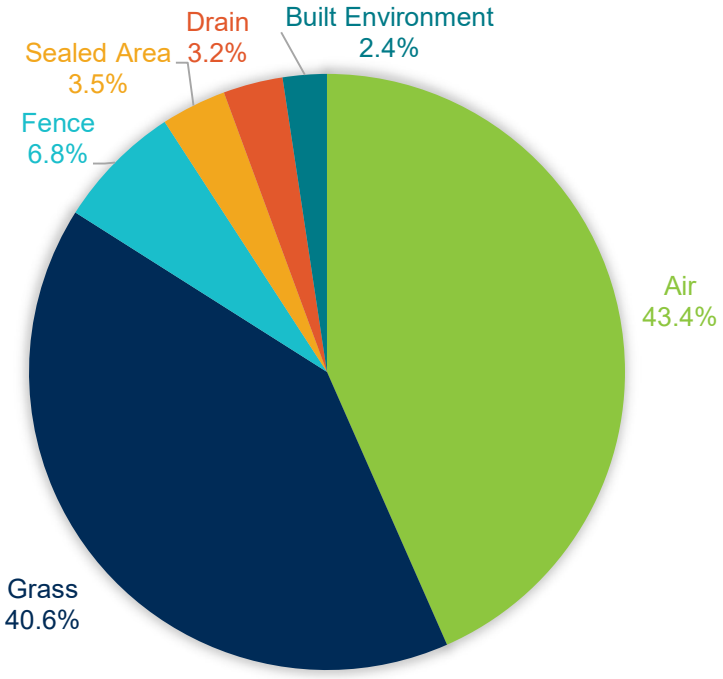


Figure G8: Proportion of habitat used by wildlife observed during airside surveys, 2022/23.

Off-airport Surveys

Mackay Cemetery Flying-fox Camp recorded the highest mass during off-airport surveys (Figure G9 and G10). Numbers peaked in November 2022 with 312 Australian White Ibis (high risk) and 51 Magpie Geese recorded nesting at this site.

Australian White Ibis breeding peaks during the wet season with survey recording them nesting at Mackay Christian College and Mackay Golf Club, and foraging and loafing at Manzelmann's Farm..

Magpie Goose activity typically increases following sugar cane harvesting and also in response to high rainfall. Their risk reduced during 2022/23 due to no recent strikes or observations during airside surveys, however due to their large body mass and flocking nature they continue to pose a risk to aircraft. Numbers at Manzelmann's Farm were low and total off-airport numbers were well below average (decreased by 69% compared to 2021/22). The following sites supported the highest geese numbers:

- Mackay Golf Club (120 geese, September 2022, 40 geese November 2022)
- 63 Farrelly's Road farm (95 geese, May 2023)
- Thomas Borthwicks Meatworks (47 geese, November 2022 and 45 geese, May 2023)
- Mackay Cemetery Flying-fox Camp (51 geese, November 2022)
- Botanical Gardens (40 geese, November 2022

Plumed Whistling-duck (high risk) was the most observed species during off-airport surveys with the highest numbers at Borthwicks Meatworks and Manzelmann's Farm.

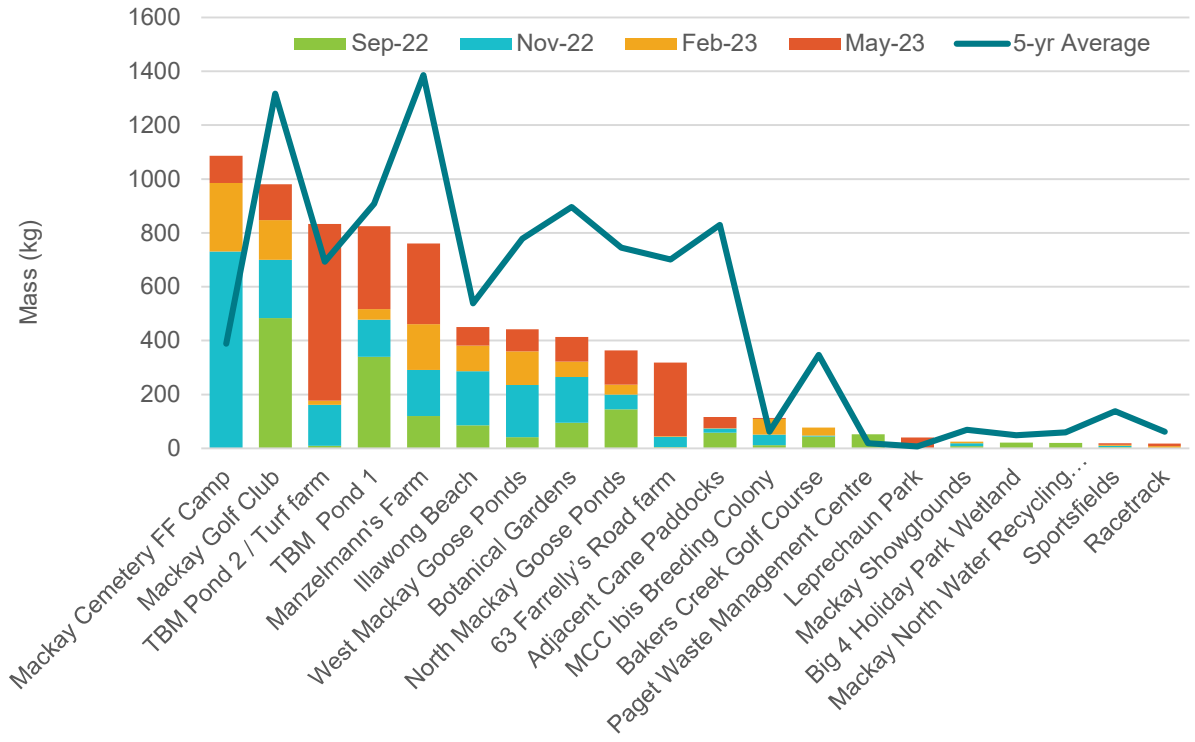


Figure G9: Mass per survey (kg) at off-airport locations[19] (2022/23) versus the 5-year average (2017/18-2021/22), YBMK, 2022/23 (Top 20 off-airport sites only).

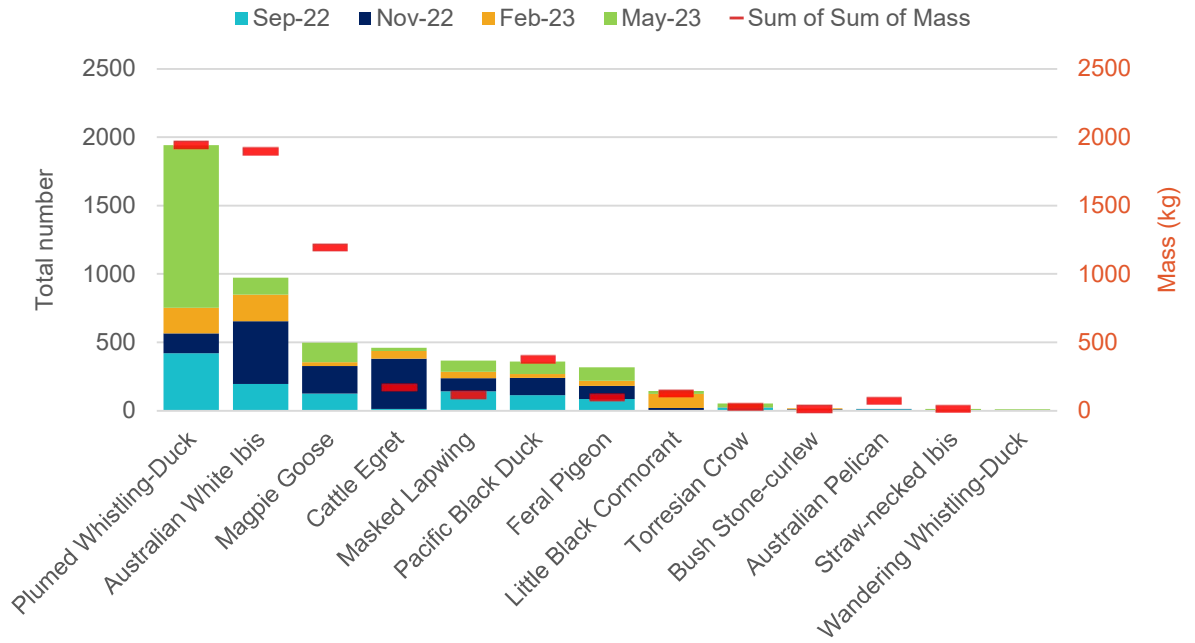


Figure G10: Number of high and moderate risk species and total mass (kg) recorded in quarterly off-airport surveys (high and moderate risk species only), 2022/23.

19 FF = Flying-fox, TBM = Thomas Borthwicks Meatworks, MCC = Mackay Christian College.

Appendix H: 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 G1. 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						
Adjacent Cane Paddocks	0.54	Open irrigated grass area	N/A	N/A	N/A	Monitor quarterly
Southern Drain	0.55	Stormwater drain surrounding airport	N/A	N/A	N/A	Monitor quarterly
Manzelmann's Farm	0.68	Open irrigated grass areas supporting livestock.	Cattle/dairy farm	Moderate	Mitigate	Monitor quarterly
Leprechaun Park	0.98	Open irrigated grass area showground	Showground	High	Mitigate	Monitor quarterly
Shellgrit Creek	1.07	Wetland with grass and vegetated surrounds	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Northern Drain	1.13	Stormwater drain surrounding airport	N/A	N/A	N/A	Monitor quarterly
Old Landfill	1.21	Grass and vegetated area surrounded by roads by a creek	N/A	N/A	N/A	Monitor annually
Illawong Beach	1.32	Natural waterbody - beach	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Milton Street Proposed Stormwater Retention Development Site	1.32	Open grass area planned for development for commercial and residential properties with water basin	N/A	N/A	N/A	Monitor quarterly

Location	Distance from ARP (km)	Description	NASF Land Use Description	NASF Wildlife Attraction Risk	NASF Action Recommended	Monitoring Actions
Southwestern Drain	1.32	Stormwater drain surrounding airport	N/A	N/A	N/A	Monitor quarterly
63 Farrelly's Road Farm	1.72	Open irrigated grass area supporting livestock	N/A	N/A	N/A	Monitor annually
Sportsfields	1.79	Open irrigated grass area	Sports facility	Moderate	Mitigate	Monitor quarterly
Paget Waste Management Centre	2.65	Putrescible waste facility	Putrescible waste facility – transfer station	High	Mitigate	Monitor annually
Nebo Road Water Treatment Plant	2.89	Potable water treatment facility	Sewage / wastewater treatment facility	Moderate	Monitor	Monitor annually
≥ 3km and ≤ 8km						
Mackay Botanic Gardens	3.05	Botanical garden with open irrigated grass areas and manmade wetland	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Bakers Creek Estuary	3.13	Tidal estuary with mudflats at low tide	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor annually
Racetrack	3.34	Racetrack	Racetrack / horse riding school	Moderate	Monitor	Monitor annually
Mackay Showgrounds	3.49	Open irrigated grass area showground	Showground	High	Mitigate	Monitor quarterly
Queens Park	3.58	Grass and vegetated area surrounded by dog park and roads	Park	Moderate	Monitor	Monitor annually
Mackay Cemetery Flying-fox Camp	3.62	Grass and vegetated area surrounded by roads by a creek	N/A	N/A	N/A	Monitor quarterly
The Blue Water Trail Boat Ramp	4.34	Man-made boat ramp surrounding by roads and water	N/A	N/A	N/A	Monitor annually
The Blue Water Trail	4.51	Man-made trail along the river for pedestrians	N/A	N/A	N/A	Monitor annually

Location	Distance from ARP (km)	Description	NASF Land Use Description	NASF Wildlife Attraction Risk	NASF Action Recommended	Monitoring Actions
Walz Road Pond 2	4.72	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor annually
Thomas Borthwicks Meatworks and Turf Farm	4.8	Farm with open irrigated grass areas and man-made waterbodies, supporting livestock	Cattle / dairy farm	Moderate	Monitor	Monitor quarterly
Bakers Creek Golf Course	5.42	Open irrigated grass areas and man-made waterbodies	Golf course	Moderate	Monitor	Monitor annually
Walz Road Pond 1	5.43	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor annually
West Mackay Goose Ponds	5.97	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
North Mackay Goose Ponds	6.2	Open man-made waterbody	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor quarterly
Mackay South Water Recycling Facility	6.48	Wastewater treatment plant	Sewage / wastewater treatment facility	Moderate	Monitor	Monitor quarterly
Mackay Christian College Ibis Breeding Colony	6.84	Vegetated area with small creek behind school surrounded by roads	N/A	N/A	N/A	Monitor quarterly
Big 4 Holiday Park Wetland	7.77	Permanent waterbody located in Big 4 Holiday Park.	Wildlife sanctuary / conservation area - wetland	High	Mitigate	Monitor annually
≥ 8km and ≤ 13km						
Mackay Harbour	8.48	Marine harbour	N/A	N/A	N/A	Monitor annually
Mackay Golf Club	9.96	Open irrigated grass areas and man-made waterbodies	Golf course	Moderate	Monitor	Monitor quarterly
>13km						
Mackay North Water Recycling Facility	16.64	Wastewater treatment plant	Sewage / wastewater treatment facility	Moderate	Monitor	Monitor annually

Appendix I: Research, Reviews, Trials, and Initiatives

This section outlines key research, reviews, trials, and initiatives undertaken by MAPL.

Date	Research /Initiative	Description	Reference
Jun 2017	Shellgrit Creek Drainage Excavation Wildlife Hazard Assessment	Mackay Airport engaged Avisure to conduct a study of wildlife hazards associated with the excavation and dredging of Shellgrit Creek located in close proximity to the aerodrome. The Wildlife Hazard Assessment summarised the site and hazard assessment results, reviewed the potential drainage site's contribution to wildlife strike risk, and provided management measures to reduce potential strike risk.	Shellgrit Creek Wildlife Hazard Assessment, June 2017

Revision History

Rev. No.	Rev. Date	Details	Prepared by	Reviewed by	Approved by
00	25/09/2023	Mackay Airport WHMP 2022/23 Draft	Will Jamieson Principal Biologist Alexandra Stone Senior Wildlife Biologist	Kylie Patrick Principal Consultant	Kylie Patrick Principal Consultant
01	31/10/2023	Mackay Airport WHMP 2022/23 Final	Alexandra Stone Senior Wildlife Biologist	Jeff Follett CEO	Jeff Follett CEO
02	11/12/2023	Mackay Airport WHMP 2022/23 Final Revision 1	Alexandra Stone Senior Wildlife Biologist	Kylie Patrick Principal Consultant	Kylie Patrick Principal Consultant

Distribution List

Copy No.	Date	Format	Issued to	Name
1	11/12/2023	E-copy	Mackay Airport Pty Ltd	Phillip Clark
2	11/12/2023	E-copy	Mackay Airport Pty Ltd	Julie Sercombe
3	11/12/2023	E-copy	Avisure	Administration

contact@avisure.com | www.avisure.com

PR7369 Mackay Airport-RE.Wildlife Hazard Management Plan.FI.R1

GOLD COAST – AUS (HQ)
1/9 Greg Chappell Drive
Burleigh Heads QLD 4220
PO Box 404
West Burleigh QLD 4219
Australia
P 1300 409 927

ADELAIDE - AUS
36A/11-13 Parkway
Mawson Lakes SA 5095
PO Box 145
Pooraka SA 5095
Australia
P 1300 409 927

MELBOURNE -AUS
Point Cook Rd
Point Cook Vic 3030
P 1300 409 927

SYDNEY - AUS
PO Box 880
Surry Hills NSW 2010
P 1300 409 927