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LEADING THE WAY
IN ENVIRONMENTAL
MANAGEMENT

LITTLE RED FLYING-FOX CAMP MANAGEMENT PLAN

MOUNT ISA

May 2020

Contents

Biodiversity Australia Pty Ltd
ABN 81 127 154 787

Document Control Page

Version Control

Version	Purpose	Author	Reviewed / approved by	Date
0.1	Draft	Lachlan Webster	Agatha Dolan	04/06/2020
1.0	Final	Lachlan Webster	Agatha Dolan	05/06/2020
2.0	Final	Lachlan Webster	Agatha Dolan	29/06/2020

Distribution Control

Copy	Purpose	Method	Issued to	Name	Date
1	Internal	File	Biodiversity Australia	Info	29/06/2020
2	Issue	Email	Mt Isa City Council	Mariah Willis	29/06/2020

Project Number: VP3768

Our Document Reference: VP3768-BVP-REP-MtIsaLRFFMangementPlan-rev2.0

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Key Abbreviations

Abbreviation	Description
ABLV	Australian Bat Lyssavirus
DAF	Department of Agriculture and Fisheries
DEH	Department of Health
DES	Department of Environment and Science
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
EVNT	Endangered, Vulnerable and Near Threatened
FRRMP	Flying-fox Roost Management Permit
IUCN	International Union for Conservation of Nature and Natural Resources
LGA	Local Government Area
LRFF	Little Red Flying-fox
MICC	Mt Isa City Council
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NC Act	*Nature Conservation Act 1992*
RE	Regional Ecosystem
SoMI	Statement of Management Intent
UFFMA	Urban Flying-fox Management Area
VM Act	*Vegetation Management Act 1999*
WTP	Water Treatment Plant

1. Overview

This Flying-fox Camp Management Plan (the Plan) has been prepared for Mount Isa City Council (MICC) in response to the presence of a large camp of little red flying-foxes within the Mount Isa Sunset Memorial Cemetery. This plan aims to provide advice, planning and methods to manage the flying-fox camp. This Plan also includes the results of habitat suitability modelling undertaken for the region with the aim of identifying potential alternative roosting sites.

1.1 Objectives

The objectives of this Plan are to:

- minimise impacts to the community, while conserving flying-foxes and their habitat;
- enable the sustainable management of flying-foxes through the use of adaptive management methodologies;
- identify areas of appropriate alternative flying-fox habitat using desktop analysis and field verification methods;
- enable the long-term conservation of flying-foxes in appropriate locations;
- allow for compliant mitigation of the current threat to human health and safety while reducing human wildlife conflict;
- clearly define roles and responsibilities for the management of flying-foxes in the Mount Isa area;
- ensure the health and welfare of flying-foxes during all management activities, including identifying gestating females and females carrying young prior to commencing works; and
- comply with all relevant legislative requirements relating to the management of flying-foxes.

2. Context

2.1 Mt Isa Flying-fox Camp

Little red flying-foxes (*Pteropus scapulatus*) have migrated seasonally to Mount Isa with numbers varying from year to year. A camp established in the Mount Isa Sunset Memorial Cemetery in 2010 (Figure 1). A large influx of flying-foxes occurred in 2011, wherein flying-foxes occupied the cemetery, surrounding streets and residential areas of Mount Isa (Ecosure 2014). They returned in large numbers again in early 2017 with numbers estimated to be between ten - 16,000 individuals (DES 2020).

Media releases from local and national sources also recount another large influx of flying-foxes to the Mount Isa Sunset Memorial Cemetery (the Cemetery) in January 2019. In these cases, flying-foxes inflicted extensive damage to roost trees causing reduced amenity of particular areas and increased incidence of human-wildlife conflict. Roosting of flying-foxes in the cemetery has caused considerable emotional distress for many who regularly utilise these public areas.

2.2 Little Red Flying-fox Biology

The little red flying-fox is the smallest of the four-mainland species of megabat. They vary in colour from reddish-brown to light brown and within the Northern Territory can be almost black. They have patches of light cream-brown fur where the wing meets the shoulder with greyish-brown head. Individuals can weigh between 300 – 600 g.

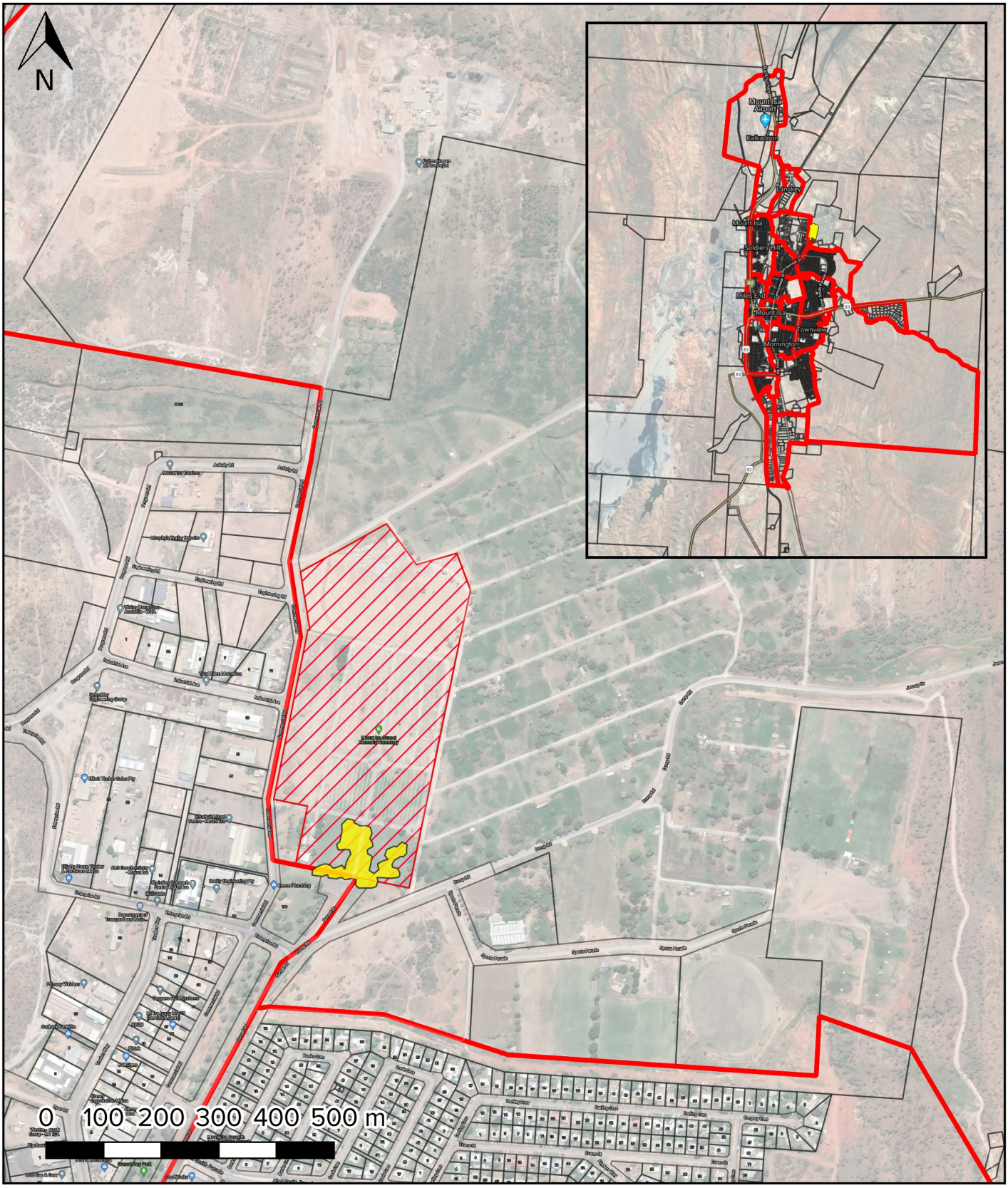
Little red flying-foxes have a wide distribution in northern and eastern Australia ranging from Queensland, Northern Territory, Western Australia, New South Wales to Victoria. They regularly utilise rainforest and sclerophyll forests with their distribution extending further into semi-arid areas.

Little red flying-foxes prefer to feed on the nectar and pollen of eucalypts, however, they will consume sap, fruit and insects if other resources are unavailable. Little red flying-foxes will travel 20 – 30 km from their roost site to feeding grounds and have been known form temporary camps in response to local flowering or fruiting events. Camps can number from 100,000 to one million individuals. They typically prefer to roost nearer to the ground then other flying-fox species. Their breeding season also differs from that of other flying-fox species, with mating taking place between November and January with young born from April to May. Young are carried for three to four weeks, then left in nursery trees when adults are foraging. Young are able to fly at two months old.

2.3 Conservation Listing

Little red flying-foxes are listed as 'Least Concern' under Queensland's *Nature Conservation Act 1992*. The species is ranked as a low priority under the Department of Environment and Science's 'Back on Track' prioritisation framework.

They are not listed under the *Environment Protection and Biodiversity Conservation Act 1999.*



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Map Author:	AD
Project Manager:	AD
Date:	05-06-2020
CRS:	EPSG 3854 WGS 84
Scale:	1:10,000

Legend

- Roost
- Locality
- Cemetary
- DCDB

Figure Name:
Figure 1 - Roost Location

Client:
Mt Isa City Council

Site:
Mt Isa Locality

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3. Legislation and Policy

There are a number of legislative instruments and policies that must be considered when managing flying-foxes. All flying-fox managers must comply with the relevant environmental Commonwealth and State regulations and policies.

3.1 Local

3.1.1 As-of-right Authority

Under the *Nature Conservation Act 1992* (NC Act) local governments in Queensland have an as-of-right authority to undertake management at flying-fox roosts within their designated Urban Flying-Fox Management Area (UFFMA), provided they act in accordance with the *Code of practice – Ecologically sustainable management of flying-fox roosts* defined by Queensland Department of Environment and Science (DES). Mount Isa City Council's UFFMA is shown in Figure 2. Outside of a UFFMA, a local government required a flying-fox roost management permit (FRRMP). The Mount Isa Cemetery requires a UFFMA.

3.1.2 Statement of Management Intent (SoMI)

To assist local governments in engaging their communities, they may develop and publish a Statement of Management Intent (SoMI). The statement will articulate a local government's plans for how it will manage both existing and new roosts in its UFFMA and ensure that communities are well informed about how their local government will deal with flying-fox roosts. Local governments should develop a SoMI for flying-fox roost management within an UFFMA.

3.2 State

3.2.1 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) aims to conserve nature across the state of Queensland, including flying-foxes and their habitat. Under this Act *P. scapulatus* is listed as Least Concern.

Under the NC Act exists *the Code of Practice: Ecologically sustainable management of flying-fox roosts* which guides the management of flying-fox roosts. All managers of flying-foxes must comply with this code of practice. This code sets out how local governments operating under Section 41A of the *Nature Conservation (Wildlife Management) Regulation 2006* may undertake management actions which may:

- destroy a flying-fox roost
- drive away, or attempt to drive away, a flying-fox from a flying-fox roost
- disturb a flying-fox in a roost.

When undertaking management actions Mount Isa City Council must:

1. notify the Department of Environment and Science two days prior to any management actions through the provided form at: https://environment.des.qld.gov.au/wildlife/animals/living-with/bats/flying-foxes/roost-management/notification-form
2. not destroy roost site vegetation while flying-foxes are present or in adjacent trees and likely to be injured by destruction or modification.
3. Notify DES if any flying-fox/es are found on the ground, injured or killed as a result of management actions
4. Ensure actions are compliant with code prior to commencing works.
5. Only commence management actions once consultation has been made with subject matter expert or with such a person present.
6. management actions are to be only undertaken during early morning and/or evening. Management actions must be carried out either immediately prior to 'flyout' at dusk or when flying-foxes start returning in the morning. Such actions must not continue for longer than 2 hours.
7. All management actions are limited to non-lethal methods.

3.2.2 *Vegetation Management Act 1999*

The *Vegetation Management Act 1999* (VM Act) may also apply to aspects of this management plan depending on the management action taken. Any roost management strategies that involve the alteration or clearing of vegetation should consider which category of vegetation will be affected by the management actions and whether permits are required for alteration of vegetation.

A summary of relevant sate/territory legislation is provided in Table 1.

Table 1. State legislation applicable to flying-fox management.

Legislation	Application
Nature Conservation Act 1992 and *Nature Conservation (Wildlife) Regulations 2006*	The spectacled flying-fox is listed as an endangered species under the NC Act. The remaining 3 species of flying-fox (grey-headed flying-fox, black flying-fox and little red flying-fox) are not listed as threatened species (Endangered, Vulnerable or Near Threatened) under the Nature Conservation (Wildlife) Regulation 2006. However, all native animals are protected in Queensland regardless of their threatened status. It is unlawful under the Nature Conservation Act 1992 to kill, injure or otherwise take protected wildlife without approval, unless the taking is accidental.
Vegetation Management Act 1999	All plants indigenous to Australia are protected in Queensland under the NC Act. The Clearing of vegetation in Queensland is regulated by the VM Act. The types of activities permitted and how they are regulated depend on the type of vegetation, the land tenure, location, extent and purpose of the proposed clearing and the proposed clearer. These factors must be considered if habitat augmentation is to be undertaken.

Legislation	Application
Code of Practice: Ecologically sustainable management of flying-fox roosts – Nature Conservation Act 1992	Minimises the risk of harm and provides a standard of welfare for flying-fox camps while management actions are undertaken and should be implemented in conjunction with Flying-fox Roost Management Guidelines.
Code of Practice: Low impact activities affecting flying-fox roosts – Nature Conservation Act 1992	Outlines the how private landholders may use low impact strategies to manage flying-foxes. Operating outside of this code is not authorised and may lead to legal proceedings.

3.3 Commonwealth

3.3.1 *Environment Protection and Biodiversity Act 1999*

The Australian Government administers the *Environment Protection and Biodiversity Act 1999* (EPBC Act) which is the key piece of environmental legislation in Australia. It oversees the protection of matters of national environmental significance (MNES), including:

- world heritage properties,
- national heritage places,
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed),
- nationally threatened species and ecological communities,
- migratory species,
- Commonwealth marine areas,
- the Great Barrier Reef Marine Park,
- nuclear actions (including uranium mining), and
- a water resource, in relation to coal seam gas development and large coal mining development.

The little red flying-fox is not listed as an MNES under the EPBC Act.

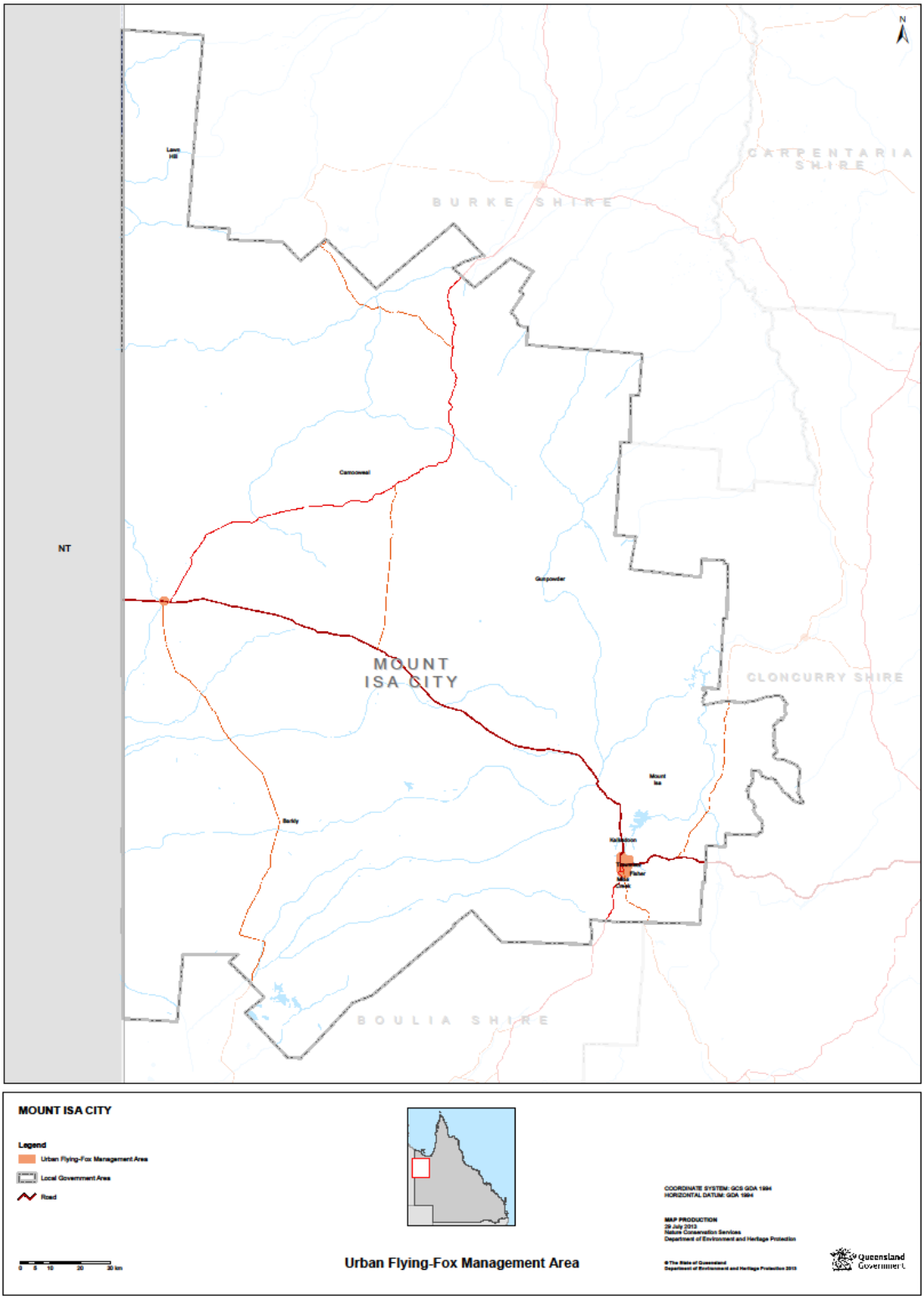

Figure 2. Mount Isa City Council Urban Flying-fox Management Area

4. Community Engagement

4.1 Stakeholders

There are numerous stakeholders that may be impacted or involved in the management of the seasonal flying-fox camp present in Mount Isa. Table 2 outlines these stakeholders and their interests in the management plan.

Table 2. Stakeholders that may be involved in the management of flying-foxes in the Mt Isa Sunset Memorial Cemetery.

Stakeholder	Interest/reported impacts
Residents	Fear of disease, reduced amenity or damage of property. Management actions should be communicated to local residents and involve residents where possible.
Business owners	Concerns of reduced amenity of surrounding community. Management actions should be communicated to business owners, particularly those that may be impacted during management activities.
Indigenous community	Traditional owners, including the Kalkadoon and Indjilandji people, should be consulted prior to undertaking management activities.
Schools	Flying-foxes may use school grounds as roost sites if appropriate habitat is available. Education in classrooms around flying-fox ecology, management and health concerns.
Hospitals	Reduced amenity of hospital grounds, increased health risk to compromised individuals
Airports	Airport managers have a responsibility to reduce the risk of wildlife strike at Mount Isa Airport.
Equine facilities and vets	Equine facility managers and local vets should be aware of Hendra virus risk and appropriate mitigation measures. Where feasible, all horse owners within 20 kilometres of the camp should be included in such communications. There are several equine facilities surrounding the Mount Isa Cemetery.
Orchardists and fruit growers	Fruit growers may be impacted by flying-foxes feeding in orchards.
Mt Isa City Council	Local government has responsibilities to the community and environment of the area for which it is responsible in accordance with the *Local Government Act 1993*. Council is also responsible for administering local laws, plans and policies, and appropriately managing assets (including land) for which it is responsible.
Department of Environment and Science	The Department of Environment and Science is responsible for administering legislation relating to (among other matters) the conservation and management of native plants and animals, including threatened species and ecological communities.

4.2 Stakeholder Engagement Methods

Stakeholder engagement is important to aid the community in understanding issues surrounding flying-foxes and to correct misinformation that may be circulating. It is also an opportunity to share accurate information and invite feedback about past management responses. Inviting community members to join advisory groups, management committees, or assist with monitoring is a good way to engage the community and aid them in feeling part of the solution. Other methods of stakeholder engagement include:

- promotion of contact details of responsible officers,
- telephone conversations to record issues and complaints,
- face-to-face meetings and telephone calls with adjacent residents,
- media (radio, television, print, social media),
- brochures and other educational material,
- website pages and links,
- direct contact with adjacent residents including letters, brochures and emails,
- on-site signage,
- public meetings,
- face-to-face opportunities in shopping centres, community centres and markets and
- online surveys.

5. Flying-fox Management and Behaviour

Pteropus scapulatus is the only flying-fox whose distribution reaches the Mount Isa local government area. It is the only flying-fox likely to be detected within the project area. Flying-foxes generally prefer to roost in dense vegetation with a thick understory and in close proximity to water. Table 3 provides a brief summary of the characteristics of *Pteropus scapulatus.*

Table 3. Little red flying-fox – general species information.

Scientific Name	*Pteropus scapulatus*	
Common Name	Little red flying-fox	
Description	 www.wildlife.org.au	Smallest mainland species of flying-fox. Fur on body is a red-brown colour while the fur on the neck is a brighter brown-orange. Patches of light cream-brown fur where wing and shoulder meet with head brown-grey. Grey colour may continue down the back in some north Queensland forms. Wings are red-brown in colour and may appear translucent in flight. They have short fur on body with lower parts of leg unfurred. Individuals can weigh between 300 – 600 g.
Habitat	 www.environment.nsw.gov.au	Native to Australia, found throughout much of Victoria, New South Wales, Queensland and the Northern Territory as well as along the north coast of Western Australia to Shark Bay. Distribution extends inland to semi-arid areas however they are absent in most arid inland areas. Common in sclerophyll forest, woodland, rainforest, paperbark swamps and mangroves. Tend to avoid urban areas. Nomadic.
Biology	Little red flying-foxes prefer to feed on the nectar and pollen of eucalypts, however, they will consume sap, fruit and insects if other resources are unavailable. Little red flying-foxes will travel 20 – 30 km from their roost site to feeding grounds and have been known form temporary camps in response to local flowering or fruiting events. Camps can number from 100,000 to a million individuals. They typically prefer to roost nearer to the ground then other flying-fox species. Their breeding season also differs from that of other flying-fox species, with mating taking place between November and January with young born from April to May. Young are carried for three to four weeks, then left in nursery trees when adults are foraging. Young are able to fly at two months old.	
Conservation Status	EPBC Act: Not listed NC Act: Least Concern Back on Track**:** Low Priority (non-statutory) IUCN Red List: Least Concern (non-statutory)	

5.1 Ecological Role

Flying-foxes play an important role ecologically through the pollination and dispersal of seeds of many native tree species across their range. Some plants have adaptations, such as *Corymbia* spp., suggesting they rely more heavily on nocturnal pollinators such as flying-foxes for pollination (Southerton *et al.* 2004). The ecosystem services provided by flying-foxes ensure the long-term persistence of many plant communities including eucalypt forests, rainforests, woodlands and wetlands (Roberts *et al.* 2006).

5.2 Reproduction

5.2.1 Little red Flying-fox

The little red flying-fox breeds approximately six months out of phase with other flying-fox species. Peak conception occurs around October to November, with young born between March and June (McGuckin & Blackshaw 1991; Churchill 2008) (Figure 3). Young are carried by their mother for approximately one month then left at the camp while she forages (Churchill 2008). Suckling occurs for several months while young are learning how to forage. Little red flying-fox generally give birth and rear young in temperate areas (rarely in New South Wales).

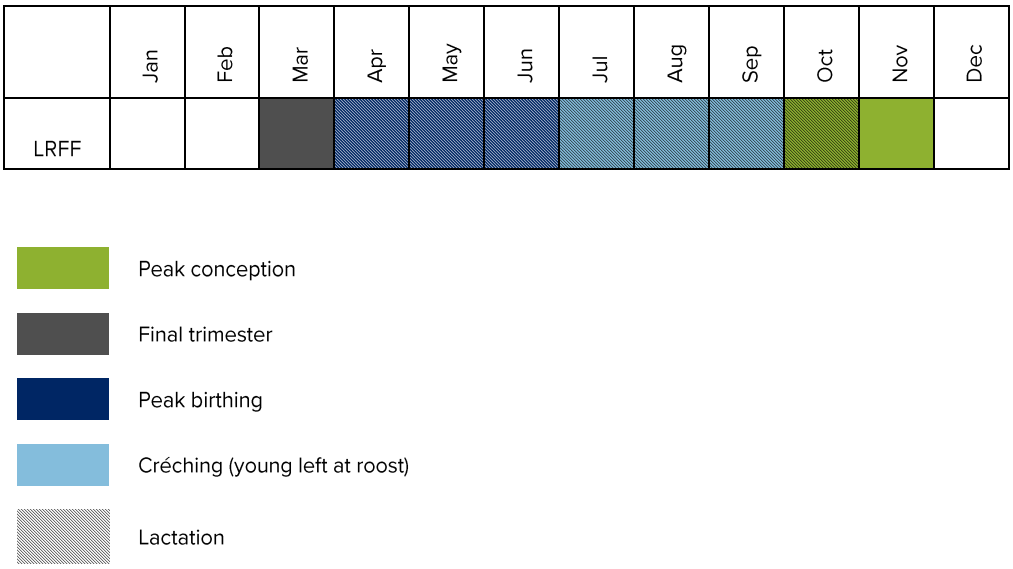

Figure 3. Indicative Little red flying-fox reproductive cycle

6. Human and Animal Health

Flying-foxes, like all animals, carry pathogens that can pose a risk to human health. Many of these zoonotic diseases are viruses that cause only minor infections with their flying-fox host but may cause significant disease in other animals such has humans.

6.1 Australian bat lyssavirus

Australian bat lyssavirus (ABLV) is a virus that can be transmitted from bats to humans. ABLV is more often found in sick or injured flying-foxes, however, apparently healthy flying-foxes may also carry the virus. In sick or injured flying-foxes, around seven percent are thought to carry the virus. Transmission of the virus from bats is through infected bat saliva typically though scratch or bite but is thought that exposure to eyes, nose or mouth or pre-existing broken skin is possible (QLD Health 2019).

6.2 Hendra Virus

Hendra virus was first identified in an outbreak of illness in horses in a large racing stable in Hendra, Queensland in 1994. Infected horses are known to transmit the virus to other horses, humans and dogs (on two occasions). There has been no evidence that Hendra virus can be passed from bats directly to humans (Halim *et al.* 2015). Humans have contracted the disease after close contact with infected horses. Infections in humans is severe and often fatal. There is currently no post-infection treatment or vaccine for Hendra virus for humans.

6.3 Menangle Virus

Menangle virus (also known as paramyxovirus no. 2) was first identified in two still born piglets in a New South Wales piggery in 1997. Knowledge on the virus is scarce, however, it has been recorded in flying-foxes, pigs and humans. In humans, the virus causes severe flu-like symptoms. The virus is thought to be transmitted from flying-foxes to pigs via an oral-faecal matter route. The two known human cases of Menangle virus Australia made a full recovery.

7. Management Options

7.1 Level 1 Actions: Education & Routine Camp Management

7.1.1 Education

Collecting and distributing education material on flying-foxes should always be the first response to alleviate community concerns. Distributing targeted flying-fox education and awareness programs providing stakeholders (such as the local community) with accurate information regarding flying-foxes should be undertaken. Such information that can be provided can include how to manage risk and alleviate concern regarding health and safety issues associated with flying-foxes. This should include management of risks associated with horses. Residents should also be made aware that the noise and faecal droppings occurring during the night are mainly associated with foraging activated by flying-foxes and are independent of camp location. If required, management of such trees in residential yards will assist in mitigating issues; however, it should be noted that removal of some trees may require council approval.

7.1.2 Provision of Alternative Habitat

Habitat suitability mapping can assist in the alternative roost site selection process. A feasibility study is required prior to site designation to assess the likelihood of success and to determine how many resources should be allocated to improvement of habitat. The results of an initial alterative roost study are provided in Appendices A and B.

Provision of alternative habitat is considered to be a viable management option for Mount Isa City Council.

7.1.3 Vegetation Modification

Managing of flying-fox camps is possible through the modification of vegetation both within the current undesired roost site as well the proposed alternative roost location. Within the current roost site, this can be achieved through the removal of limbs from roost trees and understory vegetation where possible. Removal of entire roost trees may also be considered to make the site less desirable to flying-fox camps; however, it is appreciated that this may be undesirable within the Mount Isa Cemetery.

Improvement of an alternative site may also change roost selection by flying-foxes. Modification of vegetation within the existing roost site and the alternative roost site may be used concurrently. When improving an alternative site, preferred flying-fox habitat characteristics should be considered. Little is known about flying-fox camp preferences; however, research indicates that apart from being in close proximity to food sources, flying-foxes choose to roost in vegetation with at least some of the following general characteristics (SEQ Catchments 2012; Eco Logical Australia 2018):

- closed canopy > 5 meters high;
- dense vegetation with complex structure (upper, mid and understory);
- within 500 m of permanent water source;
- within 50 km of the coastline or at an elevation <65m above sea level;
- level topography (<5˚ incline); and

- greater than one hectare to accommodate and sustain large numbers of flying-foxes.

It Is also suggested that during improvement of an alternative site that foraging trees are planted among roost trees to encourage flying-foxes to the site and assist in reducing foraging impacts in residential area. Proximity of plantings to horse paddocks or equine facilities should be considered during this process.

Modification of roost vegetation is undertaken by Mount Isa City Council on a reoccurring basis. This is considered to be a viable management option; however, it should be considered that modification of roost trees results in a lowered visual amenity for the cemetery.

7.1.4 Provision of Artificial Roosting Habitat

The construction of artificial structures to replicate roosting habitat is considered another low impact management option. Although trials have limited success using suspended ropes, it is noted that some success was had with flying-foxes using ropes in the immediate vicinity of natural roosting habitat. The structure of vegetation below and around the ropes is important.

It is relevant to note that this method is most likely to result in movement of flying-foxes to adjacent areas only. As such, this management option is unlikely to alleviate current community concerns. Movement of flying-foxes to an area immediately adjacent to their current roost will not improve public amenity or noise concerns.

7.1.5 Do Nothing

The ‘do-nothing’ management option involves leaving the current situation and site in its current state and undertaking no further management actions.

Adoption of this strategy by Mount Isa City Council will mean that flying-foxes will continue to roost in the Mount Isa Cemetery in future years as part of their normal migration patterns. This means that existing community concerns will not be alleviated. However, it must be noted that adoption of other management strategies may result in the creation of new community concerns - potentially of a greater magnitude and bearing greater consequence.

The ‘do-nothing’ approach is considered a viable option for Mount Isa City Council; however, the costs and benefits of this option must be weighed against the costs and benefits associated with other management strategies.

7.2 Level 2 Actions: In Situ Management

7.2.1 Buffers - Vegetation Removal

Buffers created by vegetation removal aim to increase the distance between flying-fox camps and the local community. Vegetation removal aims to alter the area of the buffer habitat sufficiently so that it is no longer suitable as a flying-fox roost. The amount of necessary vegetation removal varies between sites and camps and can range from some weed removal to removal of large parts of the canopy.

A staged approach to vegetation removal is preferred with the aim of removing as little native vegetation as possible. This is an important consideration where the site has other values such as ecological or public amenity, as Mt Isa Sunset Memorial Cemetery does.

The current roost trees at Mount Isa Cemetery are free-standing and do not adjoin suitable habitat. As such, creation of buffers through vegetation removal is not considered to be a viable management option.

7.2.2 Buffers – Other

Permanent of semi-permanent deterrents can be used to make buffer areas undesirable to flying-fox roosts without the need for vegetation removal. This is often an attractive option where vegetation is of high ecological or amenity value.

Deterrents have had varying success in the past, some options may include:

- Visual deterrents – Flood lighting, plastic bags, fluoro vests and balloons. The type and placement of deterrent will likely need to be varied regularly to avoid habituation.
- Aural deterrents – Noise should be random, varied and unexpected to avoid habituation by flying-foxes. Emitters should be portable on varying timers and emit a diverse range of noises. It is likely to have increased success used in conjunction with additional disturbance techniques.
- Olfactory deterrents – Bagged python excrement has been trialled in the past with varying success. The smell of certain deterrents can also impact on nearby businesses and residents. Flying-fox habituation may also become an issue.
- Canopy-mounted sprinklers – Canopy mounted sprinklers has been successful in deterring flying-foxes from buffer zones. This option can be difficult to install and water source can also be an issue as well as being costly.

The current roost trees at Mount Isa Cemetery are free-standing and do not adjoin suitable habitat. As such, creation of buffers through any of the above-listed means is not considered to be a viable management option.

7.3 Level 3 Actions: Relocation or Dispersal

7.3.1 Nudging

Noise and other low-intensity active disturbance restricted to certain areas of the camp can be encourage flying-foxes away from conflict areas. The aim of this technique is to nudge flying-foxes from one area to another area nearby while allowing them to remain at the preferred camp.

Nudging should not be conducted in the early morning if the area of the camp is small as it may lead to dispersal of flying-foxes from the camp. Disturbance should be avoided during periods when dependent young are present.

Nudging of the camp is not considered to be a viable management option for Mount Isa City Council, as the current extent of the camp is small in area and does not adjoin neighbouring bushland or other areas of suitable habitat. Nudging of the camp in any direction will not remove flying-foxes from the area of conflict (the cemetery).

7.3.2 Active Relocation or Dispersal

Active relocation or dispersal activities will be disruptive for nearby residents given the timing and nature of activities and should be considered during planning and community consultation. Active dispersal or relocation often requires ongoing dispersal attempts to prevent flying-foxes re-establishing the camp.

This method does not explicitly use modification as a means of dispersal, however if dispersal/relocation is successful, then some habitat modification is recommended to reduce the likelihood of the camp re-establishing and requiring further dispersal works.

A proactive management approach is crucial in promoting positive project outcomes. This means that management activities should be undertaken before the flying-fox camp is established. This requires ongoing monitoring for signs of flying-foxes during daylight hours during the early stages of roosting season. It is important that flying-foxes foraging overnight are not mistaken for animals establishing a camp. As there may be only a small number of animals utilising the site early in the season, dispersal to an alternative roost location may be more easily achieved. This will also avoid the establishment of the entire flying-fox camp at an undesired site before management actions are undertaken and negative animal welfare outcomes.

Pending the selection of an alternative roost site, this is considered to be a viable management option for Mount Isa City Council.

7.4 Management Option Analysis

An analysis of site-specific management options has been prepared for the roost site (Table 4).

Table 4. Site-specific management options

Management Options	Relevant Impacts	Cost	Advantages	Disadvantages
Level 1 actions				
Education and awareness programs	Fear of disease Noise Smell Faecal drop	$	Low cost, promotes conservation of flying-foxes, contributes to attitude change which may reduce general need for camp intervention and reduce anxiety, increasing awareness and providing options for landholders to reduce impacts can be an effective long-term solution, can be undertaken quickly, will not impact on ecological or amenity value of the site.	Education and advice itself will not mitigate all issues and may be seen as not doing enough. This is unlikely to alleviate community concerns associated with flying-foxes roosting in the cemetery.
Property modification	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$–$$	Property modification is one of the most effective ways to reduce amenity impacts of a camp without dispersal (and associated risks), relatively low cost, promotes conservation of flying-foxes, can be undertaken quickly, will not impact on the site, may add value to the property.	May be cost-prohibitive for private landholders, unlikely to fully mitigate amenity issues in outdoor areas. This is unlikely to completely alleviate community concerns associated with flying-foxes roosting in the cemetery; however, may mitigate some issues.
Fully-fund/subsidise property modification	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$–$$	Potential advantages as per property modification, but also overcomes the issue of cost for private landholders.	Costs to the land manager will vary depending on the criteria set for the subsidy including proximity to site, term of subsidy, level of subsidy. Potential for community conflict when developing the criteria, and may lead to expectations for similar subsidies for other issues. This is unlikely to alleviate community concerns associated with flying-foxes roosting in the cemetery.
Service subsidies including rate rebates	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$–$$	May encourage tolerance of living near a camp, promotes conservation of flying-foxes, can be undertaken quickly, will not impact on the site, would reduce the need for property modification.	May be costly across multiple properties and would incur ongoing costs, may set unrealistic community expectations for other community issues, effort required to determine who would receive subsidies. Ongoing costs of cleaning property modification can be costly. This is unlikely to alleviate community concerns associated with flying-foxes roosting in the cemetery.

Management Options	Relevant Impacts	Cost	Advantages	Disadvantages
Routine camp management (includes vegetation & weed removal, mowing grass planting etc.)	Health/wellbeing	$	Will allow property maintenance, likely to improve habitat, could improve public perception of the site, will ensure safety risks of a public site can be managed. Weed removal has the potential to reduce roost availability and reduce numbers of roosting flying-foxes. To avoid this, weed removal should be staged and alternative roost habitat planted, otherwise activities may constitute a Level 3 action.	Will not generally mitigate amenity impacts for nearby landholders and may not mitigate all impacts for those who access the cemetery.
Alternative habitat creation	All	$$–$$$	If successful in attracting flying-foxes away from high conflict areas, dedicated habitat in low conflict areas will mitigate all impacts, promotes flying-fox conservation. Rehabilitation of degraded habitat that is likely to be suitable for flying-fox use could be a more practical and faster approach than habitat creation.	Generally a costly, long-term approach so cannot be undertaken quickly. May be difficult to fund and maintain an alternative roost site over long periods of time. Due to lack of obvious alternative habitat in the area, creation of alternative habitat is likely to require significant time, effort and funding.
Provision of artificial roosting habitat	All	$–$$	If successful in attracting flying-foxes away from high conflict areas, artificial roosting habitat in low conflict areas will assist in mitigating all impacts, generally low cost, can be undertaken quickly, promotes flying-fox conservation.	Would need to be combined with other measures (e.g. buffers/alternative habitat creation) to mitigate impacts; previous attempts have had limited success. This method is unlikely to reduce current conflict in the cemetery and may make the area more desirable than it currently is.
Protocols to manage incidents	Health/wellbeing	$	Low cost, will reduce actual risk of negative human/pet–flying-fox interactions, promotes conservation of flying-foxes, can be undertaken quickly, will not impact the site.	Will not generally mitigate amenity impacts.
Research	All	$	Supporting research to improve understanding may contribute to more effectively mitigating all impacts, promotes flying-fox conservation. Research is currently being undertaken by the DES and Commonwealth Scientific and Industrial Research Organisation (CSIRO) so may not require additional funds from Mount Isa City Council.	Generally cannot be undertaken quickly. Management trials may require further cost input. May not be seen as 'doing enough' by the community.

Management Options	Relevant Impacts	Cost	Advantages	Disadvantages
Appropriate land use planning	All	$	Likely to reduce future conflict and promotes flying-fox conservation. Identification of degraded sites that may be suitable for long-term rehabilitation for flying-foxes could facilitate offset strategies should clearing be required under Level 2 actions.	Will not generally mitigate current impacts. Land-use restrictions may be viewed negatively by residents.
Property acquisition	All for specific property owners Nil for broader community	$$$	Will reduce future conflict with the owners of the acquired property.	Mount Isa City Council currently oversee the roost site and are responsible for its management. The current land-use (cemetery) cannot be readily altered.
Do nothing	Nil	Nil	No resource expenditure.	Will not mitigate impacts and unlikely to be considered acceptable by the community.
Level 2 actions				
Buffers through vegetation removal	Noise Smell Health/wellbeing Property devaluation Lost rental return	$–$$	Will reduce impacts, promotes flying-fox conservation, can be undertaken quickly, limited maintenance costs.	Will impact site amenity, will not generally eliminate impacts, vegetation removal may not be favoured by the community.
Buffers without vegetation removal	Noise Smell Health/wellbeing Damage to vegetation Property devaluation Lost rental return	$$	Successful creation of a buffer will reduce impacts, promotes flying-fox conservation, can be undertaken quickly, options without vegetation removal may be preferred by the community.	May impact the site, buffers will not generally eliminate impacts, maintenance costs may be significant, often logistically difficult, limited trials so likely effectiveness unknown.

Management Options	Relevant Impacts	Cost	Advantages	Disadvantages
Noise attenuation fencing	Noise Smell Health/wellbeing Property devaluation Lost rental return	$$	Will eliminate/significantly reduce noise impacts, will reduce other impacts, limited maintenance costs.	Costly, likely to impact visual amenity of the site, will not eliminate all impacts, may impact other wildlife at the site. Noise attenuation fencing unlikely to solve human-wildlife conflict in this case.
Level 3 actions				
Nudging	All	$$–$$$	If nudging is successful, this may mitigate all impacts.	Costly, flying-foxes will continue attempting to recolonise the area unless combined with habitat modification/deterrents. Nudging unlikely to resolve core issue to of flying-fox camp in cemetery.
Passive dispersal through vegetation management	All at that site but not generally appropriate for amenity impacts only (see Section 8)	$$–$$$	If successful can mitigate all impacts at that site, compared with active dispersal: less stress on flying-foxes, less ongoing cost, less restrictive in timing with ability for evening vegetation removal.	Costly, will impact site, risk of removing habitat before outcome known, potential to splinter the camp creating problems at other locations (although less than active dispersal), potential welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk, (potential to impact on aircraft safety.
Active dispersal or relocation	All at that site but not generally appropriate for amenity impacts only (see Section 8)	$$$	If successful can mitigate all impacts at that site, often stated as the preferred method for impacted community members.	May be very costly, often unsuccessful if not managed by subject matter experts, ongoing dispersal generally required unless combined with habitat modification, potential to splinter the camp creating problems in other locations, potential for significant animal welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk, potential to impact on aircraft safety.
Early dispersal/relocation before a camp is established at a new location	All at that site	$$–$$$	Potential advantages as per other dispersal methods, but more likely to be successful than dispersal of a historic camp.	Potential disadvantages as per other dispersal methods, but possibly less costly and slightly lower risk than dispersing an established camp.

8. Management Options

This section outlines the management actions that are considered to be the most appropriate for the flying-fox camp roosting in the Mount Isa Sunset Lawn Memorial Cemetery with consideration of:

- its proximity to urban areas, and
- the management practices that have been carried out historically.

8.1 Level 1 Actions

8.1.1 Education, Awareness and Community Engagement

Mount Isa City Council and the broader community are well aware of the conflict that exists with flying-foxes. The current camp has been visiting the cemetery since 2010. Education, awareness and community engagement, however, are still crucial tools in the management of flying-foxes. Given that an alternative roost site that can support flying-foxes immediately does not currently exist (i.e. any alternative roost site will require some long-term regeneration works) a shift in community perception of flying-foxes will aid in this ongoing process.

It is recommended that further educational awareness be undertaken. This should focus on the ecological importance of flying-foxes, their role in the broader landscape, and protocols to manage incidents. This can be achieved through:

- community information sessions;
- school visits with subject matter experts;
- distribution of educational pamphlets;
- provision of education signal near the roosting site; and
- provision of information on the Mount Isa City Council website.

It is important that such information sources and sessions should also address the actual level of health risk. Education can play an important role managing the perception of fear in the community. Targeted consultation through a working group may also aid in the sharing site specific information and could include members of MICC, consulting ecologists, affected community members, DES, and flying-fox researchers. This information should be included on the MICC webpage.

Continuing to undertake periodic surveys to determine community perception will also be a good performance indicator of education and awareness campaigns. Engaging the community in early detection and monitoring will also be an important tool in empowering the community to feel they are proactively assisting with the flying-fox issue. Protocols to Manage Incidents

Due to the urban setting in which the current camp resides, the implementation of protocols to manage incident or situations specific to the camp at the cemetery should be prepared. Development of management protocols should address interactions between:

- humans and flying-foxes to prevent the spread of disease;
- horses and flying-foxes to prevent the spread of disease;

- flying-foxes and aircraft;
- flying-foxes and sites that host vulnerable people; and
- flying-foxes and pets at sites where pets are walked.

It should also be noted that management protocols are not limited to the management of the general public and community but should also include the welfare of flying-foxes. For example, protocols to manage the following may also be prepared:

- heat stress incidents;
- flying-fox entanglements; and
- orphaned or abandoned flying-foxes.

8.1.2 Land-use Planning

This management plan recommends alternative roost locations within the Mount Isa area. This site should be taken into consideration during any future land-use planning If it is to be used as an alternative roost site. Creation of alternative habitat can potentially have negative implications for the surrounding community if it is not strategically planned. Ideally, land-use planning controls (e.g. a buffer surrounding the chosen alternative roost site) would be implemented surrounding the preferred alternative habitat site to ensure that conflicting land-uses are not located near the roost site.

Future planning of schools, hospitals, airports, equine facilities, residential and certain recreational areas should be considered in alternative areas within Mt Isa to avoid future human-wildlife-conflict and the need for management intervention.

8.1.3 Property Modification and Maintenance

Due to the continued use of the cemetery as a roosting site, it is necessary to employ actions to mitigate impacts of flying-foxes on cemetery visitors. This can be achieved through creating barriers to sound and smell of flying-foxes through the use of fencing or hedges in problem areas. For hedging, species should be selected that do not produce fruit or nectar-exuding flowers and grow in a dense form and maintained between to less than 5 meters (Roberts 2006). Selection of species with fragrant flowers would aid in masking camp odour where this is a problem. Regular cleaning of faecal droppings within the cemetery grounds (particularly of grave sites and general use areas) to alleviate public concern would also be beneficial.

In addition, Mount Isa City Council can offer advice for the community about managing impacts of flying-foxes on their property. This can include information relating to:

- vegetation management through pruning, wildlife friendly netting or tree replacement;
- covering of vehicles and other structures such as clothes lines;
- installation of removable overs for swimming pools; or
- how to minimise camp disturbance during daylight hours to decrease camp noise.

The partial or full subsidisation of property modification efforts by Mount Isa City Council would be costly and would require funding over multiple years.

8.1.4 Alternative Habitat Creation

The establishment of an alternative roost site and adoption of a long-term strategy is likely to have the most favourable outcomes for Mount Isa City Council, its community and flying-foxes. An alternative roost study has highlighted a potential location for creation of alternative habitat (Appendices A and B). This preferred site was analogous with the preferred site for Mount Isa City Council (provide by the DES) adjacent the Mount Isa water treatment plant.

The preferred roost site will require considerable revegetation before it can be considered suitable habitat for flying-foxes. It is suggested that native plant species mirroring the assemblages of surrounding regional ecosystems (REs) are selected to revegetate this area. This will assist in ensuring that the species selected are suitable to the climatic conditions. This approach will also negate the negative impacts of further planting further introduced species. Species of the families *Myrtaceae* (eucalypts and melaleuca), *Mimosaceae* (acacia) and *Proteaceae* (grevillea), should be selected to encourage flying-foxes to utilise the site for both foraging and roosting habitat. Examples of species that could be considered to use in revegetation of the site are:

- *Eucalyptus camaldulensis*
- *E. leucophylla*
- *E. normantonensis*
- *Melaleuca viridiflora*
- *Grevillia striata*
- *G. heliosperma*
- *Acacia chisholmii*
- *Acacia phlebocarpa*

Irrigation of the site using treated water from the nearby water treatment plant would reduce the need to provide additional infrastructure to maintain the site, and would assist in maintaining a cooler temperature at the site. The aim of the establishment of the alternative roost should be to attain as many desirable habitat features as possible.

8.1.4.1 Land Tenure

Flying-fox camps and the roost sites they select are highly dynamic. They expand and contract and are colonised and abandoned frequently. Flying-foxes can also move between or expand across one or more land tenures. As such, land tenure is an important consideration when selecting alternative roosting sites.

The preferred alternative roost site is located on Lot 73 Plan SP265806 which is leased to the Mount Isa local government with the purpose of sewerage treatment and pasturage. Similarly, the current roost site is also on land leased to the Mount Isa local government (Lot 95 Plan 265806).

Under the *State Planning Policy 2017*, there is no land located directly adjacent the preferred alternative roost site or cemetery that has been identified as priority for development residentially or economically. Some matters of state environment significance (MSES) regulated wildlife habitat (endangered or vulnerable and special least concern animal) and MSES regulated vegetation (essential habitat) are located to

the northwest of the alternative roost site on a tributary of the Leichhardt River. The confluence of the tributary and the Leichhardt River is the location of the secondary site identified to provide potential habitat for flying-foxes. This site already contains an abundance of mature vegetation; however, roosting of flying-foxes in this location may result in continues human-wildlife conflict.

8.2 Level 2 Actions

8.2.1 Buffers - Vegetation Removal

Within the Mount Isa Cemetery, it is likely that large limbs or parts of the canopy nearest to grave sites or visitor areas would need to be removed to create a sufficient buffer since there is no understorey vegetation that flying-foxes can move to. Vegetation removal would need to be undertaken in a staged approach to encourage the camp to occupy the vegetated periphery or the vegetated area to the south of the cemetery adjacent to Sunset Drive.

8.2.2 Buffers – Other

In a similar manner as vegetation removal, permanent or semi-permanent deterrents could be used in specific problem trees or areas within the cemetery grounds. Deterrents may could be placed within or near to established *Ficus* spp. along Sunset Drive to, again, encourage flying-foxes to move to peripheral areas.

Permanent or semi-permanent deterrents can be used to make buffer areas undesirable to flying-fox roosts without the need for vegetation removal. This is often an attractive option where vegetation is of high ecological or amenity value.

Prior to establishment of an alternate roost site, implementation of such actions in years where a large camp is present may cause flying-foxes to take up residence in less desirable locations.

8.3 Level 3 Actions

It is recommended that Level 3 actions be carried out once the alternative roost site is established and deemed to the capacity to house a large flying-fox camp. If level 3 are actions are carried out prior to establishment of an alternative roost site, further conflict may arise or the camp may splinter and begin to roost in undesirable locations.

8.3.1 Passive Dispersal

Passive dispersal aims to make habitat of a site unattractive to flying-foxes so that they will disperse under their own means with relatively little stress. This would be achieved through staged removal of vegetation from the Mount Isa Sunset Memorial Cemetery. Previous use of this method resulted in flying-foxes abandoning a camp in Bundall, Queensland only after 70% of the canopy/mid-story and 90% of the understory had been removed (Ecosure 2011). Adoption of this measure would mean a significant alteration to the vegetation within the cemetery and ongoing maintenance to prevent the site returning to a state suitable for flying-foxes.

The extent of required vegetation removal would also result in a considerable reduction in the amenity of the area. Although this has been conducted previously within the cemetery grounds with varying levels of success, a transition of vegetation from large tree species to smaller shrubs and ground covers could also be a

consideration. This would necessitate the eventual removal of the large *Ficus* spp. that are already established within the cemetery. It is important to note that such actions must only be undertaken when no flying-foxes are roosting in large trees and that such actions should only be carried out once an alternative roost site is established.

Flying-fox tracking data collected over 2018-19 summer did not appear to show a great affinity for the alternative roost site chosen for this project (CSIRO, 2020). Migratory routes do show flying-foxes migrating to Mount Isa from the Gulf of Carpentaria from the north, and from Mount Isa to the northeast. Migratory routes also show that flying-foxes use the air space directly to the west of the proposed alternative roost site. This suggests that flying-foxes may utilise this space once habitat is of appropriate quality.

8.3.2 Active Dispersal

8.3.2.1 Proactive

Proactively managing flying-foxes requires early intervention while the camp is establishing at the preferred roost location. This involves on-going monitoring early in the season to detect the arrival of flying-foxes at their known roost site. Once flying-foxes are detected, low impact methods may be utilised to redirect flying-foxes to a preferred location.

The use of this method should encourage community engagement in the monitoring of the cemetery and surrounding areas. Community members should notify Mount Isa City Council and/or the managing agency of flying-fox presence during daylight hours (indicating roosting) through a hotline or website established as part of a management program.

8.3.2.2 Reactive

Reactively responding to the flying-fox camp in Mt Isa Sunset Memorial Cemetery would involve allowing the flying-fox camp to fully establish, then enacting a more comprehensive suite of dispersal techniques over the course of several days. A description of equipment that can be used to deter flying-foxes is presented in Table 5.

Table 5. Flying-fox camp relocation strategies

Type	Method	Description
Visual Deterrents	Flood lighting	Temporary flood lighting focusing on the roost trees provides a deterrent for flying-foxes returning to the roost location. Illumination of the trees results in the creation of an undesirable roost. This measure prevents some individuals from landing in the roost trees. It may not be effective on all individuals.
Aural Deterrents	Distress whistle	When blown, personal distress whistles creates a loud high-pitched audible deterrent at a different frequency to all other aural deterrents.
	Distress calls	Audio equipment with distress calls can be an effective audible tool in the management of flying-foxes. The success of this tool is highly dependent on each individual.
	Pool noodle	A hollow pool noodle is cut into quarters, which are then brought sharply together to create a loud noise. This sound is

Type	Method	Description
		disruptive to wildlife and encourages flying-foxes to leave the area.
	Gas gun	A gas gun is an additional aural harassment measure that produces a loud noise via the release of compressed LPG. The gas gun is an effective tool as it can be set to different time intervals, and does not require supervision by a staff member.
Combined Visual and Aural Deterrents	Pyrotechnics	Pyrotechnics may be used for flying-foxes which have not responded as well to previously used methods
	Stock whip	The sound created by the use of stock whips, whilst simple, is highly effective in preventing flying-foxes from roosting. Stock whips create a loud crack, which acts as an audible deterrent. In addition, the fast movements of the whip and person's arm result in a physical/visual harassment measure. Stock whips are used to create a negative auditory association only and are not used to contact the animals.
	Air dancer	The air dancer, which is generally in line with the height of roosting flying-foxes, is an effective visual deterrent. In addition to the erratic movement of the air dancer, the noise from the generator creates a second layer of disturbance.

9. Assessment of Impacts on Flying-foxes

9.1 Measures to Avoid Impacts

9.1.1 All Management Activities

The following measures should be engaged to ensure minimal impact to flying-foxes when conducting any management activities.

- DES must be notified of any management or dispersal/relocation activities being carried out two days prior to works commencing. Notification will be submitted via completion of form supplied at this address: https://environment.des.qld.gov.au/wildlife/animals/living-with/bats/flying-foxes/roost-management/notification-form.
- All personnel will be appropriately experienced, trained and inducted. This will include each team members responsibilities under the plan.
- All personnel involved in management activities will attend a pre-start meeting prior activities on each day and debriefed at the completion of each day.
- Works will cease in accordance with any 'stop work triggers' and DES notified in the event of a flying-fox fatality, injury or grounding as a result of management activities (email: wildife.management@des.qld.gov.au).
- Large crews will be avoided where possible.
- Activities likely to disturb flying-foxes at any-time will begin as far away from the camp as possible working towards the camp allowing them to habituate.
- Non-critical activities will be scheduled when the camp is naturally empty where possible. If this cannot be achieved then works should be carried out where abundances are seasonally lower or during non-breeding season.
- Any activity likely to disturb flying-foxes so that they take flight will be avoided during daylight hours during birthing periods and avoided altogether during crécheing.
- Works will not take place during periods of adverse weather conditions likely to increase stress (strong winds, sustained heavy rain, very cold temperatures or resource shortage).
- Works will not be carried out on days predicted to exceed 38˚C and for one day following a day that reached ≥38˚C. If an actual heat stress event has been recorded at the camp or at nearby camps, a rest period of several weeks will be scheduled to allow affected flying-foxes to fully recover.

9.1.2 All Level 2 and Level 3 Actions

9.1.2.1 Prior to Works

The following measures should be engaged to ensure minimal impact to flying-foxes prior to conducting any level 2 and 3 management activities.

- One week prior to on-ground management activities commencing, residents adjacent to the camp should be notified of the intended works. This should include information on what to do if injured or orphaned flying-foxes are

observed, a reminder to not participate or interfere with any works and details on how to report unusual flying-fox behaviour or daytime sightings.

- Information should be made available on the Mount Isa City Council website with program coordinator details provided
- A licensed wildlife carer should be notified prior to commencement of works in the event that rescue or care is required.

9.1.2.2 During Works

The following measures should be engaged to ensure minimal impact to flying-foxes during any level 2 and 3 management activities. This includes compliance with the Queensland Code of Practice – Ecologically Sustainable Management of Flying-fox Roosts *Nature Conservation Act 1992.*

- A flying-fox expert will be present during works to monitor flying-fox behaviour and ensure compliance with plan and relevant policy. Such an individual will be able to identify pregnant females, individuals of poor health and be up to date with any climatic extremes or food shortages
- Dispersal of an occupied camp will only occur when females are not in their final trimester and dependent young are not present (generally May and July). If flying-foxes in the region are recorded as being visibly pregnant dispersal will cease.
- Dispersal may continue for up to a total of 2.5 hours in a 12-hour period, early morning and/or in the evening. Morning activities will not continue past sunrise. Evening activities will not begin before sunset.
- At least one day with no active flying-fox management will be scheduled weekly
- No actions should be undertaken at splinter groups if they have deemed to have settled from initial dispersal efforts.

9.1.2.3 Monitoring

The following measures should be engaged to ensure minimal impact to flying-foxes after any management activities have been completed.

- Daily checks of ‘potential flying-fox habitat’ within 600 metres, twice-weekly checks of 'potential flying-fox habitat' within three kilometres.
- Potential flying-fox habitat within three kilometres of the site monitored within two weeks of works commencing and at the completion of works.
- A count is also suggested at any known camp site within a 25 kilometres radius, once within two weeks of works commencing, and again at the completion of works.

9.1.3 Vegetation Trimming and Removal

The following measures should be engaged to ensure minimal impact to flying-foxes and other fauna while vegetation trimming and removal are being conducted.

- Habitat features such as dead wood and hollows will be retained on site where possible.
- Chipping of vegetation will be undertaken as far as possible from active flying-fox roost as possible.

- No tree with flying-foxes present will be trimmed or removed. Works can only be carried out in adjacent trees to roost trees where a person experienced in flying assesses no flying-foxes are at risk of harm and should remain on site if trimming/removal of canopy is required within 50m of roosting flying-foxes.
- While most females are likely to be carrying young (generally September – January) vegetation removal within 50 metres of the camp will only be done in the evening after fly-out, unless otherwise advised by a flying-fox expert.

9.1.4 Bush Regeneration

The following measures should be engaged to ensure minimal impact to flying-foxes and other fauna and flora while any bush regeneration works are being carried out.

- All works will be carried out by suitably qualified and experienced bush regenerators, with at least one supervisor knowledgeable about flying-fox habitat requirements and familiar with Level 1 and 2 actions.
- Vegetation modification, including weed removal, will not alter the conditions of the site such that it becomes unsuitable flying-fox habitat for Level 1 and 2 actions.
- Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys at all times.
- Weed control in the core habitat area will be undertaken using hand tools only (or in the evening after fly-out while créching young are not present).
- Species selected for revegetation will be consistent with the habitat on site, and in buffer areas or conflict areas should be restricted to small shrubs/understorey species to reduce the need for further roost tree management in the future

10. Assessment of Impacts to Other Threatened Species or Communities

An EPBC Act Protected Matters search within 10km of the project area and a NC Act Threatened Species search within the Mount Isa local government area were conducted to determine the potential impacts of this management plan on other threatened species or communities that may be present.

The EPBC Protected Matters search revealed no threatened ecological communities within the project area; however, twelve threatened species are listed as potentially occurring in the project area. The NC Act threatened species search returned 31 species listed as threatened and potentially occurring within the Mt Isa local government area. Appropriate measures should be undertaken prior to any management actions being implemented (i.e. pre-clearing inspections for fauna before vegetation removal or clearing).

11. Evaluation and Review

This management plan should have a scheduled review annually, which is suggested to include an evaluation of management actions outlined in Sections 7 and 8. Additionally, the following items should trigger a review of this management plan:

- Completion of management activities;
- Progression to higher level of management (e.g. from Level 1 action to a Level 2 action);
- Changes in relevant policy/legislation;
- New management techniques becoming available;
- Outcomes of research that may influence the plan; or
- Incidents associated with the camp.

To ensure this Plan is kept relevant, a full review that includes stakeholder consultation and expert opinion should be undertaken in the final year of the management plan.

12. Plan Administration

12.1 Monitoring

Establishment of routine camp monitoring should be implemented and account for the area, abundance and species composition of the camp as well as the breeding status and presence of young as per Department of Environment and Science flying-fox monitoring program methods (DES 2020). Monitoring is suggested to be carried out on a quarterly basis with the information entered into the national flying-fox monitoring program database. Monitoring should be continued in the case that the flying-fox camp is dispersed to a preferred location due to the implementation of management actions identified in Section 10.

12.2 Contingency Plans

All efforts must be made to ensure that flying-foxes and other fauna are not injured as a result of management activities. In the event that any wildlife is accidentally injured, the wildlife must be taken to a vet or local wildlife care group for treatment. The following local resources are available to provide emergency and rehabilitation care if required:

- RSPCA
- North West Veterinary Clinic
- Mount Isa Veterinary Surgery
- Copper City Vet Clinic
- North Queensland Wildlife Care

12.3 Reporting Requirements

A service report must be provided to Mount Isa City Council prior to and after any management activities to be carried out. This report should include a summary of:

- management works undertaken;
- any data collected; and
- assessment of impacts to flying-foxes.

12.4 Adaptive Management

This Plan has an adaptive management approach to reflect changes in management approaches in relation to relevant conservation legislation and general management of flying-fox colonies as well as any feedback received. This approach will be achieved through the following mechanisms:

- the review process of the document specified in Section 11 of this Plan;
- review of feedback received from members of the community received through Council's consultation mechanisms; and
- any other relevant advice or research received from experts in relation to Flying-foxes threatened or otherwise.

12.5 Roles and Responsibilities

Table 6 includes a summary of the roles and responsibilities relevant to management of the flying-fox camp roosting in the Mount Isa Cemetery. It is relevant to note that different responsibilities may be fulfilled by different roles depending on the type of project being conducted.

Table 6. Roles and Responsibilities

Role	Name	Required experience/approvals	Responsibilities/authority	Communication lines
Program Coordinator	Environmental Services Coordinator	Project management Human resource management Community engagement Reporting	Inform and consult with stakeholders and interested parties Community engagement Evaluate program Submit reports to DES Ensure all landowners have provided consent prior to works	Direct reports: Project Manager
Project Manager	Environmental Services Coordinator or Environmental Officer	Project management Team leadership and coordination Data management	Coordinate field teams and ensure all personnel are appropriately experienced and trained for their roles Induct all personnel to the program Collect and collate data Liaise with DES Liaise with wildlife carers/veterinarians (for orphaned/injured wildlife only)	Reports to: Program Coordinator Direct reports: Supervisor, Contractor
Supervisor	Environmental Officer or Environmental Consultant	Knowledgeable in flying-fox biology, behaviour and camp management. ABLV-vaccinated and trained in flying-fox rescue Team training, leadership and supervision	Pre- and post-management monitoring Surrounding camp monitoring Coordinate daily site briefings Coordinate daily activities Monitor flying-fox behaviour Rescue flying-foxes if required (and no carer/vet on-site) Determine daily works end point Participate in management activities	Reports to: Project Manager Direct reports: Team members, Observers/support

Role	Name	Required experience/approvals	Responsibilities/authority	Communication lines
Team member	As required by project	Recommended ABLV-vaccinated (employer to assess risk) Ideally, all team knowledgeable in flying-fox biology, behaviour and camp management; however, not required	Attend daily site briefings Participate in relevant management activities	Reports to: Supervisor Direct reports: Nil
Contractor	As required by project	Relevant licences and experience in field	Conduct specified activities (e.g. tree trimming) Adhere to all directions given by Supervisor	Reports to: Project Manager Direct reports: Nil
Observer/support	As required by project	Approval to access site	Provide care of injured/orphaned wildlife (under licence) if required	Reports to: Supervisor Direct reports: Nil
Flying-fox expert	Environmental Consultant or Specialist	Project Management Extensive experience in flying-fox biology, behaviour and camp management.	On-site population assessment, monitor flying-fox behaviour and ensure compliance with the Plan	Reports to: Supervisor Direct reports: Nil

13. References

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Department of Environment and Science (2020c). Flying-fox roost monitoring and locations. Accessed 26 May 2020. https://environment.des.qld.gov.au/wildlife/animals/living-with/bats/flying-foxes/roost-locations

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Appendix A

Habitat Suitability Analysis

1. Habitat Suitability Analysis Methodology

1.1 Desktop Analysis

Prior to field verification surveys, a series of habitat models were created using GIS to assess the suitability of alternative areas that could support, or have the potential to support a flying-fox reserve. These models were combined into a weight overlay analysis, consisting of multiple sub-models that individually identify desirable areas for flying-foxes based on their habitat requirements.

All habitat sub-models were created using the multi-criteria evaluation framework, in which multiple attributes were weighted according to their attractiveness to flying-foxes (e.g. proximity to water course, wetland, coastline or high value vegetation were weighted more highly). A number of constraints models were also created so that areas where the presence of a large flying-fox camp would be undesirable were considered. All analyses were performed in Quantum GIS (QGIS). A schematic showing the weight overlay structure is shown in Figure A-1.

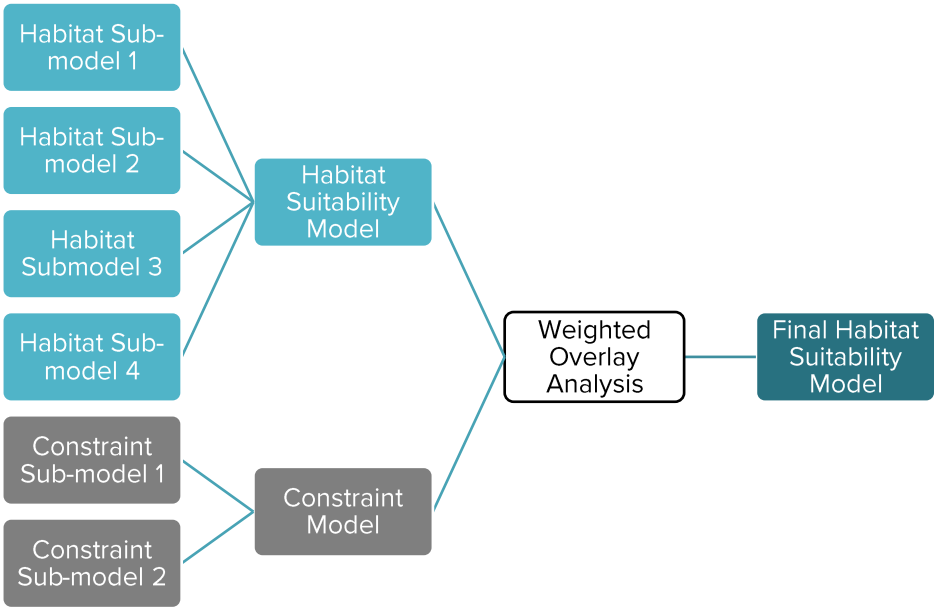


Figure A-1. Weighted overlay conceptual diagram

1.2 Selection Criteria

Selection of criteria for habitat models was based on contemporary, available flying-fox research. Flying-foxes are known to have a number of habitat requirements and factors that determine roost site selection. Table A-1 lists five general habitat criteria that may determine suitability for flying-foxes which have been considered for this study.

Table A-1. Alternative roost selection criteria

Criteria	Rationale
1. **Current roost preference**	Areas that are already preferred by flying-foxes are far more likely to be chosen as roost locations, meaning that the provision of a reserve in an already existing camp (or near an existing camp) is far more likely to successfully recruit seasonal influxes of flying-foxes.
2. **Proximity to remnant vegetation**	Proximity to closed canopy forest (greater than 5 meters in height) of a total area no less than 1 hectare in size may determine roost selection. Roost selection may also depend on vegetation community, complexity of vegetation structure and type of vegetation present Flying-foxes are more likely to roost in trees with larger diameters and canopy trees. Camp size also tends to be larger in densely forested regions with lower annual precipitation and flood affected areas (Hahn *et al.* 2014). Flying-fox roost tree selection is non-random with respect to tree species (Hahn *et al.* 2014). The diet of *P. alecto* includes fleshy fruit and blossom (pollen and nectar), while *P. scapulatus* feeds mostly on Eucalyptus blossom. *P. alecto* also eats leaves but the importance of this in the diet is unknown. The food preference of both species is known to vary seasonally (Vardon *et al.* 2001).
3. **Proximity to watercourse or waterbody**	Flying-foxes are known to prefer roosting in close proximity to a water body or riparian area (Mildenstein *et al.* 2005).
4. **Proximity to coastline**	Flying-foxes are known to prefer sites within close proximity of a coastline (Mildenstein *et al.* 2005).
5. **Elevation**	Flying-foxes are known to prefer lowland habitat at an elevation of less than 65m above sea-level (Mildenstein *et al.* 2005).

1.3 Weighting Habitat Suitability Criteria

Each of the criteria outlined in the previous section was then weighted according to its importance in determining the success of the area in supporting flying-foxes. The weighting of each objective was determined by the project team following review of current research. This included a variety of resources that assess the importance of a range of habitat features in determining flying-fox roost locations. Criteria weightings are shown in Table A-2.

Each criterion used in this analysis may not contribute as heavily in determining flying-fox roost habitat. As such, each layer was assigned a weighting, or a percentage influence based on importance. The total influence of all input layers must total 100 percent.

Table A-2. Suitability criterion weightings.

Criteria	Weighting
Current roost preference	30%
Proximity to remnant vegetation	30%
Proximity to a watercourse or waterbody	30%
Proximity to coastline	Not considered due to Mt. Isa's inland location. Such a distance is deemed to have negligible influence on flying-fox roost choice.
Elevation	10%

All sub-models were rendered at a scale of 10m intervals, with the exception of the 'current roost preference' which was rendered at a scale of 1m intervals.

The input criteria rasters were then multiplied by their respective weights and the added together to produce a final habitat suitability raster (Figure A-2)

(Proximity to flying-fox camp * 30%) + (Proximity to remnant vegetation * 30%) + (Proximity to watercourse or waterbody * 30%) + (Proximity to coastline * 10%)
= **Combined Habitat Suitability Model**

Figure A-2. Habitat suitability analysis equation.

1.4 Constraints Model

A number of constraints were identified in a single model to ensure that sensitive areas were not adversely affected by the location of the flying-fox reserve. Non-desirable habitat characteristics were also incorporated into the analysis and given a negative weighting. Areas containing a degree of human urbanisation are far less desirable for fly9ng-foxes due to the human-wildlife conflict that can arise. Exacerbating this conflict, flying-foxes are known to prefer roost sites within a certain proximity of urban settlement (Hahn. 2014).

It is relevant to note that the likelihood of flying-fox camp relocation success decreases with increasing distance to new roost site. Flying-foxes also present a considerable strike-risk to aircraft, minimising the potential for aircraft interaction is an important consideration of flying-fox camp management strategies. In addition, flying-foxes are likely to continue to forage between 12km to 40km from roost sties, therefore likely to continue to utilise the same habitat patches surrounding Mt. Isa for foraging purposes (Midenstein *et al.* 2005; Smith *et al.* 2014)

Specifically, constrained sites that were identified for this assessment were:

- schools and early learning centres,

- parks and ovals,
- Mount Isa Race Club and Rodeo Ground, and
- Mount Isa Airport.

Buffers from all sites were rendered at a scale of 10m intervals. Only one input layer was used to create the constraints model (Figure A-3).

Constraints Model * 100%
= **Constraints Model**

Figure A-3. Constraints model equation.

1.5 Final Suitability Model

Resulting layers from the habitat suitability analysis and the constraints analysis were then overlaid to provide a final model that examines habitat suitability while considering land-use constraints within the locality. The equation used to produce this model is shown in Figure A-4.

(Habitat Suitability Model * 50%) + (Constraints Model) * 50%)
= **Final Suitability Model**

Figure A-4. Final suitability model equation.

All data used for the purposes of this analysis were spatial datasets provided by the Queensland Government – Queensland Spatial Catalogue (QSpatial). All datasets were provided in vector format and converted into raster dataset layers.

For example, some criteria may be measured in terms of their desirability, whereas others may be measured by elevation, land-use or binary presence or absence of vegetation. A criterion, such as elevation, may incorporate a wide range of values (e.g. one to 5000), whereas other criteria may incorporate a small range of values (e.g. one to 10). In order to prevent large values from biasing the results they must be reclassified so that they are portrayed on the same numerical scale as all other criteria. To achieve this, data were normalised into a common number range.

Each cell for each criterion was reclassified into a common preference scale of 1 (most favourable) to 10 (least favourable). The preference values were not only assigned relative to each other within the layer but should have the same meaning between the layers. For example, if a location for one criterion is assigned a preference of 5, it will have the same influence on the phenomenon as a 5 in a second criterion.

A conceptual diagram illustrating this process is shown in Figure A-5.

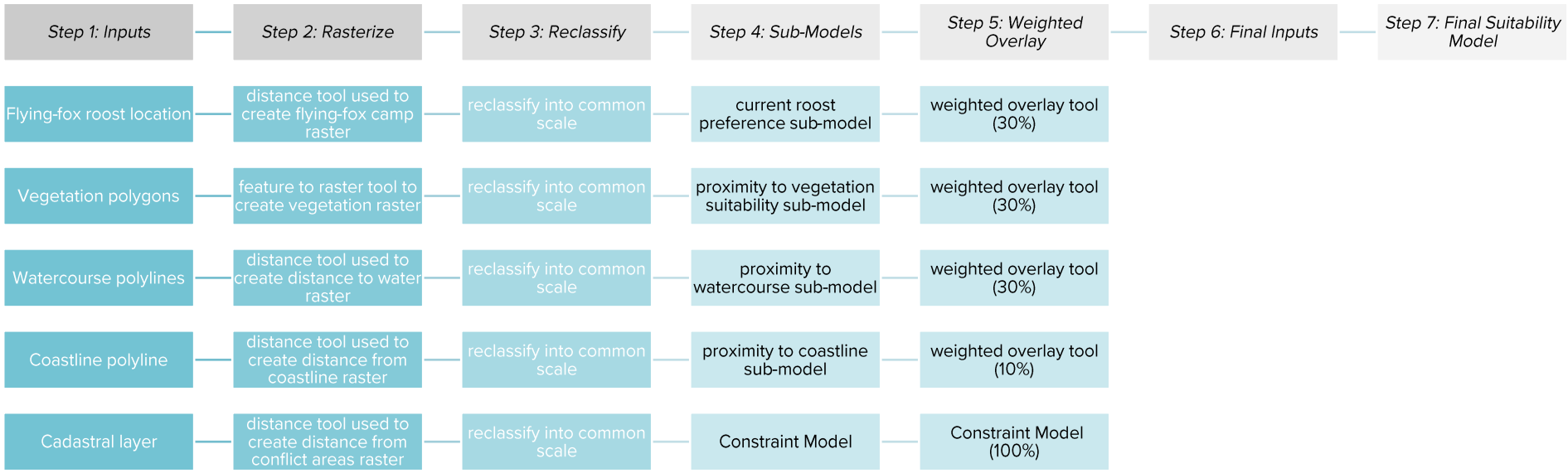


Figure A-5. Suitability analysis and weighted overlay process.

2. Results

2.1 Weighted Overlay Analysis

2.1.1 Habitat Suitability Model

The habitat suitability model (made up of weighted habitat sub-models) is shown in Figure A-6. The model predominantly favoured areas of riparian vegetation following the Leichardt River and its tributaries. These areas included land to the North and North-west of the Mt Isa township as well as more urban areas throughout the township itself. It is important to consider that the model only considers mapped habitat features and does not consider anthropogenic influences on suitability or constraints.

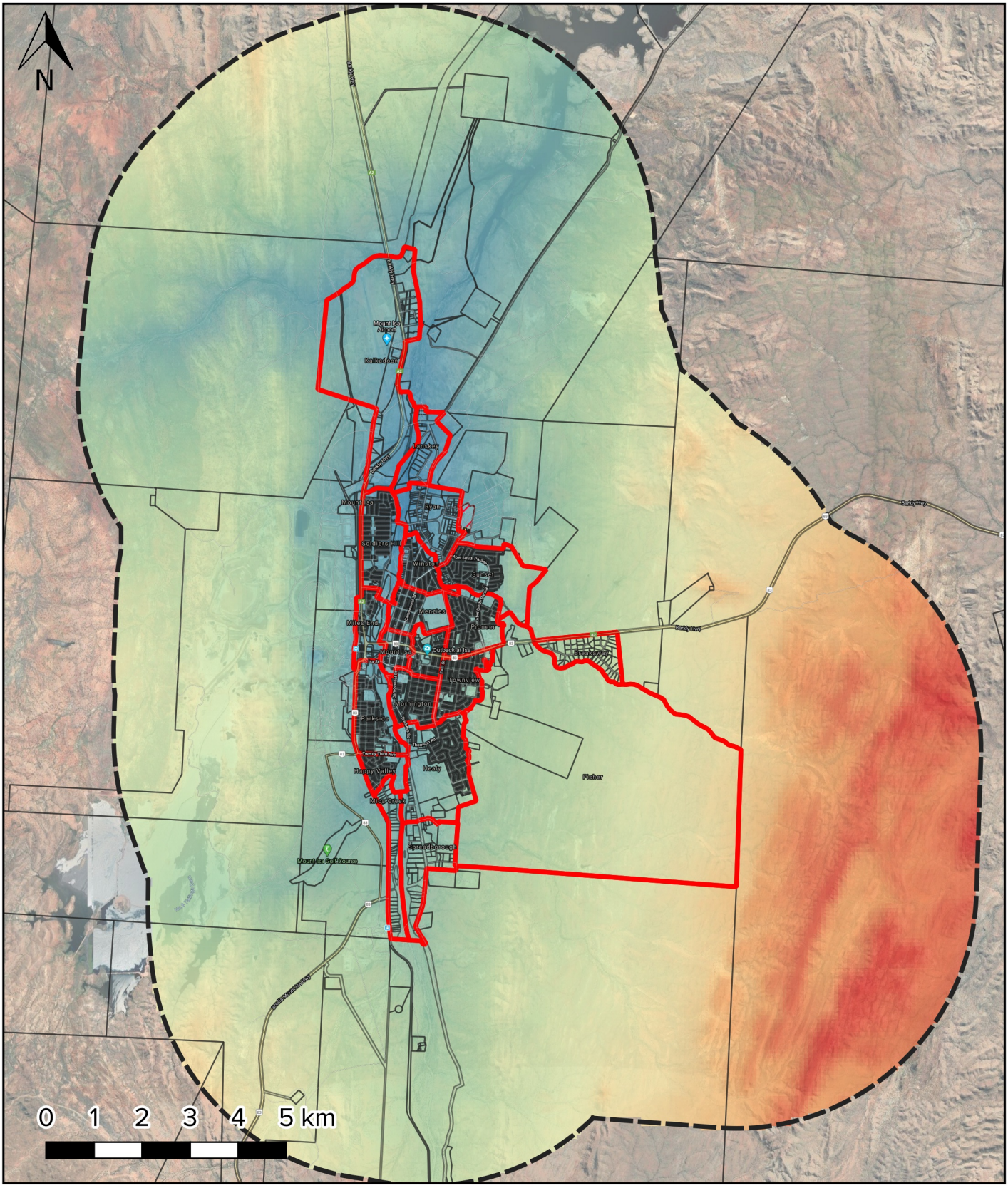
2.1.2 Constraints Model

The constraints model, identifying undesirable areas for flying-fox camp establishment are shown Figure A-7. The two major areas shown to be highly constrained by modelling were the Mt Isa airport to the North, and the township of Mt. Isa which has a number of land-use constraints such as residential and commercial sensitive receptors.

2.1.3 Final Suitability Model

The final suitability model, or weighted overlay analysis consisting of the habitat suitability model and the constraints model are shown in Figure A-8.

The model identified 11802 ha of land that scored 5 or better in terms of suitability. These areas are shown in Figure A-9.



This mapping is to be considered indicative only and all derivations (e.g. vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to Bio Aus where were not independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, ect. should be placed upon this map without independent validation of the information by the user. Naturecall takes no responsibility for any sudsequent error losses etc. that may arise from use of this data without independent verification.

Map Author: AD

Project Manager: AD

Date: 05-06-2020

CRS: EPSG 3854 WGS 84

Scale: 1:120,000

Suitability Level

- 1 (most suitable)
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 (least suitable)

- Study area
- DCDB
- Locality
- Roost
- Cemetary

Figure Name: Figure A-6 - Habitat Suitability Model

Client: Mt Isa City Council

Site: Mt Isa Locality

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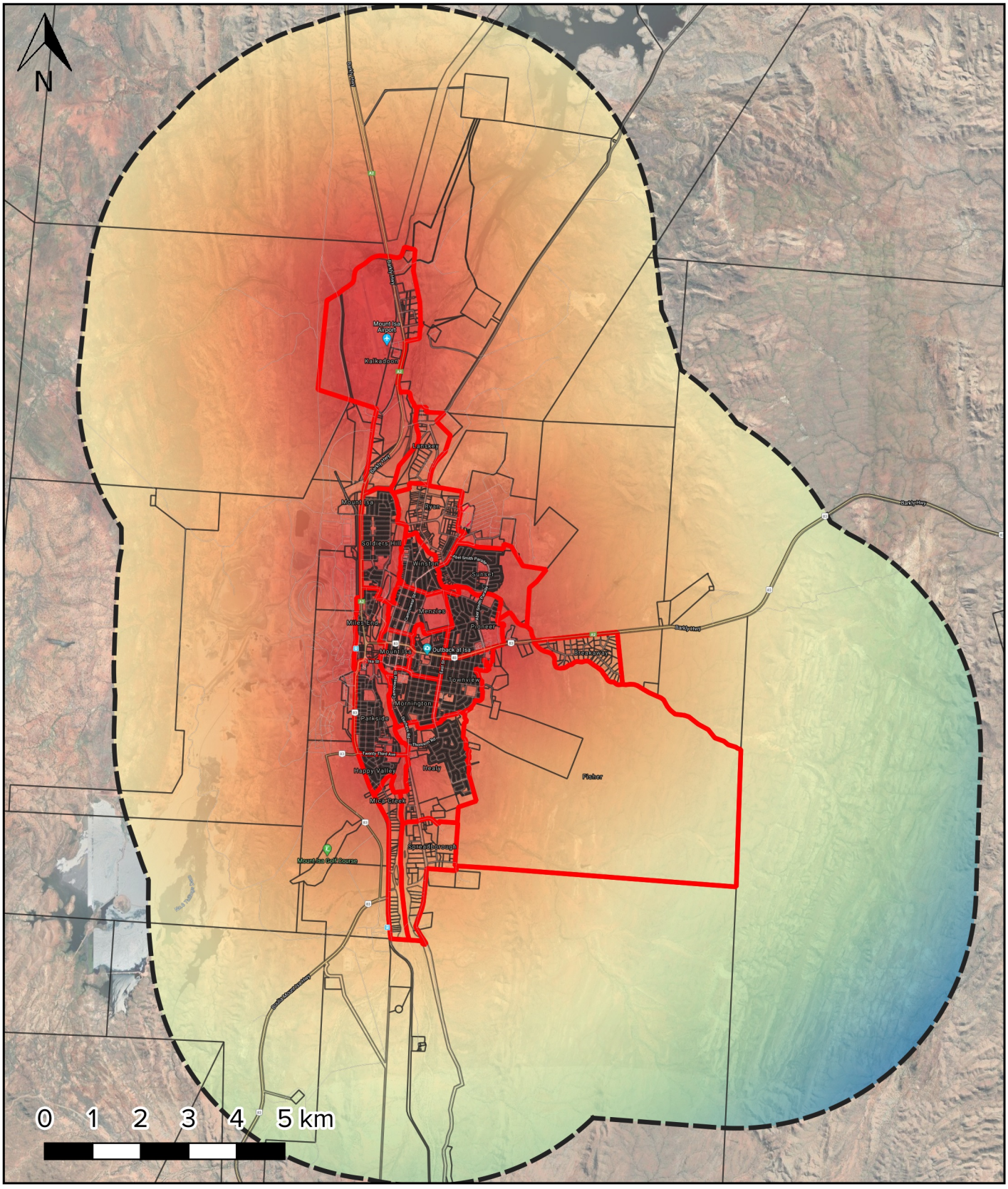
Revision 1



This mapping is to be considered indicative only and all derivations (e.g. vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to Bio Aus where were not independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, ect. should be placed upon this map without independent validation of the information by the user. Naturecall takes no responsibility for any sudsequent error losses etc. that may arise from use of this data without independent verification.

Map Author: AD

Project Manager: AD

Date: 05-06-2020

CRS: EPSG 3854 WGS 84

Scale: 1:120,000

Suitability Level

- 1 (most suitable)
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 (least suitable)

- Study area
- DCDB
- Locality
- Roost
- Cemetary

Figure Name: Figure A-7 -Constraints Model

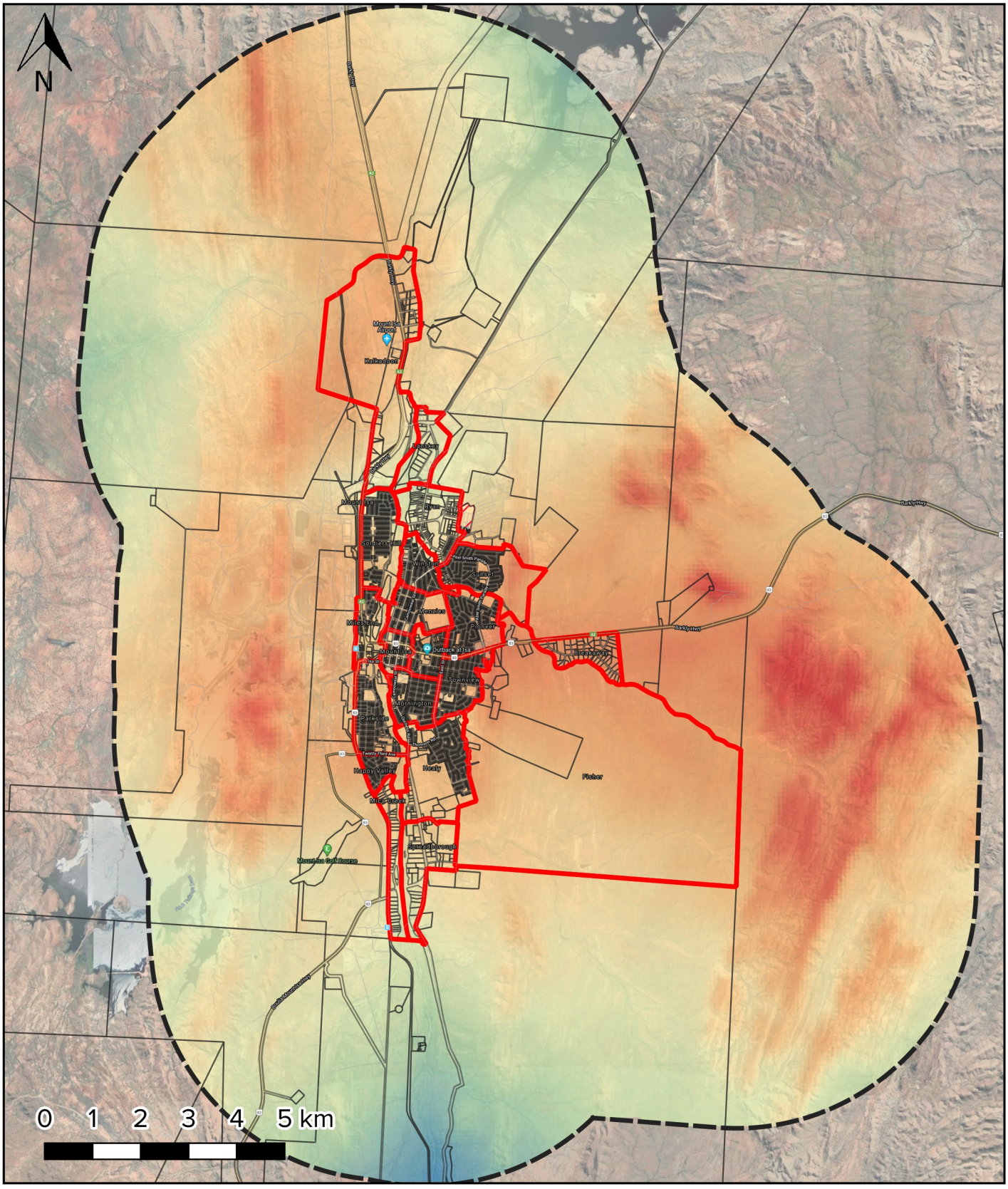
Client: Mt Isa City Council

Site: Mt Isa Locality

Biodiversity AUSTRALIA

Job Number: VP3768

Revision 1



This mapping is to be considered indicative only and all derivations (e.g. vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to Bio Aus where were not independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, ect. should be placed upon this map without independent validation of the information by the user. Naturecall takes no responsibility for any sudsequent error losses etc. that may arise from use of this data without independent verification.

Map Author:	AD
Project Manager:	AD
Date:	05-06-2020
CRS:	EPSG 3854 WGS 84
Scale:	1:120,000

Suitability Level

- 1 (most suitable)
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 (least suitable)

- Study area
- DCDB
- Locality
- Roost
- Cemetary

Figure Name:
Figure A-8 - Final Model

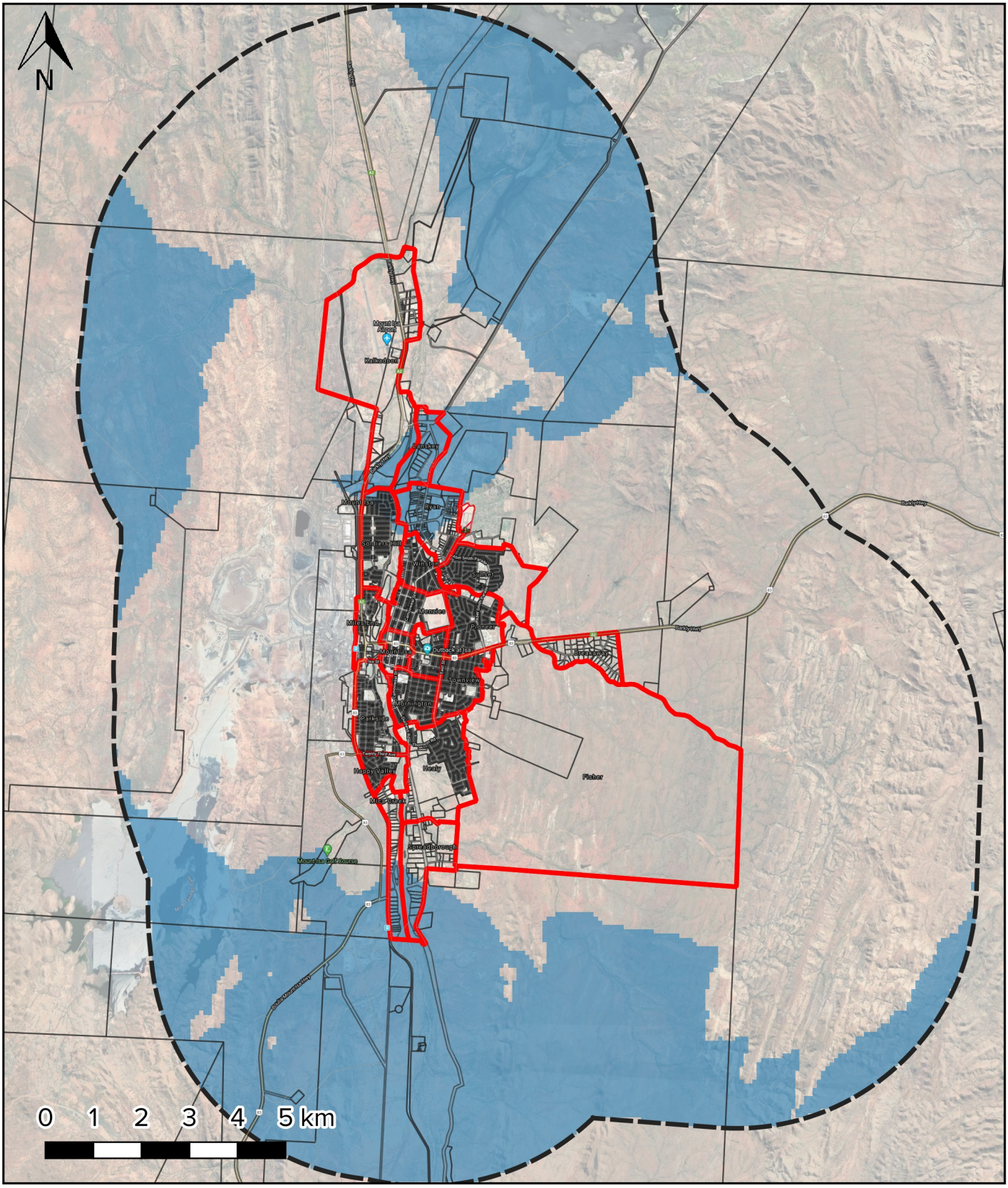
Client:
Mt Isa City Council

Site:
Mt Isa Locality

Biodiversity AUSTRALIA

Job Number: VP3768

Revision 1



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Map Author:	AD
Project Manager:	AD
Date:	29-06-2020
CRS:	EPSG 3854 WGS 84
Scale:	1:120,000

Suitability Level

- High Suitability Areas
- Study area
- DCDB
- Locality
- Roost
- Cemetary

Figure Name:
Figure A-9 -High-suitability Areas

Client:
Mt Isa City Council

Site:
Mt Isa Locality

Biodiversity AUSTRALIA

Job Number:	VP3768
Revision	1

Appendix B

Field Verification Surveys

Biodiversity Australia Pty Ltd
ABN 81 127 154 787

1. Field Verification Survey Methodology

1.1 Field Verification Survey

1.1.1 Site Selection

There was 11802 ha of land within 5km of Mount Isa that was identified as having potentially suitable habitat characteristics. Sites with existing mature vegetation (ideally including species preferred by flying-foes), are preferred as alternative roost sites because they require fewer establishment and maintenance costs associated with making them desirable for use by flying-foxes.

Because of the complex habitat needs of flying-foxes, only high-value areas (scoring 5 or better) that contain patches of remnant vegetation were subject to field verification surveys. Two sites without remnant vegetation, including an indicative historical roost site (Tony White Oval) and DES' preferred site (Appendix C), were also surveyed.

Flying-fox roost relocation is most successful when the alternative roost site is within close proximity of the original roost. There are two patches of remnant vegetation within 3km of the current roost site that are also within a highly suitable area (scoring 5 or better according to the habitat model shown in Appendix A). The closest of the two is located 1200 m west of the current roost site. While this site is located near the current roost; it is located directly under the flight path of Mount Isa Airport (a constraining land-use). Relocation of the camp to this area is likely to be hazardous for aircraft that transit to and from Mount Isa.

There is another patch of remnant vegetation 2.1km northeast of the current roost site; however, this would place the flying-fox roost considerably closer to the Mount Isa Airport.

Remnant vegetation to the east of the current roost site was not considered because it does contain a number of the required habitat characteristics preferred by flying-foxes. It is not located within a low-laying area, is not within close proximity of a watercourse or waterbody, and does not contain vegetation species or canopy structure preferred by flying-foxes.

1.1.2 Data Collection

Field verification surveys at selected sites were undertaken on the 29th and 30th of April and the 1st of May 2020. Data collected during these surveys corresponded with the criteria used in the weighted overlay analysis, including:

- collation of vegetation data,
- verification of presence of important land features (such as waterbodies),
- likelihood of future human-wildlife conflict,
- presence of conservation value areas, and
- anecdotal knowledge of historical use by flying-foxes (where possible).

A summarised description of data collection structure is shown in Table B-1.

1.2 Vegetation

1.2.1 Dominant Species

Dominant canopy and sub-canopy vegetation were identified to the species level within appropriate area s of interest. Vegetation identification was undertaken using four quaternary plots where the dominant canopy, sub-canopy and ground layer were recorded.

1.2.2 Canopy Cover

Canopy cover was estimated using 10 random point samples taken in each area of interest (e.g. those identified during pre-site assessment modelling).

1.2.3 Diameter at Breast Height

Average diameter at breast height (DBH) was estimated at each site by taking measurements from 10 random canopy trees.

1.2.4 Median Tree Height

Median tree height for each site was taken by measuring heights of three randomly selected canopy tree. Height was measured using a clinometer.

1.3 Biodiversity Value

1.3.1 Prior Habitat Use by Flying-foxes

Prior use of land parcels by flying-foxes was also discussed with council or land managers where feasible. Conversations were not always possible in some survey areas due to limited public land use.

1.3.2 Other Species Present

Other species utilising each site were recorded opportunistically throughout surveys. Stationary counts were also conducted at each site to assess presence and absence of avian species. Presence of other terrestrial fauna by searching each site for evidence of habitat use (e.g. scratch marks, dreys, scat, etc.).

1.4 Significant Land Features

1.4.1 Watercourse & Wetland Presence

Presence of state-mapped watercourses was confirmed during site verification surveys. Evidence of ephemeral waterbodies was also noted, where present. Anthropogenic water bodies that were not identified during the desktop assessment were also noted.

1.5 Conservation Values

1.5.1 Threatened Regional Ecosystem Presence

Presence of threatened regional ecosystems (Res) was verified by comparing vegetation species identified on site against RE database descriptions.

1.6 Other features

Current land-use was verified against Queensland cadastral data. Land-use were grouped into the following categories: anthropogenic (e.g; residential or commercial), recreational (e.g; parkland) or agricultural (e.g; livestock grazing or other farmland). Presence of existing trails or roads were visually identified and level of use noted.

Table B-1. Field verification surveys – data collection structure.

Feature	Data collected
Vegetation	
Dominant species	Record of dominant canopy species present at each site.
Canopy Cover (%)	Random meander through site - average canopy cover recorded at 10 random locations approximately 45m spacing between each sample.
Diameter at breast height (DBH) (m)	Measurements of 10 canopy trees undertaken randomly at approximately 30m spacing between each sample.
Average tree height (m)	Average tree height of the site determined by approximating the height of three random trees using a clinometer.
Structure	Age classes and summary of canopy and sub-canopy structure recorded for each site following consensus with project ecologists.
Biodiversity value	
Use by flying-foxes	Anecdotal evidence of site use by flying-fox was noted, as was any additional evidence of flying-fox use (i.e. observation of roosts etc)
Other species present	Record of all other fauna species observed during the survey
Significant land features	
Proximity to watercourse	Identification of watercourses within the site, both anthropogenic and natural.
Wetland presence	Verification of permanent/ephemeral wetlands within the site.
Conservation values	
Threatened Regional Ecosystems	Identified by regional ecosystem mapping on desktop, confirmed following vegetation identification on site.
Other Features	
Existing trails	Identification of existing walking/bike trails on site that are used by people.
Current land use	Identification of current land use (e.g. farming, public reserve etc.)
Anthropogenic activity	Identification of features that are likely to increase anthropogenic activity on site (i.e. playground etc).
General notes	Any additional information that would assist in determining the suitability of the site for flying-foxes.

2. Results

All features considered in the weighted overlay analysis were verified at each site. Vegetation was surveyed at quaternary sites using the methods described by Nelder *et al.* (2019).

Summaries of data collected at DES' preferred site (Site 1) and nearby remnant vegetation (1.2 km west; RE 1.3.7a/1.3.7b/1.3.6a – riverine wetland) (Site 2) are presented in Tables B-1 and B-2.

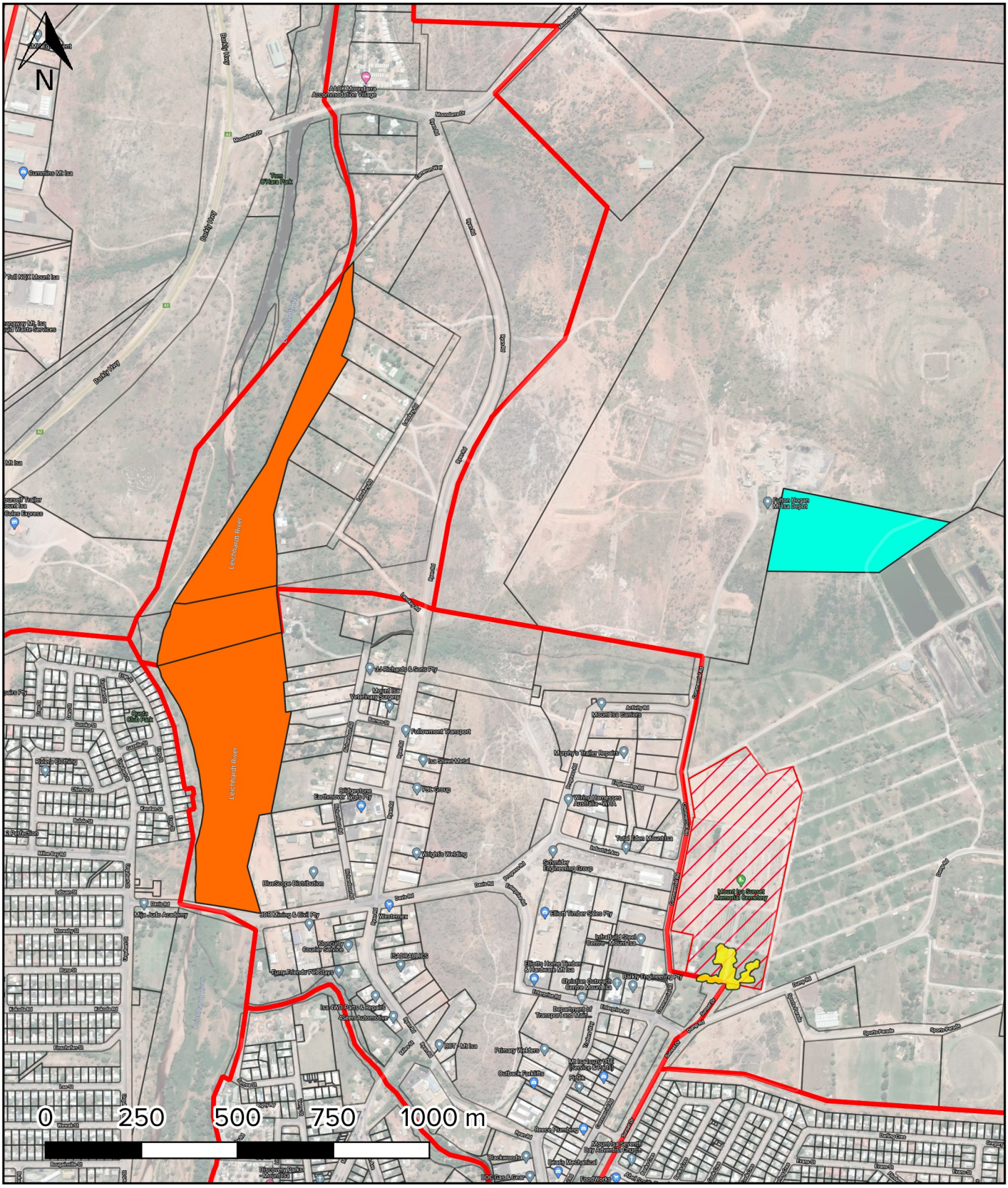
Photos showing indicative vegetation at each site are provided in Photo Plate 1 to 5.

Site 1 was the most suitable given its proximity to the current roost, distance from sensitive receptors, and proximity to a constant source of water; however, this Site does not currently contain suitable roosting vegetation and will require considerable revegetation works. Use of this site will require a considerable financial investment if it is eventually be used as a roost site.

Site 2 was somewhat suitable, but use of this area by flying-foxes will not be looked upon favourably by the Mount Isa Airport and nearby residents. Further, flying-foxes may be averse to the inconsistent water availability in the area. However, this site contains an abundance of mature vegetation (*Eucalyptus camaldulensis* woodland) that is immediately suitable for use by flying-foxes. There are numerous patches of dense vegetation throughout this area.

The Tony White Oval was surveyed; however, it is not considered appropriate given its location from the current roost site and proximity to sensitive receptors (e.g. residential areas).

The locations of the two potential alternative roost sites are shown in Figure B-1.



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Map Author: AD

Project Manager: AD

Date: 29-06-2020

CRS: EPSG 3854 WGS 84

Scale: 1:15,000

Legend

- Site 1
- Site 2 (indicative extent)
- DCDB
- Locality
- Current Roost
- Cemetary

Figure Name:
Figure B-1 - Potential Roost SItes

Client:
Mt Isa City Council

Site:
Mt Isa Locality

Biodiversity AUSTRALIA

Job Number: VP3768

Revision 1

Table B-2. Field verification survey results -Site 1 (DES preferred site).

Survey Feature	Results
Dominant flora species (including canopy, understory, & groundcover)	Part of the site is undergoing revegetation with scattered eucalypt species. Canopy inside the revegetation area is dominated exclusively by Senegal mahogany (*Khaya senegalensis)* 70% of which were dead. The surrounding land parcel dominated by *Acacia spp.*
Average canopy cover (%)	Varying, 20% within the revegetation site, 0% outside.
Average DBH (m)	Average DBH 10 – 20 cm
Average tree height (m)	5 m within the revegetation area, 1 m outside.
Flying-fox camp preference	No anecdotal evidence of flying-fox use.
Proximity to watercourse	Site approximately 1 km from the Leichhardt River, however, is directly adjacent to Mt. Isa water treatment plant.
Wetland presence	None present. Irrigation system present although may not be functioning.
Regional ecosystems present	None.
Existing trails	Green Corps site with one existing trail.
Current land use	Revegetation site
Anthropogenic activity	Limited anthropogenic activity apart from adjacent Water Treatment Plant (WTP).
Outcome of inspection	This site may be suitable as an alternative roost site given the site's proximity to a water source and distance from sensitive receptors. Use of this site as an alternative roost site will require complete revegetation of the site, including allocation of considerable resources and funding.

Photo Plate 1. Site 1 – Quaternary Plot 1.

Photo Plate 2. Site 1 – Quaternary Plot 2.

Photo Plate 3. Site 1 – Quaternary Plot 3.

Table B-3. Field verification survey results -Site 2

Survey Feature	Results
Dominant flora species (including canopy, understory, & groundcover)	Open woodland community with canopy dominated by *Eucalyptus camaldulensis* with *Melaleuca bracteata.* Groundcover dominated by buffel grass (*Cenchrus ciliaris*, some scattered Alexander Palms (*Archontophoenix alexandrae*) present.
Average canopy cover (%)	Varying, open (0%) in areas up to 40% in others.
Average DBH (m)	Average DBH ~40 cm
Average tree height (m)	10m
Flying-fox camp preference	No known historic use of site.
Proximity to watercourse	Site is bounded by the Leichhardt River
Wetland presence	No wetland; however, site is prone to flooding.
Regional ecosystems present	1.3.7a/1.3.7b/1.3.6a
Existing trails	Access trail possible via vehicle. Potential for this to be used maintained as walking track.
Current land use	Rural. Cattle fence present. Adjacent residential and industrial areas
Anthropogenic activity	No obvious regular use. Some vehicle tracks and litter.
Outcome of inspection	The natural vegetation of this site means that it could be used as an alternative roosting site. However, the site is subject to flooding which may be unattractive to flying-foxes. The site is close to residential areas which may present an issue.

Photo Plate 4.Site 2 – Quaternary Plot 1.

Photo Plate 5. Site 2 -Quaternary Plot 2.

Appendix C

Mount Isa City Council Alternate Roost Site Plan

LOCATION OF WORKS

TREATMENT PLANT

COMMERCIAL ROAD

INDUSTRIAL ROAD

SUNSET LAWN CEMETARY

JESSOP ROAD

ENTERPRISE ROAD

LOCALITY PLAN
NTS

EXISTING PROPERTY BOUNDARY

TREATMENT PLANT

250m

EXISTING ACCESS TRACK

EXISTING PROPERTY BOUNDARY

TOTAL AREA = 65182 m2
(6.518 Ha)

262m

PROPOSED SITE BOUNDARY - TYPICAL

217m

EXISTING ACCESS ROAD

EXISTING PROPERTY BOUNDARY

EXISTING SITE PLAN
1:1000

PRELIMINARY ONLY
NOT FOR CONSTRUCTION

REFERENCE DOCUMENTS		REVISIONS							
		1	SCB	PMAPIYE	ENV. SER.		ISSUED AS CONCEPT		4/12/19
DRG NO	TITLE	REV	DRAWN	CHECK	CLIENT	APP	DESCRIPTION		DATE

MOUNT ISA CITY COUNCIL
23 West Street MOUNT ISA QLD 4825
PO Box 815 MOUNT ISA QLD 4825
T (07) 4747 3200
E city@mountisa.qld.gov.au
ABN 48 761 425 059

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SCALE
AS SHOWN
UNITS
MILLIMETERS
PROJECTION
3RD ANGLE
DO NOT SCALE
SHEET SIZE A1

DRAWINGS DESCRIPTION
FACILITIES & LAND - GENERAL RESERVES
PROPOSED ALTERNATIVE ROOST SITE
LOCALITY PLAN & EXISTING SITE PLAN

DRAWING NUMBER	PROJECT NUMBER	REV.
2500-D1-0004	201911291330	1

\\miccsnap01\Hdrive\ENGINEERING SERVICES_Tech Services\01_Projects\01_Active\201911291330_EH_Concept Plan for Proposed Alternative Roost Site\01_Design\Roost Site-CONCEPT PLAN.dwg, 5/12/2019 10:07:24 AM

EXISTING PROPERTY BOUNDARY
- TYPICAL

PROPOSED NEW IRRIGATED SPRINKLER INSTALLATION
- TYPICAL

N

EXISTING
ACCESS
ROAD

PROPOSED NEW TREE PLANTINGS
- TYPICAL

PROPOSED NEW IRRIGATED SPRINKLER INSTALLATION
- TYPICAL

PROPOSED PROPERTY BOUNDARY
- TYPICAL

PROPOSED NEW GRASSED AREA

EXISTING PROPERTY BOUNDARY

PROPOSED NEW TREE
PLANTINGS - TYPICAL

EXISTING TREES
- TYPICAL

EXISTING ACCESS TRACK

REFERENCE DOCUMENTS		REVISIONS							
		1	SCB	PMAPIYE	ENV. SER.		ISSUED AS CONCEPT	4/12/19	
DRG NO	TITLE	REV	DRAWN	CHECK	CLIENT	APP	DESCRIPTION	DATE	

PRELIMINARY ONLY
NOT FOR CONSTRUCTION

MOUNT ISA CITY COUNCIL
23 West Street MOUNT ISA QLD 4825
PO Box 815 MOUNT ISA QLD 4825
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E city@mountisa.qld.gov.au
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Any services shown on this drawing are approx. only, based on or containing data provided by The State of Queensland (DNRM) (2018). In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data including accuracy, reliability, completeness, currency or suitability) and accepts no liability (inc. without limitation, liability in negligence) for any loss, damage or costs (inc. consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

SCALE 1 : 500
UNITS MILLIMETERS
PROJECTION 3RD ANGLE
SHEET SIZE A1
DO NOT SCALE

DRAWING DESCRIPTION
FACILITIES & LAND - GENERAL RESERVES
PROPOSED ALTERNATIVE ROOST SITE
CONCEPT PLAN

DRAWING NUMBER	PROJECT NUMBER	REV.
2500-D1-0005	201911291330	1

\\miccsnap01\Hdrive\ENGINEERING SERVICES_Tech Services\01_Projects\01_Active\201911291330_Et_Concept Plan for Proposed Alternative Roost Site\01_Design\Roost Site-CONCEPT PLAN.dwg, 5/12/2019 10:06:23 AM

Appendix D

Desktop Searches

Biodiversity Australia Pty Ltd
ABN 81 127 154 787

Australian Government
Department of the Environment and Energy

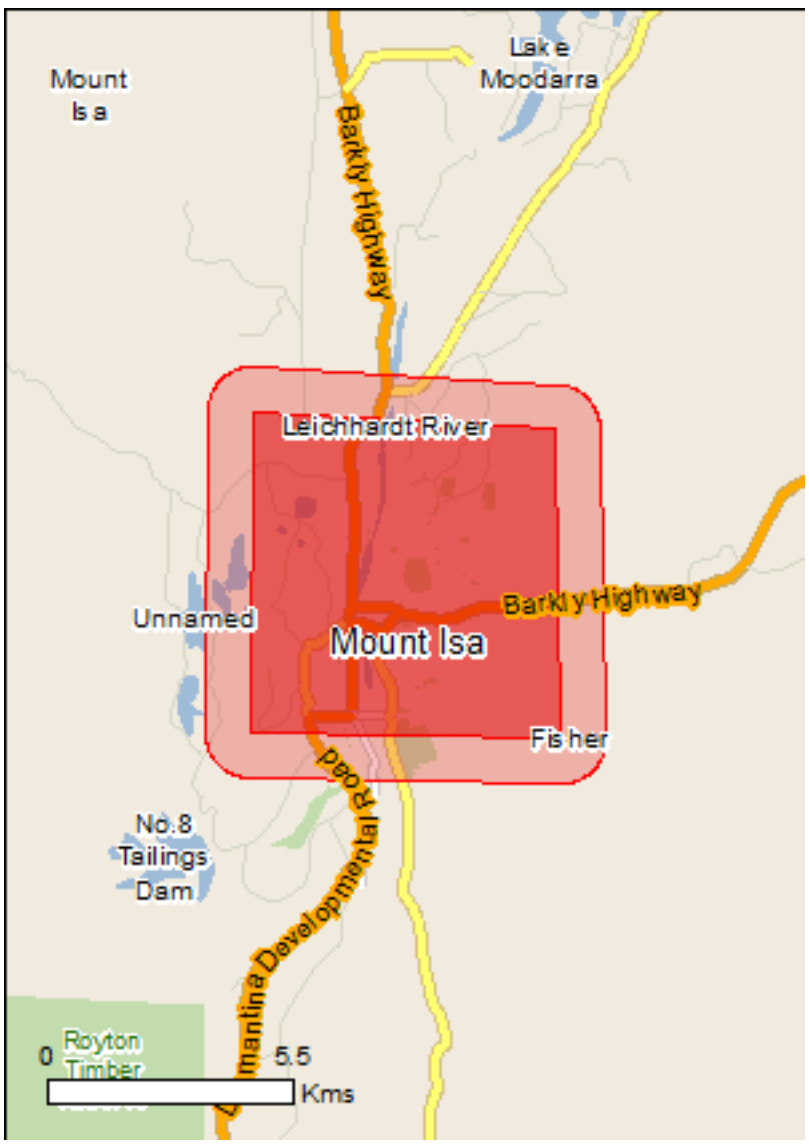
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

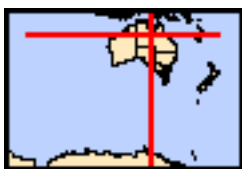
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 02/06/20 12:37:33



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	12
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	23
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Amytornis dorotheae Carpentarian Grasswren [558]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Elseya lavarackorum Gulf Snapping Turtle [67197]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Defence - MT ISA TRAINING DEPOT

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Reptiles		

Name	Threatened	Type of Presence
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-20.68732 139.467543,-20.68716 139.467543,-20.690532 139.528311,-20.748815 139.529512,-20.747691 139.467028,-20.68732 139.467543

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Selected Area
Species: All
Type: All
Status: Rare and threatened species
Records: All
Area: Mount Isa City Council
Email: lachlan.webster@biodiversityaust.com.au
Date submitted: Tuesday 02 Jun 2020 12:34:14
Date extracted: Tuesday 02 Jun 2020 12:40:02

The number of records retrieved = 31

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

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Feedback about Wildlife Online should be emailed to wildlife.online@science.dsitia.qld.gov.au

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Accipitridae	*Erythrotriorchis radiatus*	red goshawk		E	V	4
animals	birds	Cacatuidae	*Lophochroa leadbeateri*	Major Mitchell's cockatoo		V		1
animals	birds	Charadriidae	*Charadrius mongolus*	lesser sand plover		E	E	4
animals	birds	Charadriidae	*Charadrius leschenaultii*	greater sand plover		V	V	1
animals	birds	Estrildidae	*Erythrura gouldiae*	Gouldian finch		E	E	8
animals	birds	Falconidae	*Falco hypoleucos*	grey falcon		V		14
animals	birds	Maluridae	*Malurus coronatus*	purple-crowned fairy-wren		V		81
animals	birds	Maluridae	*Amytornis dorotheae*	Carpentarian grasswren		E	E	100/2
animals	birds	Meliphagidae	*Grantiella picta*	painted honeyeater		V	V	9
animals	birds	Meliphagidae	*Epthianura crocea*	yellow chat		V		3
animals	birds	Meliphagidae	*Epthianura crocea crocea*	yellow chat (gulf)		V		3
animals	birds	Psittacidae	*Pezoporus occidentalis*	night parrot		E	E	1
animals	birds	Rostratulidae	*Rostratula australis*	Australian painted snipe		E	E	14
animals	birds	Scolopacidae	*Calidris tenuirostris*	great knot		E	CE	1
animals	birds	Scolopacidae	*Calidris ferruginea*	curlew sandpiper		E	CE	23
animals	birds	Scolopacidae	*Numenius madagascariensis*	eastern curlew		E	CE	2
animals	birds	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit		V	V	4
animals	birds	Tytonidae	*Tyto novaehollandiae kimberli*	masked owl (northern subspecies)		V	V	1
animals	mammals	Hipposideridae	*Hipposideros stenotis*	northern leaf-nosed bat		V		4
animals	mammals	Hipposideridae	*Rhinonicteris aurantia*	orange leaf-nosed bat		V		9
animals	mammals	Macropodidae	*Petrogale purpureicollis*	purple-necked rock-wallaby		V		38/1
animals	mammals	Megadermatidae	*Macroderma gigas*	ghost bat		E	V	22
animals	reptiles	Chelidae	*Emydura subglobosa worrelli*	diamond head turtle		NT		10/1
animals	reptiles	Chelidae	*Elseya lavarackorum*	Gulf snapping turtle		V	E	15/1
animals	reptiles	Elapidae	*Acanthophis hawkei*	plains death adder		V	V	2
plants	land plants	Amaranthaceae	*Ptilotus maconochiei*			NT		12/12
plants	land plants	Araliaceae	*Trachymene glandulosa*			NT		1/1
plants	land plants	Convolvulaceae	*Ipomoea antonschmidii*			NT		9/9
plants	land plants	Cyperaceae	*Fimbristylis distincta*			V		1/1
plants	land plants	Myrtaceae	*Eucalyptus nudicaulis*			V		9/9
plants	land plants	Solanaceae	*Solanum carduiforme*			V		2/2

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.* The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.