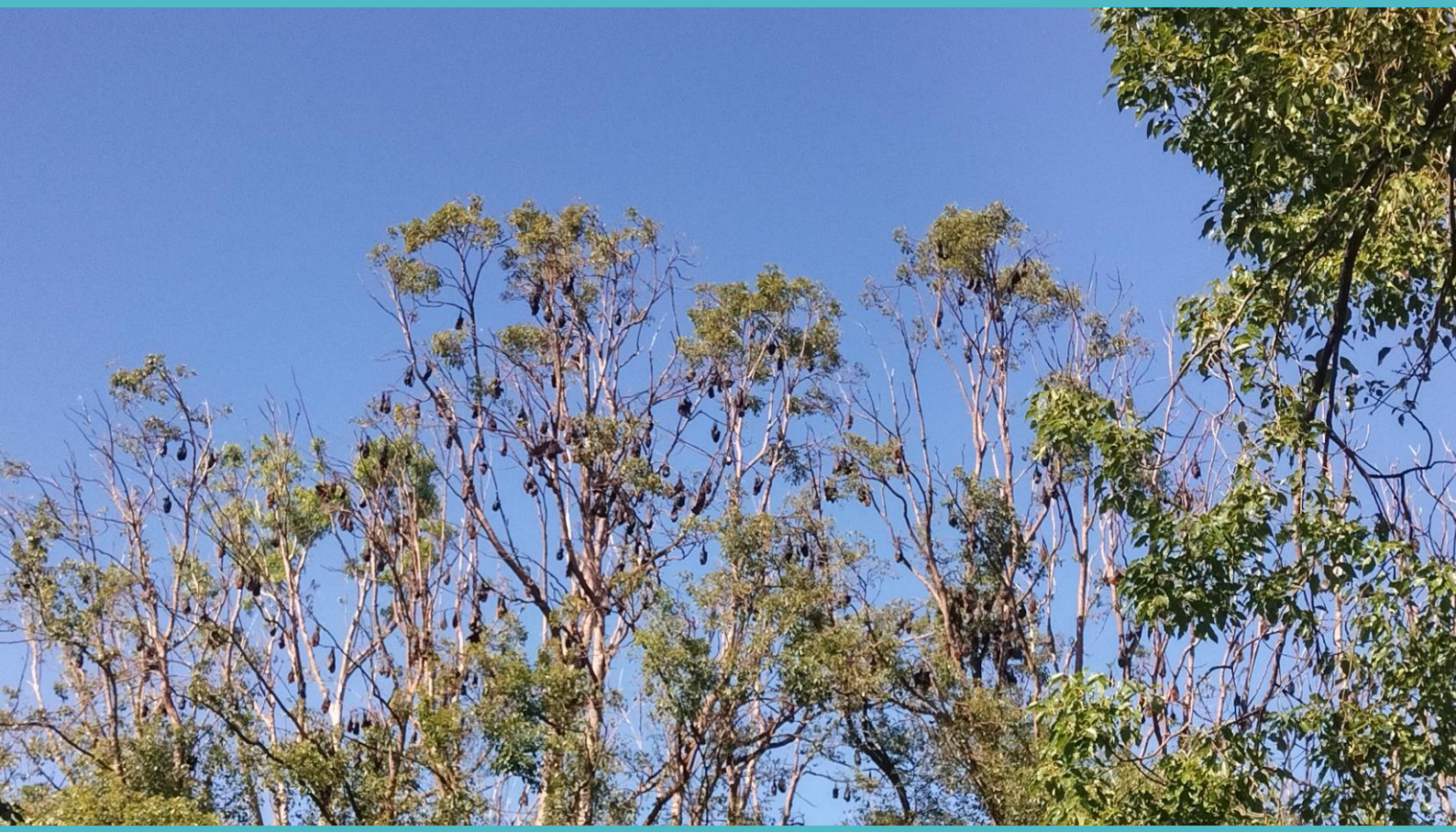
Flying Fox Roost Management Plan

Taromeo Creek
April 2024



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Cover Photo: Grey headed and Black Flying Foxes.

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Abbreviations & Acronyms

Animals Regulation	Nature Conservation (Animals) Regulation 2020 (Qld)
DAWE	Department of Agriculture, Water and the Environment (Cth)
DES	Department of Environment and Science (Qld)
EPBC Act/EPBC	*Environmental Protection Biodiversity Conservation Act 1999 (*Cth*)*
Fisheries Act	*Fisheries Act 1994* (Qld)
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NC Act	*Nature Conservation Act 1992 (*Qld*)*
Offsets Act	*Environmental Offsets Act 2014* (Qld)
Offsets Regulation	Offsets Regulation 2014 (Qld)
Planning Act	*Planning Act 2016* (Qld)
Planning Regulation	Planning Regulation 2017 (Qld)
Plants Regulation	Nature Conservation (Plants) Regulation 2020 (Qld)
RE	Regional Ecosystem
SARA	State Assessment and Referral Agency
SPP	State Planning Policy (Qld)
Vegetation Regulation	Vegetation Management Regulation 2012 (Qld)
VM Act	*Vegetation Management Act 1999* (Qld)
LGA	Local Government Area
GHFF	Grey Headed Flying Fox
BFF	Black Flying Fox
LRFF	Little Red Flying Fox

Definitions

Term	**Definition**
Conservation significant	Collective term for species listed as Special Least Concern (SL), Near Threatened (NT), Vulnerable (V), Endangered (E), Critically Endangered (CR) under the *Nature Conservation Act 1992* or species listed as Vulnerable (V), Endangered (E), Critically Endangered (CE), Migratory (Mi), Marine (Ma) under the *Environment Protection and Biodiversity Conservation Act 1999.*
Regional Ecosystem (RE)	A vegetation community, within a bioregion, that is consistently associated with a particular combination of geology, landform and soil (Young et al. 1999). REs may be classified under schedules 1 to 3 of the Vegetation Management Regulation as 'Endangered', 'Of Concern' or 'Least Concern'. Refer to VM Act conservation status for meaning of 'Endangered', 'Of Concern' and 'Least Concern' under the Act. REs status in this report refers to the RE status under the Act.
Significant impact	In accordance with the EPBC Act, a significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant residual

	impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.
Significant residual impact	As per Section 8 of the Environmental Offsets Act 2014, a significant residual impact is generally an adverse impact, whether direct or indirect, of a prescribed activity on all or part of a prescribed environmental matter (MSES) that: a) remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site avoidance and mitigation measures for the prescribed activity; and b) is, or will or is likely to be, significant.
Threatened species	Critically Endangered, Endangered, Vulnerable species under the *Environment Protection and Biodiversity Conservation Act 1999* and Critically Endangered, Endangered, Vulnerable or Near Threatened under the *Nature Conservation Act 1992*

Contents

1 Introduction

Flying foxes are social animals that migrate through most of Australia in search of food sources. They like to roost near the coast or along watercourses. Unfortunately, most towns and grazing lands are also built around water sources which has led to traditional habitats having been destroyed for development and agriculture. This has led to a decline in flying-fox populations and an increase in flying-foxes living in urban areas. As more habitat is destroyed or houses are built closer to roosts an increase in conflict occurs. Most people object to living near flying fox roosts as they can be noisy in large groups, smelly due to scent marking behaviour and their dropping can cover outdoor furniture, cars, and roofs. Additionally, bats in general have a negative perception and some are fearful of diseases.

Recently South Burnett Regional Council has increased complaints at the Taromeo Creek roost. This roost is in the town of Blackbutt, Qld and is within 20 m of houses. Redleaf has undertaken two roost surveys over 2021-2023 and despite some vegetation clearing at the original roost flying foxes have continued roosting in Taromeo creek and have started using additional adjacent trees that were not a part of the original roost.

This flying fox management plan aims to provide South Burnett Regional Council with the knowledge and tools to successfully manage flying fox roosts and reduce human-wildlife conflict.

1.1 Site location and description

The roost is mapped under the Queensland Government's Urban Flying-Fox Management Area (UFFMA) and as such Local Governments have an "as-of-right" authority to manage this flying fox roost. The roost is not mapped under the national important flying-fox camps but is registered, and counts are recorded for 2021 and 2022. See Appendix A for previous counts and map.

The roost is located within a vegetated section of Taromeo Creek, to the south of the D'Aguilar Highway in Blackbutt and is situated close to the town centre. The main roost also borders 10 residential properties.

Secondary roost/resting trees are currently being utilised approximately 200m from the original roost, see Figure 1.

Three species of Flying Fox have been previously recorded at this roost from a past survey by Redleaf Environmental and from surveys by DCCEEW. Recorded species are the Little Red flying fox (*Pteropus scapulatus*), the Black flying fox (*Pteropus alecto*), and the Grey-headed flying fox (*Pteropus poliocephalus*). The latter species is listed as Vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

The flying-fox camp location and adjacent residential properties can be seen in Figure 1.

Legend

- Main roost
- Possible movement zone (600m)
- Secondary roosting trees
- Sensitive locations
- DCDB

CRS: GDA 1994 MGA Zone 56
Projection: Transverse Mercator

0 100 200 m

Scale (A4)

N

Figure 1: Roosting sites, with possible relocation sites and sensitive areas.
Blackbutt, QLD
Prepared for Southern Burnett Regional Council

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2 Flying-fox ecology

2.1 Species

There are five [5] species of flying fox in Australia with three occurring in the South Burnett Regional Council LGA. These species and their status under the EPBC and NC Act are listed below in Table 1.

Table 1 Flying foxes present in the Taromeo Creek roost

Scientific name	Common name	Status+	
		Q	A
Pteropus poliocephalus	Grey-headed flying-fox	LC	V
Pteropus alecto	Black flying-fox	LC	-
Pteropus scapulatus	Little red flying-fox	LC	-

+ Status: **Q** - Indicates the Queensland conservation status of each taxon under the Nature Conservation Act 1992. The codes are LC (Least Concern), Near Threatened (NT), Vulnerable (V), Endangered (E), Critically Endangered (CR).
A - Indicates the Australian conservation status of each taxon under the Environment Protection and Biodiversity Conservation Act 1999. The codes are Vulnerable (V), Endangered (E), Critically Endangered (CE).

2.1.1 Grey-headed flying-fox (*Pteropus poliocephalus*)

Description

Grey-headed flying-foxes are the only flying-fox with fur that extends to the ankles (other flying foxes have fur to the knees) as well as a full encircled orange/brown collar (Hall 1987). The head and belly are grey, and they weigh between 600-1000g (Churchill 2008)

Distribution

This species occurs from Rockhampton in Queensland to Melbourne in Victoria. This distribution is not used at the same time as flying-foxes are highly nomadic with local movement patterns relating to availability of flowering tree species (Eby 2000).

Habitat and feeding

Flying foxes typically have separate feeding and roosting sites. They inhabitant rainforests, open forest, open and closed woodlands, melaleuca swamps and banksia woodlands. Additionally, they will feed on commercial food crops. It is thought that the reason there is permanent camps in large cities is the abundance and variety of fruit trees that are giving the species year-round access to food in one location.

Life expectancy

This species has a mean life expectancy of 7.1 ± 3.9 years in the wild with their maximum life span being 20+ years (Tidemann & Nelson 2011).

2.1.2 Black flying fox (*Pteropus alecto)*

Description

Black flying foxes are black all over or have a small half collar of reddish fur on the back of their neck. Their fur only extends to the knees. They are a large flying fox weighing between 500-1000g (Churchill 2008).

Distribution

This species occurs in tropical and subtropical habitats around the northern coast of Australia down to northern New South Wales (DCCEEW 2021). This species is also migratory and are often found dispersed in camps with grey-headed flying-foxes. Additionally, their distribution has shifted south, and they are occupying larger areas of grey-headed flying-fox habitat (Webb & Tidemann 1995). It has been noted that since this shift more grey-headed flying-foxes are being displaced and moving further inland (Eby 2003, Hall 2002a).

Habitat and feeding

This species roosts in mangroves islands or in estuaries, paperbark forests, eucalypt forests and rainforests (Churchill 2008). They are often seen dispersed in camp with grey headed flying foxes. This species has the same diet as the grey-headed flying-fox.

Life expectancy

Little is known about this species mean life expectancy in the wild, though it has been recorded up to at least 17 years in captivity (Churchill 2008).

2.1.3 Little red flying fox (Pteropus scapulatus)

Description

This species is much smaller than the other flying foxes only weighing between 300-600g. This species has reddish-brown body fur with light brown fur where the wing membranes connect with the shoulder (Churchill 2008). The head is pale grey to black and fur only extends to the knees. Additionally, the pale brown wings appear translucent in flight in comparison to the other flying foxes in this region (Strahan 1995)

Distribution

This species has the largest distribution of the Australian flying-foxes. It's distribution starts at Shark Bay in Western Australia around the northern coast of Australia to the northern part of Victoria (Churchill 2008).

Habitat and feeding

Preferred habitat for this species is sclerophyll woodland, paperbark, bamboo, mangroves and occasionally in orchards. They usually travel 20-30km every day to get to feeding habitat. This species prefers to roost lower to the ground and in higher densities leading them to be more problematic with breaking vegetation in roosting trees.

Life expectancy

This species has an average lifespan of 15 years in captivity (Weigl 2005), little is known about their survival in the wild however it is postulated that they may live up to 30 years the same as other fruit bats (Nowak 1999).

2.2 Threats

2.2.1 Habitat loss and fragmentation

Flying foxes rely on many species that flower and fruit at different times of the year (Eby 1996, Parry-jones 1993). This makes them difficult to conserve as they are not confined to one area but rely on many large feeding grounds. For example, if all Forest Red Gum (Eucalyptus tereticornis) and Spotted Gum (Corymbia maculata) habitat had been cleared, then the species might only survive on orchards trees and backyard fruit trees as their winter food species have been cleared. This would lead to greater conflict and more flying fox deaths.

Roosting habitat degradation is also a major threat (Tidemann et.al 1999) to the point that many animals are living in small tracts of bushland within suburban areas (Birt 2000). This leads to increased human-animal conflict as more developments are built on their habitat.

2.2.2 Human/animal conflict

Commercial orchard damage

As more habitat is destroyed flying foxes are seeking alternate food sources such as commercial fruit crops. The main method of protection for this damage was shooting. However, this method was not very effective and has been banned in all Australian states due to its inhumane nature. As of 1 July 2023, the Department of Environment and Science began moving away from permits to shoot flying foxes as a crop prevention method. While this is a positive step it does not stop illegal shooting of flying foxes which may be up to 100, 000 per year (Vardon & Tidemann 1995). Additionally, the direct deaths are a misrepresented figure for mortality as a large percentage of shot individuals are pregnant or lactating females so their young will also die from starvation due to shooting actions (Parry-Jones 1993, Tidemann et.al 1997).

Roost problems

There are many common problems that appear when bats roost near human settlements. The main issues are noise, odour, excessive faeces and urine, damage to vegetation and perceived health risks. Additionally, as more councils choose to relocate or move roosting colonies this further complicates the problems as bats have high fidelity to their roost and generally only move 600m away from the original roost which may be in a worse location (Roberts & Eby 2013). See Appendix B on the Australia Bat Society (ABS) position statement on flying fox camp dispersal. It details documented attempts to disperse flying foxes between 1990-2013. The majority of these attempts were not successful and had large costs associated with the attempts.

2.2.3 Competition and hybridisation

Grey headed flying foxes are the only vulnerable species present in the Taromeo Creek roost and this species faces extra pressure due to competition and hybridisation with the BFF. Black flying foxes and grey-headed flying foxes are closely related, their breeding seasons are aligned and successful interbreeding in captivity has been document since 1987 (Hall 1987, Webb & Tidemann 1995). Therefore, GHFF may continue to decline due to interbreeding with BFF.

While there has been no direct competition recorded between BFF and GHFF as BFF distribution has expanded into GHFF coastal territory indirect competition for food and roosting habitat is favouring the BFF and pushing GHFF further inland.

Therefore, the combination of black flying foxes moving into the grey-headed flying foxes range and the possible scenario of interbreeding would further deceases the numbers of the vulnerable grey-headed flying fox putting this species under threat.

2.2.4 Biological factors

Unfortunately, flying-foxes have a low maximum population growth rate for their size (Parry-Jones 2000) this is probably due to the species lack of threats (before human settlement) and a long survival rate in the wild (McIlwee & Martin 2002). However, now that flying-foxes have a high mortality from human-made threats their natural reproduction rate is slow to recover from losses of individuals.

Female flying-foxes generally take 2-3 years to reach sexual maturity (Martin 2000) and only give birth to one pup per year. This means to replace the population a flying fox must live to 4-5 years or 5-6 to increase the population (assuming no juvenile mortalities). One study by Tidemann & Nelson (2011) found the mean age of death for 86 banded flying foxes was 7.1 ± 3.9 years in the wild. This average mortality age is only just above their minimum replacement rate, thus if any large die-offs happened this species would be very slow to recover. Additionally, females are known to abort their young in times of stress with many mass abortions being documented in the wild (Hall et.al 1991). This could occur from heat waves, scarcity of resources or human involvement.

2.2.5 Heat stress

Hyperthermia can cause mass deaths usually when the temperatures exceeds 42°C though heat stress can start at around 38°C. One such heat wave in 2004 was recorded and found that when the ambient temperatures exceeded 45°C an estimated rate of 5,000-7,000 individuals were lost (Eby et. Al 2004). Juveniles and females accounted for a high percentage of the losses in the study. An additional study by Tidemann & Nelson (2011) attributed 33.7% of deaths to hyperthermia, see Figure 2 for all mortalities recorded.

The council has a responsibility to flying foxes during management actions such as tree trimming or dispersal attempts. These actions should never occur during heat events due to the increase likelihood of death occurring. If a flying fox is killed, injured or found on the ground as a result of the management action all work must cease, and the Department of Environment and Science should be notified.

Management actions can continue if:

1. The flying fox has been removed by an appropriately trained person, and
2. The person in charge determines, after receiving advice from a person knowledgeable about flying-fox behaviour, that resuming management actions poses no risk to other flying-foxes at or near the roost.

The Blackbutt roost is particularly susceptible to heat stress due to the defoliation of the main roost trees and lack of understory vegetation. While the council does not have any obligations during these events it is advisable to make sure that council has plans in place to help affected residents, education the community, prevent undue harm to the animals and prevent any health concerns from injured or dead bats.

Firstly, the council should consider monitoring for heat stress events using tools such as the flying fox heat stress forecaster by Western Sydney University and The University of Melbourne. It can be found here: www.animalecologylab.org/ff-heat-stress-forecaster.html

Secondly, plans should be developed on what management actions the council plans to take during these heat stress events such as communicating with the community about ways to help, safety education and contacting bat welfare groups. Additional plans should be made for if the heat event leaves many injured or deceased flying foxes on the ground as it is not advised that untrained or unvaccinated members of the public pick up bats due to health concerns. To help make a heat stress plan for this roost the Queensland Government has developed a flying fox heat stress guideline that the council can follow. Available here: www.des.qld.gov.au/policies?a=272936:policy_registry/gl-wl-ff-heat-stress-guideline.pdf

2.2.6 Climate change and weather events

The effects of climate change on flying foxes are unknown but increasing temperatures, storms, bushfires, floods and droughts are likely to degrade foraging and roosting habitat as well as directly killing individuals. The first recorded account of direct deaths from bushfires was confirmed in the 2019 bushfires. Witnesses saw grey-headed flying foxes flying out of the camp and falling to the ground perishing from the fire and heat (Mo et.al 2022).

Climate change may also be the reason for the southerly shift of the black flying fox distribution. This shift has resulted in reduced numbers of grey-headed flying-foxes from their coastal habitats (Webb & Tidemann 1995).

2.2.7 Pollutants electrocution, entanglement, and pathogens

Since flying foxes are utilising urban environments and eating backyard fruit they have been found with lethal levels of lead in their body (Hariono et al 1992). Flying foxes in urban environments can also come into contact with powerlines. One study by Tidemann and Nelson (2011) attributed 18.6% of mortalities with electrocution - see Figure 2. This study also identified hyperthermia as the largest mortality (33.7%), followed by entanglement with fruit- netting (5.8%) and barbed wire (4.7%). 33.2% of deaths were classified as unknown which suggest a need for more research to determine these other factors.

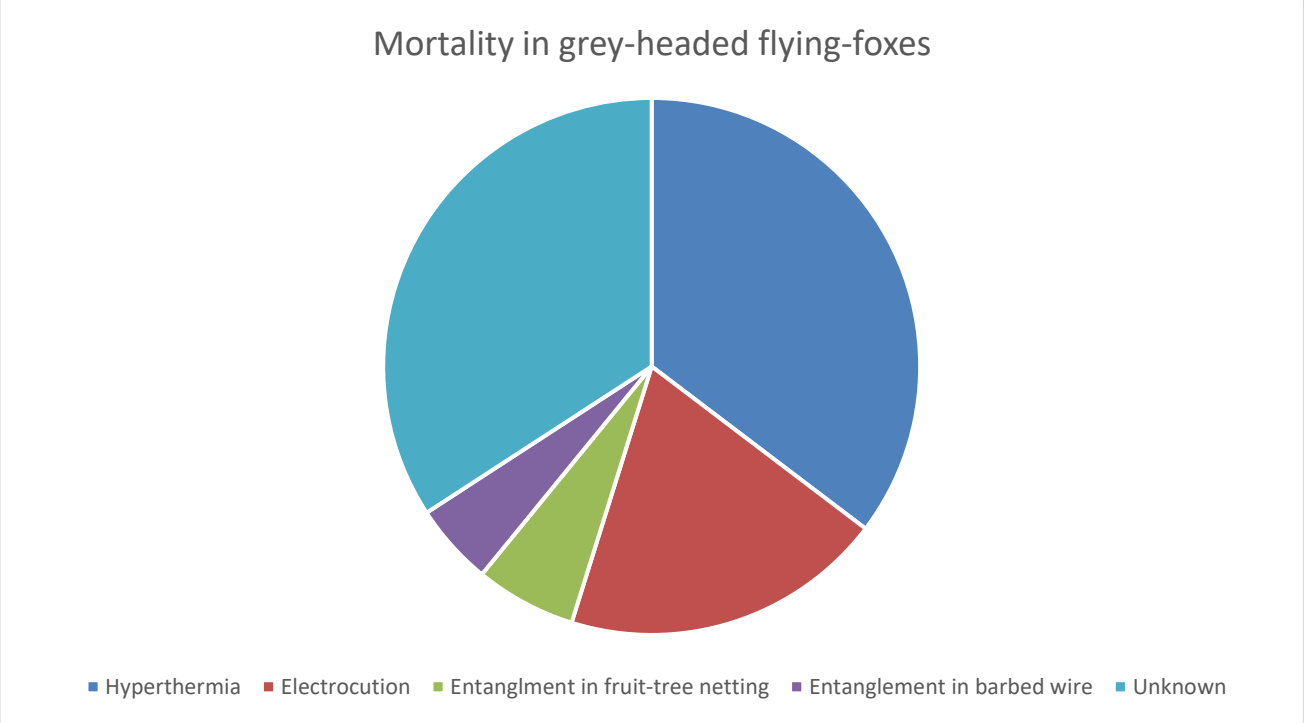


Figure 2 Tidemann & Nelson's (2011) study of the cause of death for 83 recovered grey-headed flying-foxes.

2.3 Ecological significance

Flying-foxes are one of the only long distance pollinators of many trees species in Australia. Flying foxes are responsible for the distribution of seeds and pollen for many rainforest flora species. One study by Fujita & Tuttle found over 289 species that rely on flying foxes for pollination or seed dispersal. Flying foxes travel long distances, usually with 15km but up to 50km in a night and spread seeds and pollen for natural forest regeneration (Hall & Richards 2000, Strahan 1995, Tidemann 1998). Additionally, as flying foxes can travel large distances, they are responsible for increasing the health of forests by adding more variability to the gene pool (Hall & Richards 2000, Strahan 1995). This is important for the *Eucalyptus* genus which produces most nectar at night to entice flying foxes to visit as they need a high level of outcrossing to provide viable seeds (Eby 1991).

2.4 Movement ecology

While the black flying fox and grey-headed flying fox occupy different distributions, when they roost together, they usually will have the same or similar movement patterns with both species leaving and arriving at the same time to a roosting site. The little red flying foxes arrives and disperses on their own irrespective of the other flying foxes. Flying foxes have daily movement patterns to and from food sources as well as seasonal movement patterns to follow flowering and fruiting times of different regions.

2.4.1 Daily movement patterns

Flying foxes are a nocturnal species and spend the day resting in large camps. They leave on mass just after dusk to travel to feeding sites usually with 15km (Tidemann 1998). The timing of when they leave the camp can vary and in winter they may leave up to an hour after dusk (Meade et.al 2019). All flying foxes leave the camp to feed except for juveniles. These juveniles who are too large to be carried by the mother are left in the camps and the mother will return to feed them throughout the night. Adult flying foxes start returning to the camp in the early hours of the morning with all arriving back at camp in the hours around dawn.

2.4.2 Seasonal movement patterns

Black and grey headed flying fox

These species are more regular visitors and form semi-permanent to permanent camps. These camps can be broken up into two types 'Summer camps or maternity camps' and 'Winter camps'. Summer camps are the most important as this is when mating and rearing young occurs (Nelson 1965). In winter the males and female separate and camps generally consist of immature individuals (Nelson 1965).

When flying foxes arrive and depart these camps differs from year to year and some camps may not be utilised every year. For the Blackbutt roost grey headed and black flying foxes have been recorded in 2021-2022 on the national flying fox monitoring viewer and Redleaf staff have recorded these species in 2021 and 2023. This suggest this camp is a regular summer camp as it has been used every year since 2021.

On consulting with some residents, it seems that this year the flying foxes arrived Dec/Jan and started thinning out around Mar/Apr. The arrival coincidences with mating territories being formed, while they start to depart after the mating season.

Little red flying foxes

This species is highly nomadic and occurs occasionally at the Blackbutt roost. This species moves camp regularly and only stays for 1-2 months at a time. Little reds were recorded at the Blackbutt roost in 2021 by the national flying fox monitoring viewer and by Redleaf staff.

It is difficult to predict when or if this species will be present at the blackbutt roost so this management plan will aim to deal with the more permanent residents, grey headed and black flying foxes and give advice for when/if the little red flying foxes return.

Table 2 Flying foxes life cycle and Blackbutt roost occupation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Arrival timing	Colony at largest capacity		Colony starts to disperse									Colony arrives
GHFF & BFF	Crèche Mating territories formed	Mating	Peak conception Mating Young independent	Peak conception Young independent				Final trimester	Final trimester	Birthing Crèche	Crèche	Crèche
LRFF												

GHFF – Grey Headed Flying Foxes, BFF – Black Flying Foxes, LRFF – Little Red Flying Foxes

2.5 Reproductive ecology

Grey headed flying foxes give birth to one pup a year and have synchronised timing with black flying foxes giving birth usually in October. The young are not capable of independent flight for 2 months usually around January (Eby, 1995, Churchill 1998). They are fully independent and weaned from February -April (Eby, 1995).

Little red flying-foxes breed 6 months offset to black and grey headed flying foxes so if any are present from April to July, they are likely to be either in late-stage pregnancy or with dependent young. See Table 2 for important reproductive times for flying fox species in Blackbutt.

3 Human/animal conflict

The number of flying fox roosts in urban areas is increasing, suggesting that flying foxes are adapting to living in an urban environment (Tait et.al 2014). As flying foxes are moving into town this brings a roost closer to human houses and this causes many real or perceived impacts. The major impacts are discussed below however it is best to gather community consultation as not all these impacts may apply or there may be unique issues relevant to only the Blackbutt community.

3.1 Noise

Flying foxes can roost together in large groups numbering of tens of thousands of individuals. When congregated into large groups flying foxes can be quite noisy, usually they are the noisiest just before they leave camp at dusk and while returning in the early morning. Flying foxes will also make more noise in response to stress such as predatory birds in the area, human or dog disturbance and loud machinery.

Most complaints are during the breeding season as flying fox noise is more constant during the day as fights over territory and mating calls occur during roosting. During this period anywhere for January to March flying foxes are active during the day.

3.2 Odour

Flying fox males produce an odour to attract females. This is most apparent during the mating season from January to March. Males will secrete an odour onto their branches within a roost to attract females. This smell can be unpleasant, and the smell increases with the size of the roost. It is important to note that the smell of flying foxes is not from them being unclean but from a natural mate selection process.

To mitigate this effect people can plant fragrant flowers that bloom during the breeding season or use odour neutralisers in the home when the smell becomes too much. In days when the wind is still, and the smell is overpowering residents can close windows and doors and use fans or the recirculate option on air conditioners.

3.3 Faeces and urine

Flying foxes will usually defecate or urine while flying out at dusk so any houses under these flight paths may be affected by faeces. Flying fox faeces are no different from any other animal faeces. You should avoid directly touching them and clean any soiled objects with soap and water.

To mitigate the effects of this residents under flight paths should not leave washing out at night or use a drier. Anything left outside at night/dusk can be covered with a tarp or marquee e.g., children's toys, clothes lines, cars or outdoor furniture.

To clean animal faeces:

- Wear gloves and mask
- Saturate area with water to soften up droppings
- Wipe up are with a sponge
- If needed clean with soapy water
- Throw away rags and gloves in seal bag
- Clean hands with warm soapy water

3.4 Damage to vegetation

Damage to vegetation mostly occurs when there is a reduction in the number of roosting trees in the area so more flying foxes are crowding the remaining trees present. Little red flying foxes are known to break branches and strip leaves when they are present as they group close together in smaller trees and their combined weight can break some branches. However, this species is rarely present for long so any damage wouldn't be long term the trees should heal from this short infrequent damage.

3.5 Perceived health risks

Flying foxes have a perceived health risk associated with them because they can carry Australian bat lyssa virus (ABLV) and be a carrier of Hendra virus.

3.5.1 ABLV

This can only be transmitted by saliva from a scratch or bite so for public safety no one should touch a bat. If you find a sick or injured bat, call a wildlife handler who is vaccinated to come and handle the bat.

Additionally, the health risks from bats are very low with only 1% of bats carrying ABLV (7% in sick or injured bats). However, as this virus is fatal unless treated it is for public safety that only vaccinated people handle bats.

3.5.2 Hendra Virus

Bats are also a carrier for Hendra however there is no direct transmission of Hendra virus from bats to humans this virus must incubate in domestic livestock such as horses who have direct contact with bat faeces or urine. Horses can be vaccinated against Hendra virus and some paddock modifications can be made to limit the likelihood of contact with the virus. Water and feed troughs should be placed away from trees where flying foxes are roosting to avoid faeces enter the water. Additionally, food and water should be covered if near flying fox fly out zones and horses can be vaccinated. If horses become sick, then it should be separated from other animals and humans until a qualified veterinary has assess the horse.

3.6 Commercial orchard loss

Flying foxes feed on soft fleshed fruit in the wild and can eat some commercial products such as stone fruit, apples, and pear particularly in times of drought when eucalyptus do not flower. Firstly, it should be determined whether flying foxes are damaging fruit or if the damage is from other animals such as possums or rats. If flying foxes are causing damage, then netting is an appropriate barrier to stop fruit from being eaten. Paper bags or individual fruit covers may also be used.

It should be noted that only small netting less the 5mm by 5mm made of sturdy material should be used and coloured white so flying foxes can see the netting. The small size of the mesh means flying foxes are unlikely to become entangled and die.

4 Legislation considerations

All flying foxes are protected under the Nature Conservation Act, 1992 (NC Act) with the grey headed flying fox having given extra protection under the Environmental Protection and Biodiversity Conservation Act, 1999 (EPBC) because of its status as a vulnerable species.

4.1 EPBC requirements

The grey-headed flying fox is listed as 'vulnerable' under EPBC Act 1999. Under this act this species and its habitat is protected. Any action should aim to avoid and mitigate harm to this species and its habitat. If impacts are still likely to occur based on the Significant Residual Impact (SRI) criteria, then a referral to the Department of the Environment will be needed and the minister will decide within 20 business days whether a proposed action requires assessment.

The Significant Residual Impact criterion for vulnerable species:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

4.2 Roost management in Queensland

4.2.1 Nature Conservation Act 1992

All three species are protected under this act and any roost management activities must comply with Nature Conservation (Wildlife) Regulations 2006.

Councils have an 'as of right' authority to manage flying fox roosts within identified urban flying-fox management areas (UFFMA's) and must comply with the Queensland Government's ecologically sustainable management of flying-fox roost code of practice in addition to any other regulations under the EPBC 1999 and VMA 1999. The Blackbutt roost is identified as a UFFMA and is within non-remnant vegetation RE mapping. Therefore, the procedure before any management actions are scheduled is to notify the Department at least 2 business days prior to any roost management activities and keep within the code of practice guidelines. A notification is valid for up to 4 weeks from the date of notification. Additionally, a flying fox roost management evaluation form needs to be complete within 6 weeks of management activities.

The guidelines stipulate how management actions can proceed with the least harm to flying foxes. It controls how and when roost trees can be trimmed or destroyed as well as methods for driving away flying foxes with the least harm.

4.2.2 Vegetation Management Act 1999

Tree clearing work will be regarded as exempt clearing as vegetation is classified as Category X within freehold land. Additionally, most of the known roosting trees are exotic invasive camphor laurel trees which are not protected under the Vegetation Management Act. If extra clearing is required outside of Category X areas, then Vegetation Management regulations will apply as well as permits for flying fox dispersal as this will likely be outside of the UFFMA.

As the roost is not within council property, any management actions taken by the council should acquire the land holders consent to access the property.

4.3 Flying-fox roost management permit

Councils do not need a permit to manage the Blackbutt roost as it is within an UFFMA and when following the codes of practice. If council wishes to manage additional roosts outside of the UFFMA or in a way not covered under the codes, then they will need to apply for a permit.

Landholders can also apply for a permit if they believe the flying foxes are causing damage to their property or negatively affecting their health or wellbeing. If individuals are also applying for permits, then these will be assessed in conjunction with the council's roost management plans as while individual efforts may not cause a SRI for the grey-headed flying-fox cumulative efforts may cause a SRI.

4.4 Low impact activities

Low impact activities are management activities that homeowners can do without a permit in accordance with section 62 of the Nature Conservation (Animals) Regulations 2020. These activities include:

- Trimming of roosting trees (additional regulations apply).
- Installing, maintenance or removal of infrastructure in close proximity to a roosting tree e.g. installing a fence.
- Mulching, mowing, weeding or watering under or in close proximity to roosting trees.

The Code of practice for low impact activities affecting flying-fox roost can be found on the Queensland Government website under Authorised flying-fox roost management (Appendix D).

5 Taromeo Creek roost

5.1 Known roost site

The Taromeo Creek roost is entirely withing freehold lots cantered around Taromeo Creek in the town of Blackbutt. This roost has been monitored on the national flying fox monitoring viewer since 2021. Redleaf staff have also assessed this roost in 2021 and 2023. The roost is home to all 3 species within the area but not always at the same time. Little red flying foxes are more nomadic and don't appear every year. Black and grey headed flying foxes have both appeared every year since records started in 2021 with only a few thousand using the roost at any one time. This is quite a low number probably due to the small amount of suitable roosting trees.

Blackbutt is a known summer roost site for black and grey headed flying foxes. It is likely this species will appear every year in varying numbers in response to food sources.

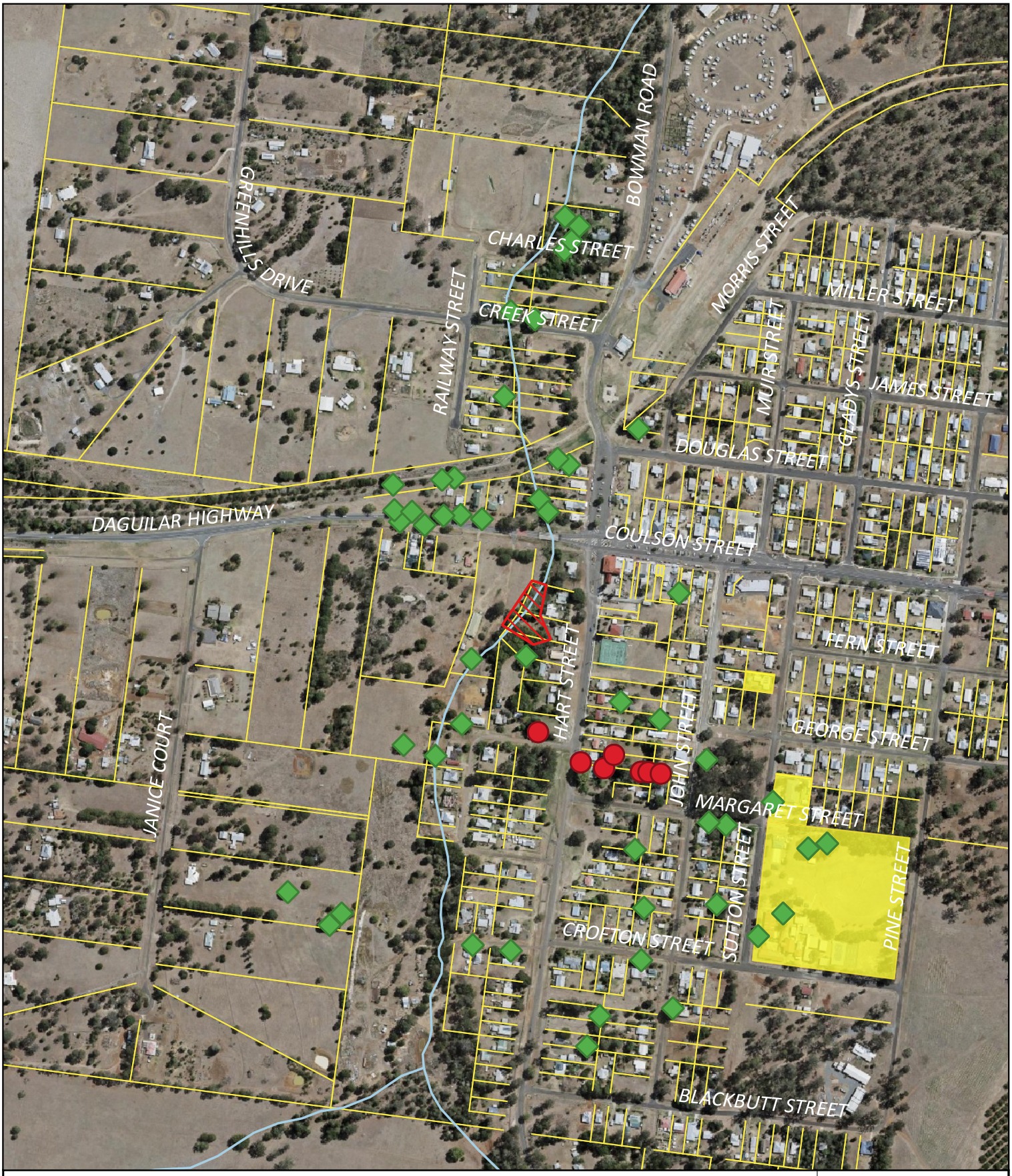
5.2 Potential roost sites

Most of the roosting trees within Taromeo Creek are within an exotic invasive tree: camphor laurel (*Cinnamomum camphora*). Flying foxes are known to pefer this species due to its wide and thick branches which can handle the weight of many bats on each branch. Additionally the canopy for this species is quite thick which provides protection from the elements.

Six secondary trees have appeared in the 2022-2023 summer. One is a camphor laurel, and the remaining are native planted silky oak (*Grevillea robusta*) - see Figure 3 for locations. Taromeo Creek is surrounded by many planted camphor laurels and silky oaks as well as extra camphor laurels that are spreading via the creek.

Since bats are attracted to camphor laurels when available near creek lines, Figure 3 shows potential camphor laurels within 600m of the current roost from satellite imagery. Many of these trees are close to houses, schools, daycares, and workplaces. If roosting trees are removed in Taromeo Creek, it is possiblethe bats will move into more camphor laurels or other vegetation near the creek and town bringing them in closer contact with people.

Section 8.6 shows potential alternative roosts sites and their suitability.



Legend

- Main roost
- Secondary roosting trees
- DCDB
- Sensitive locations
- Watercourse (VM Act)
- Buffered
- Possible camphor laurels

CRS: GDA 1994 MGA Zone 56
Projection: Transverse Mercator

N

Scale (A4)
0 50 100 m

Figure 3: Taromeo Creek roost and possible camphor larurel locations
Blackbutt, QLD
Prepared for Southern Burnett Regional Council

Rev	Description	Drawn	Approved	Date
O	Issued for use	SMIN		17/08/2023
A	Issued for review	SMIN		17/08/2023

Job Number:

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5.3 Timing for management options

Management options should be performed only when bats are not heavily pregnant or with dependent young as per the code of practice (Appendix C). Table 3 shows that there is never any time that is not within at least one species fragile times however, as little red flying foxes are highly nomadic and not present every year at the Taromeo roost the management plan is based on the known timings of the black and grey headed flying foxes and assumes no little red flying foxes are present. If little reds are present then check 1-2 times a month until they disperse, then management actions can commence. See Figure 4 for management option decision tree to determine if management options can proceed.

The best options for management actions are when black and grey headed flying foxes are absent (from community information) it appears this is a summer roost that appears in Dec/Jan with most bats dispersing in March/April. Therefore, management actions should be performed when no bats are present from May-Nov as it will be the safety option for management actions. If bats are present during winter the best months for management are June and July as bats are not likely to have dependent young or be heavily pregnant (Table 3).

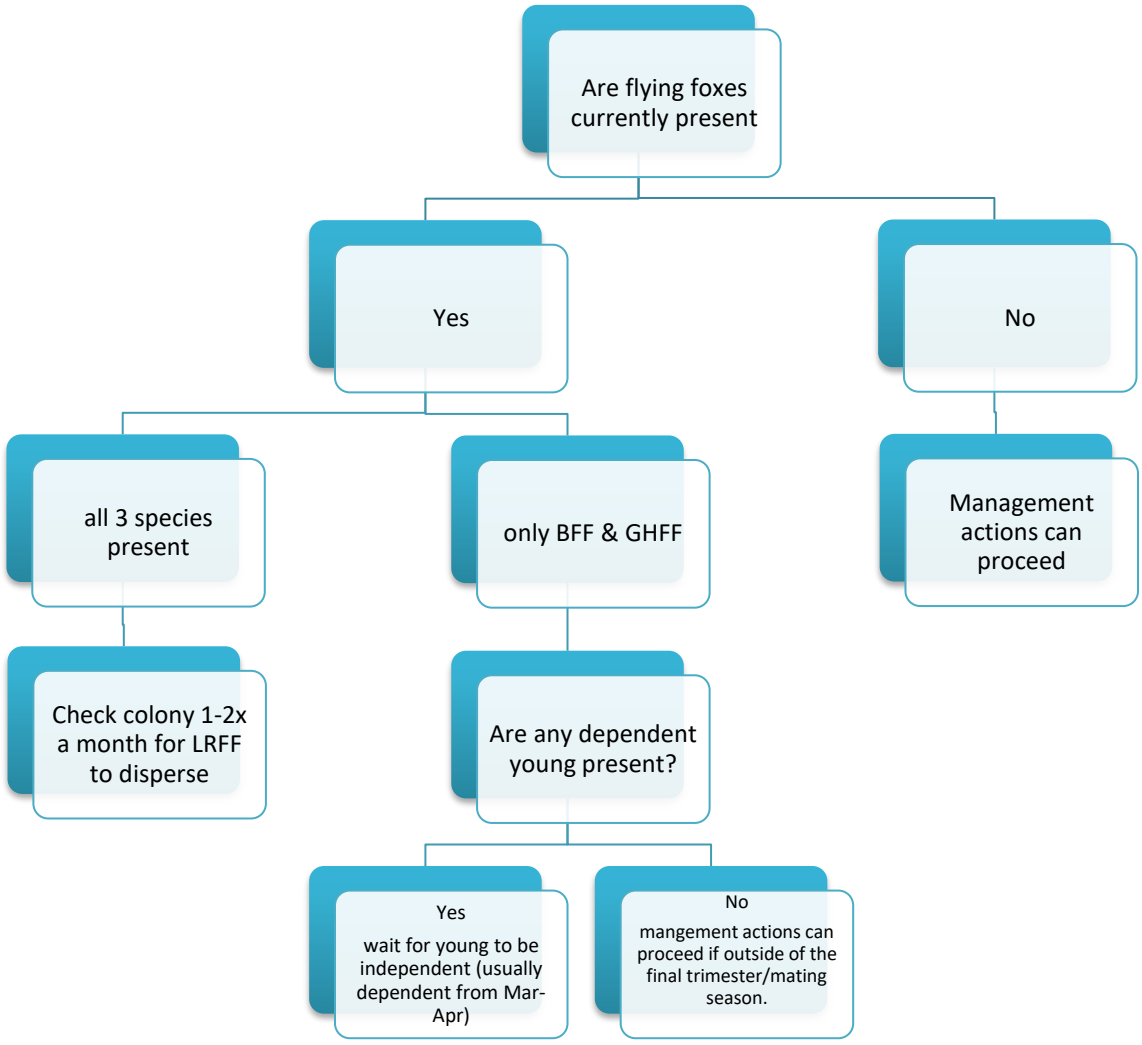

Figure 4 Management actions decision tree

Table 3 Timing of management actions in relation to flying fox ecology

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
GHFF & BFF	Crèche Mating territories formed	Mating	Peak conception Mating Young independent	Peak conception Young independent				Final trimester	Final trimester	Birthing Crèche	Crèche	Crèche
LRFF			Final trimester	Final trimester	Birthing	Crèche	Crèche	Crèche				
Best management timing (**only if no LRFF present**)					⇧ Possible if no dependent young present	⇧	⇧	⇧ Possible if no species present	⇧ Possible if no species present	⇧ Possible if no species present	⇧ Possible if no species present	

6 Past management actions

Redleaf Environmental was contacted to conduct a roost assessment in March 2021 as the residents were unhappy with the Taromeo Creek roost. A vegetation assessment was conducted in June 2021, and it found that the majority of the vegetation in the creek had a weedy understory. The council decided to remove this weedy understory vegetation and trim roost trees to discourage the bats from roosting in Taromeo Creek. During the clearing landholders attempted to scare away the bats and were warned against this course of action. Additionally, some extra trees were cleared while the workers were away. This resulted in more trees being removed than expected. Consequently, in the summer of 2022/2023 new roosting trees were inhabited that are closer to houses.

In direct response to the management actions the roost has not dispersed but has relocated within the town closer to human occupied areas.

7 Impacts of a roost management plan

Flying foxes are highly intelligent social animals that have high fidelity to roosting sites. They may quickly adapt to dispersal attempts and roost disturbances. While in the past dispersal attempts and culling have been the main method to solve communities flying fox concerns, councils and communities are now choosing more in-situ responses for the lower cost and more successful results.

A study by Roberts et.al (2020) has complied 48 records of flying fox dispersals mostly from 2013-2014. Only 23% of dispersal actions were successful mostly by the complete destruction of the roost and the lowest costing successful action was over $250,000. Repeat actions were needed in most cases (58%) over months to years to keep the flying foxes from returning. This is supported by another well studies example the large roost in Maclean, NSW and is summarised in Roberts et.al (2011) extract. Dispersal attempts were made between 1999-2007 (8 years) during this time the flying foxes attempted to return 23 times and splinting into 12 camps throughout the area including a problem camp in Iluka which also started the process of dispersal. Additional actions have continued to present day and focused on in-situ methods including revegetating habitat to move the flying foxes away from houses. Revegetation took 6-7years to allow trees to mature to a size flying foxes started using them. The cost from these management actions is now over 900,000, see NSW Governments flying foxes in Maclean case study.

The Australian Bat Societies also does not support dispersal attempts as seen in their document “ABS position statement” (Appendix B) as they are not effective. This document compiles dispersal attempts from over 20 years and includes cost, outcomes and methods where known. Most of these attempts did not solve conflict at the current site or within the community as new sites appeared.

Dispersal attempts from the literature have many hindrances:

- Flying fox biology means the species has high site fidelity so when dispersals are attempted flying foxes rarely move more than 600m away (Roberts & Eby 2013).
- Flying Foxes quickly adapt to noise and other means of disturbance, with adaptation occurring over two to four days. Thus, a relocation disturbance needs to be intensive at the outset and will become increasingly less effective as each day passes. This will require Council to commit a significant allocation of staff and resources if a dispersal is attempted and this action is unlikely to be successful.
- Flying foxes are becoming more likely to roost in urban areas (Tait et.al 2014). If dispersal options are used throughout the town, they have a higher likelihood of moving into another urban area in the region.
- Dispersal attempts are rarely successful without the complete destruction of the roosting site, and this may splinter the roost throughout the area instead of dispersing them from the town. Without removing all suitable trees (most large old trees) dispersals attempts are likely to move the bats closer into town and into greater conflict with people.
- Attitudes towards bats are changing and now more people are seeing that dispersal and culling attempts are not appropriate management options for councils.

Dispersal attempts have been the main method for dealing with flying foxes however more councils are moving away from this option as dispersal attempts are expensive and largely unsuccessful. Additionally, more communities are changing their views and now see dispersal as an unacceptable action.

7.1 Sensitive areas

As per Figure 3, it is evident that many places in Blackbutt have mature camphor laurels or similar large trees that could be use as roosting trees. Additionally, it was noted that there is large camphor laurels and native vegetation surrounding Blackbutt state school and one large camphor laurel at the front of a childcare centre. The lots in town are also smaller than those in the creek so if flying foxes relocate within Blackbutt it is likely for them to choose the mature trees in people yards which brings them more in conflict with the town.

7.2 Community consultation/consideration

Community consideration has been given to determine the attitudes of the community. Generally, only those next to the roost would have direct impacts and the rest of the community may have other concerns such as perceived

health risks. Through community consultation these problems can be discussed, and community education or management can be used to ease the community's problems.

Community consultation consisted of an online survey with questions considering residency in Blackbutt, impacts of flying fox roosts on residents, potential management options and desired options for Council to manage flying foxes. Overall, residents are primarily impacted by flying fox roosts through noise and smell, sleep deprivation, and concerns about health, with damage to property also a significant impact. The most popular management actions included revegetation of suitable areas for long-term relocation, tree trimming to create buffers, property modification to reduce the effects of the roosts, and creating a list of trees not to be planted near sensitive receptors. Relocation of flying foxes was the most popular proposed method for Council to use when managing flying foxes, followed by the creation of alternative roosting sites, increased monitoring of flying fox activity, non-invasive deterrents such as sounds and lights, and increased public education. The full list of results can be found in Appendix F.

Another option is to prepare a Statement of Management Intent (SoMI) using the Queensland Governments template. This will describe the councils plan and keep the community informed as a starting point for community engagement.

7.3 Community Education

Flying foxes and bats in general are portrayed negatively in the media. In an Australian study by Kung et.al (2015) it was found up to 20% of respondents believed there was a direct transmission risk of Hendra virus to humans. Additionally, this study found that a minority of community members were directly impacted, most likely those closest to the roost. Therefore, community programs will be most useful for the broader community to change negative perceptions and provide correct information. This aims to alleviate the broad communities' concerns.

Consideration should also be given that the community may be against certain management actions as indicated by Kung et.al (2015) that had many responses indicating that dispersal and culling were not appropriate actions. These responses included those living in areas where flying fox management was topical.

7.4 Potential risks

If a dispersal of the current roost is attempted, then it is likely the roost will continue to splinter and move into individual trees closer to town.

Community education alone will not address the direct issue from landholders closest to the roost site. These landholders may try to disperse the roost on their own or cut down more roosting trees on their property which has already happened in 2021. This would also likely move the bats closer into town.

An integrated approach is needed to manage the multitude of issues that a community may have. Management plans are not likely to solves everyone's problem but will address the main issues of the community.

8 Roost management actions

These actions could be used singularly but will be most effective if multiple types are used together.

- Community education
- Scientific research
- Support for directly affected residences 4, 5
- Roost modification and housing buffers 2
- Roost dispersal
- Alternative roost sites 1, 3
- Combination of the above

8.1 Community education

The main goal of community education is to alleviate any misconceptions around bats and to gauge what the main human-wildlife conflicts occurring are.

There are two target groups in a community education program, firstly the directly affected residents which are usually the most vocal and have the most impacts or concerns. These concerns may not be entirely alleviated by community education alone, but it can be used to gather information on what the main issue upsetting the residents is, allowing tailored management options to target these issues.

The second group is the broader community which may have some misconceptions about bats and flying foxes that have been sensationalized by the media which leads to misconceptions, fear and/or hate towards them being present in the community. Community education can include meeting with flying fox experts, school presentations, pamphlets, posters, informational signage at the roost or on the footpaths. This could also include an official statement of management intent.

Community education is a great low-cost option to start a management plan to get the community involved. This allows individuals to feel like their voices are being heard and that the council is being proactive in this situation. It could be used as the only option in certain situations depending on the number of residents affected. However, for this roost, community education alone may not be ideal as residents have illegally cleared roost vegetation or tried to disperse the roost in the past (2021). If the council decides not to do anything else, it is likely more illegal actions to disperse the roost would occur.

8.1.1 Risk

This option only alleviates misconceptions and does not help with residents that are directly affected by bats for example from the noise or smell and loss of amenity. Other options may need to be considered to address direct issues.

If no direct options are used it could result in a negative response from the directly affected residents and more illegal driving away or culling.

8.1.2 Cost

Minimal cost is associated with these types of programs.

8.2 Scientific research

Further research can provide useful data on the specific situation in Taromeo Creek. This would prove useful for current and future management options and may include:

- Flying fox noise studies
- Flying fox population studies
- Community surveys on flying foxes
- Habitat assessment and research for alternative sites

8.2.1 Risk

These studies will take time to complete, and residents may not be content to wait. Additionally, management actions may be required based on the studies.

8.2.2 Cost

The cost is variable and will depend on the type of studies. The studies may lead to additional management actions with associated costs.

8.3 Support for directly affected residents

This would involve council offering subsidiaries, advise, rebates, discounts, or deals for those within the impact area of the roost (10 houses within 100m of main roost, additional 19 properties with 100m of secondary roosting trees) and offering some or all of the suggestions to limit impacts from living near a flying fox roost. For more technical information on sound proofing limits see Appendix E which has a noise study done on a much larger flying fox camp.

- Providing subsidiaries or deals for residents to purchase these items to reduce noise or smell:
  - Recirculating air conditioners.
  - House and roof insulation.
  - Additional insulation around window and door seals.
  - Double glazed windows and doors.
  - Noise attenuating fencing or tree barriers.
    - Additional technical advice and quotes for each resident bordering the roost.
  - Free screening plants to block noise.
  - Exotic tree removal (focusing on camphor laurels) only available if bats are not using it as a roost (but may splint into these trees from management actions or over time).
- Providing subsidiaries or deals for residents to purchase these items to stop droppings:
  - Covered carports, gazebos or marquees for cars, outdoor sitting areas or children's toys.
  - Temporary marquees for use during the flying fox season.
  - Washing line covers.
- Purchasing a high-pressure washer for use by the broader community for spraying dropping off houses, deck, and driveways.
- Rate reductions or subsidies such as electrical subsidy to offset use of air conditioning and clothes driers.
- Installation of first flush diverters on roofs (only if collected rainwater is being used for human consumption and this is an active issue the residents have).
- If the community is vocal about Hendra virus the subsidiaries could include horse shelters to cover food and water where bats are present/roosting. It is important to remember if bats are roosting in rural areas and these trees are removed, they may join the roost in town.

These options will help the directly affected residents to gain back some amenity in their property and feel like the council is hearing their problems and responding. The broader community would also benefit as there will be no splintering of the roost which would lead to increased roost conflicts within the community.

8.3.1 Risk

These subsidiaries may not solve all aspects of the residents' problems with the roost especially those that have lived there before the roost was established. However, this should limit other actions such as illegally driving away the roost or clearing as well as complaints to the council.

Possible low uptake of the subsidies.

8.3.2 Cost

This will depend on the number of properties with the roost area and type of offers the council uses. This option would be cheaper than roost dispersal activities and can be limited to a specific amount.

8.4 Roost modifications and housing buffers.

This involves doing minor modifications to limit the main issues with flying foxes, their noise and smell. Additionally, trees can be removed within 30 m of houses to create a buffer while reestablishing trees further away from houses. The Taromeo Creek roost is quite small and on private land so this option is quite constrained (or sensitive) and only some of the options below may be suitable. See Figure 5 for housing buffers.

Management action can include:

- Removing/trimming roosting trees closest to residential houses to move the roost further away from houses.
- Planting of non-roost buffering trees/shrubs to block most of the noise and smell.
- Regeneration of roosting trees to move the roost further away from houses.
- Providing support for those directly affected by the roost, offer a planting guide and free screening plants.
- Continue removing undergrowth vegetation each season before bats arrive to discourage bats from roosting in large numbers.

It is important to do this management action in stages as if all the vegetation is removed at once before the buffering plants have grown this would increase the noise levels. Flying foxes are also loudest when they can see threats such as human, dogs or machinery moving under or through the roost. Therefore, if the outermost plants are removed before buffering plants are grown this could increase sightlines for bats and thereby increase noise levels.

This option is the most proactive without driving away the roost and should reduce complaints. It is best used with a combination of subsidiaries and community education to mitigate most of the effects of a flying fox roost.

8.4.1 Risk

Vegetation removal may splinter bat colony into other trees in town.

May not stop vocal residents who want the bats removed entirely. Some people may not be happy with the bats staying at all; however, studies show a large percentage of people disapprove of dispersal and culling activities in addition to these activities being expensive and not working as intended.

8.4.2 Cost

The cost of the option will also vary but would be similar in cost to the last effort made by the council in 2021 to remove the understory of the roost vegetation. It is likely to be an expensive operation, however, less expensive than a full roost dispersal.

8.5 Roost dispersal

Dispersal attempts if successful would eliminate complaints from the directly affected residents however, this option is the riskiest and is the least likely to succeed. As can be seen in Appendix B by the Australian Bat Society dispersal attempts are largely ineffective and very costly. There are two types of dispersal options:

- Passive dispersal using water sprinklers, flood lights or vegetation trimming to discourage bats from use the roosting trees.
- Active dispersal using loud noises, smoke, and lights during the hour before sunrise to actively discourage bats from roosting in trees.

Both dispersal options are not recommended based on the management actions from 2021 it is likely the roost will form additional splinter roosts in worse locations throughout Blackbutt. Roost dispersal is not likely to solve the issues in the community. It is more likely to spread the roost further into town and increase the human-wildlife conflict.

8.5.1 Risk

Likely to splint the roost and exacerbate the problems as more residents will be directly affected by the roost.

Mostly likely to cause harm to flying foxes and if multiple dispersals are need may constitute a Significant Residual Impact (SRI) and require referral to the EPBC.

8.5.2 Cost

Roost dispersal is the most expensive options and requires ongoing dispersals at the onset of each season as well as maintenance dispersals when needed.

8.6 Alternative roosting site

As the current site is close to residents it may be beneficial to find an alternative site and try to move the bats into this alternative site. This option is a long-term plan as it requires planting of new roosting trees and waiting until they are of adequate size to move the roost (approx. 6-7 years).

A buffer zone of at least 50 m should be used however if the roost is expected to grow a 100 m buffer is preferable with planting of vegetation at the edge that is not suitable for roosting but to stop noise from leaving the area.

8.6.1 Risk

The roost may not move into the new site. Limited research has been done with moving roosting bats into alternative sites so it is difficult to say how effective this strategy will be. Regardless, vegetation should be accounted for in the planning scheme and buffers should be put in place to stop development occurring close to flying fox roosts.

8.6.2 Cost

This may involve the purchase of suitable land if the council does not already own it. Planting of the new site with roosting trees. Maintenance of new site to ensure trees survive and remove any weeds.

8.6.3 Priority classification of potential roosts

To assist Council's decision-making process around flying-fox management in the SBRC LGA, the proximity and vegetation classes described above are combined to classify the "Flying-fox Conflict Potential" for vegetation on Council-managed land. The following matrix shows how the conflict classes are derived for the mapping of potential conflict sites in Council's UFFMAs.

Table 4 Classification of potential flying-fox roosts on Council-managed lands.

Proximity class ⟶ / Vegetation class ↓	Potential roost is <50 m from a sensitive site	Potential roost is 50-100 m from a sensitive site	Potential roost is >100 m from a sensitive site
Cluster of large mature trees <50m from a watercourse / water body	HIGH	HIGH	MODERATE
Cluster of large mature trees 50-100m from a watercourse / water body	HIGH	MODERATE	LOW
Cluster of large mature trees >100m from a watercourse / water body	MODERATE	LOW	LOW

Mapping derived using the above categories (see Figure 5) serves two purposes regarding roost management decision-making in the Council's UFFMA's.

a) If dispersal actions are to be considered for existing roosts, the mapping provides an indication of where flying-foxes might move to and the level of conflict that may arise as a consequence. This information will be vital for determining the risks of undertaking a dispersal, alternative management options, and the level of resources required to prevent flying-foxes moving to other high-conflict sites.
b) A better understanding of the location of potential roost sites can help Council plan for and implement pro-active management to reduce the likelihood of sites becoming a "problem roost" in the future. This might include activities such as vegetation management to create and maintain suitable buffer zones adjacent to potential roosts.

8.6.4 Field survey results for potential roosts

On 27th March, Graduate Ecologist Levi Burton surveyed the Council tenured land displayed in Figure 5 to determine if desktop analysis regarding potential alternative roosts is accurate. The results from the field survey can be observed below in Table 5.

Table 5 Potential alternative roosts on Council tenured land within 1km of current roost.

SITE	LAT,LONG	LOT/PLAN	SUITABLE HABITAT	FLYING FOXES PRESENT	POTENTIAL OF ALTERNATIVE ROOST
1	-26.88410, 152.08901	217/CSH2046	Yes.	No.	Moderate, low.
2	-26.88639, 152.09075	21/RP884794	Yes.	No.	Moderate.
3	-26.89479, 152.10039	196/CSH1903	Yes.	No.	Moderate.
4	-26.89209, 152.09977	24/RP32394	Yes.	No.	High.
5	-26.89096, 152.09928	67/RP32398	Yes.	No.	High.
6	-26.88755, 152.10100	1/SP315757	Yes.	In adjacent property	High (currently roosting)
7	-26.88769, 152.10234	2/SP315757	Yes.	In adjacent property	High (currently roosting)
8	-26.88485, 152.10150	1/RP120337 2/RP120337	No.	No.	N/A
9	-26.88250, 152.10421	21/RP3286	No, suitable habitat in adjacent property.	No.	N/A
10	-26.88237, 152.10424	20/RP32386	No.	No.	N/A
11	-26.88154, 152.10405	53/RP32387 36/RP32387 37/RP32387	No, suitable habitat across the road.	No.	N/A

12	-26.88143, 152.09954	33/RP32391 78/RP167978	No, suitable habitat close by to the north.	No.	N/A
13	-26.87521, 152.10657	87/SP102660	No.	No.	N/A
14	-26.88599, 152.11062	1/RP130127	No, suitable habitat across the road in road reserve.	No.	N/A

Legend

- 1km Buffer
- Main roost (reprojected)
- VM Watercourses QLD
- Council tenure land
- Low Conflict
- Moderate Conflict
- High Conflict

CRS: GDA 2020 MGA Zone 56
Projection: Universal Transverse Mercator

N

Scale (A4)

0 80 160 240 m

Figure 5: Potential alternative roost sites and conflict levels.

Blackbutt, QLD

Prepared for Southern Burnett Regional Council

Rev	Description	Drawn	Approved	Date
O	Issued for use	LB	DF	26/03/2024
A	Issued for review	LB	DF	26/03/2024

Job Number: 23398

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8.7 Combined approach

While any of these options could be done alone it is most effective to consider a combined approach to cover any gaps that may be present with only one option. The council should discuss each option and see what they can fit into their budget. Additionally, flying fox management should be considered as a long-term approach.

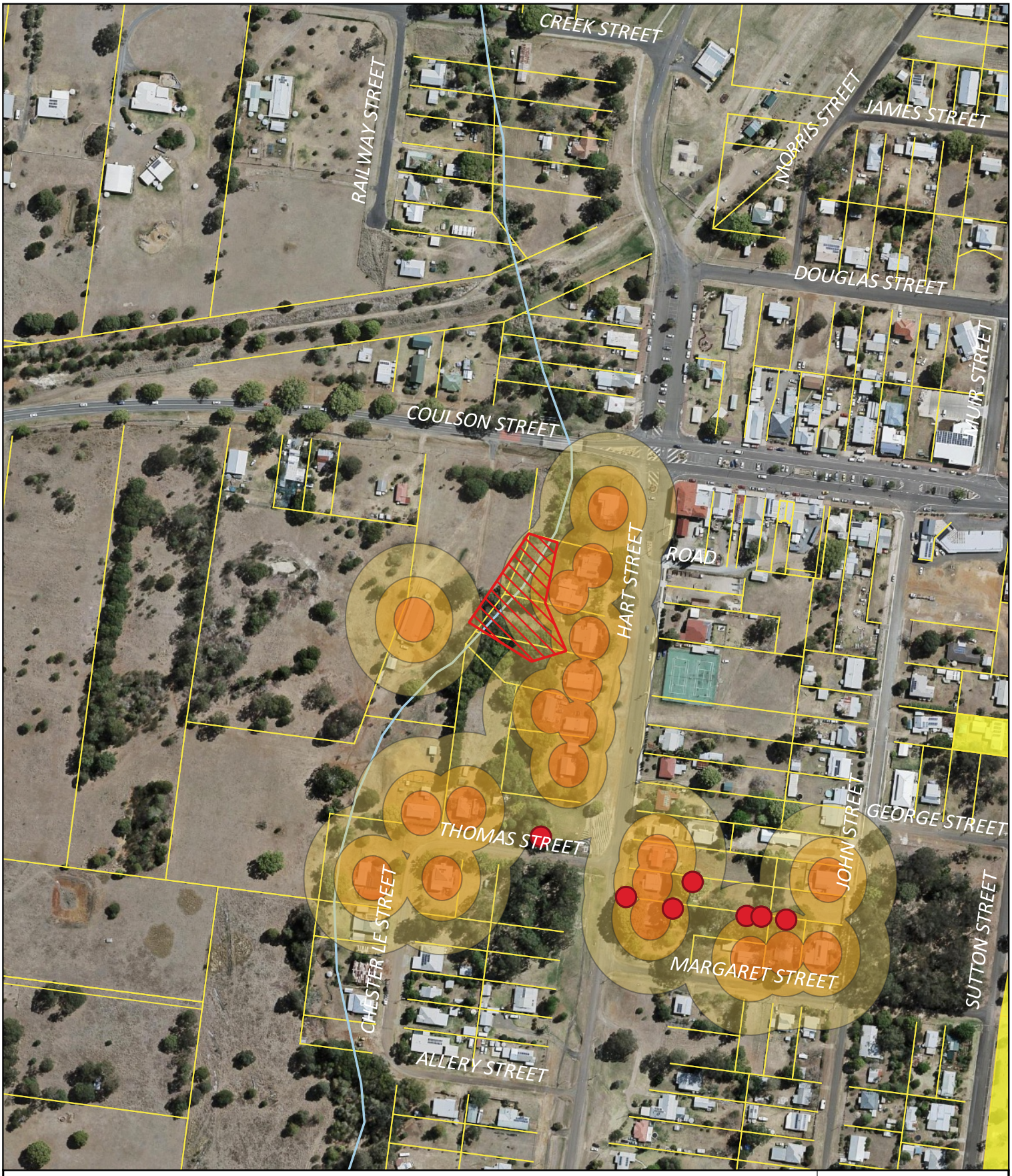
Table 6 Management actions

	COMMUNITY EDUCATION	ROOST MODIFICATION	SUPPORT FOR RESIDENTS	DISPERSAL	ALTERNATIVE SITE
Cost	Low $	Moderate $$ + time	Moderate $$	High $$$	Moderate $$ + Time
Covers	Broader community	Directly affected residents	Directly affected residents	Most of the community	Full community
Gaps	Directly affected residents	Broader community and this may not be enough for directly affected residents	Broader community and this may not be enough for directly affected residents	Residents that don't want the bats moved or harmed	None

8.7.1 Management actions in the short and long term

Short term actions: Community consultation and education should be the starting point of any action plan. The next steps can involve revegetating the current roost and encouraging bats from the secondary roosting trees back to the main roost. This would limit the amount of directly affected residents and the old roost has the most space for the creation of buffer zones. The main roost should be revegetated so it is outside of a 30m radius of each house (Figure 6). Trees can be planted outside of the 50 m radius to encourage bats to move further away from houses. Additional subsidiaries for sound proofing, vegetation buffers or noise attenuating fencing would limit impacts to the 10 directly impacted residents. Offer subsidies to remove exotic camphor laurels to minimise the colony splitting into these trees. Community consultation should also be conducted throughout management actions to determine if these actions are sufficient.

Long term actions: could involve either rezoning the current site or creation of a new alternate roosting site in Blackbutt with 50-100 m buffer from the roost to the nearest houses. This could be created in the current location and may need either the purchase of land or rate reduction for those living within these limits, and a cessation of building new houses in the area. A long-term plan should account for the roost possibly growing and should limit the planting of any suitable roosting trees near houses including smaller trees known to be used by little red flying foxes.



Legend

- Main roost
- Secondary roosting trees
- DCDB
- Sensitive locations
- 15m house buffer
- 30m house buffer
- 50m house buffer

CRS: GDA 1994 MGA Zone 56
Projection: Transverse Mercator

N

Scale (A4)
0 50 100 m

Figure 5: Taromeo Creek roost and housing bufffer zones
Blackbutt, QLD
Prepared for Southern Burnett Regional Council

Rev	Description	Drawn	Approved	Date
O	Issued for use	SMIN		17/08/2023
A	Issued for review	SMIN		17/08/2023

Job Number:

redleaf ENVIRONMENTAL

9 References

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10 Appendix A – National Flying-fox monitoring map

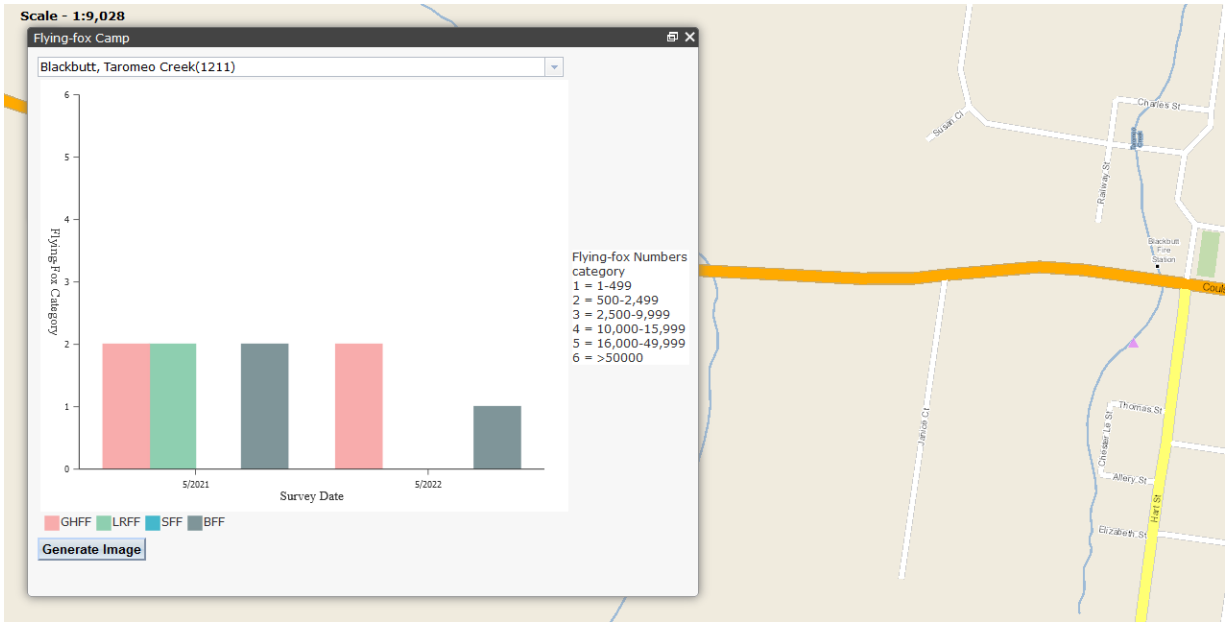


Figure 7 Previous data on flying fox numbers at the Blackbutt roost from the National flying fox monitoring map.

11 Appendix B – Australasian Bat Society Flying Fox Dispersal Statement

Table 1 Summary of known documented attempts to disperse Australian flying-fox camps using non-lethal methods, during 1990 to 2013.

Location	Species	FF population estimate at time of dispersal	Method	Did the animals leave the local area?	Did the local population reduce in size?	How far did they move?	Were new camps formed (number of new camps if known)?	Number of separate actions	Cost (if known)	Was conflict resolved at the original site?	Was conflict resolved for the community?	Source+
Barcaldine, Qld	R	>50,000	VN	no	no	≈2 km	yes (1)	trees in township felled		yes	no	a,b
Batchelor, NT	B	200	BNS	no	no	<400 m	yes (1)	2		yes	yes	c,d
Boyne Island, Qld	BR	25,000	LNS	no	no	<500 m	yes (2)	3		yes	no	e,f,g
Bundall, Qld	GB	<1600	V	no	no	uk, but 6 camps were within 5 km	yes (2)	1 action over 21 days		yes	yes	h,i,j, k
Charters Towers, Qld	RB	variable	HLNPOW	no	no	200 m	no (returned to original site)	repeated since 2000	>$500,000	no	no	l,m
Dallis Park, NSW	BG	28,000	V	no	yes	300 m	yes (1)	2		yes	no	n
Duaringa, Qld	R	>30,000	VNFO	no	no	400 m	yes	1	$150,000	yes	uk	o
Gayndah, Qld	RB	200,000	VN	no	no	600 m	yes	3 actions, repeated		yes	no	i
Maclean, NSW	BGR	20,000	NS	no	no	350 m	yes (7)	>23	>$400,000 and ongoing	no	no	n
Mataranka, NT	BR	>200,000	BHLNOSW	no	no	<300 m	uk	>9		no	no	n
North Eton, Qld	B	4800	VNFB	uk	no	<1.5 km initially	yes (≈4 majority temporary)	2	$45,000	yes	yes (conflict at one site)	j,p,q,r

Location	Species	FF population estimate at time of dispersal	Method	Did the animals leave the local area?	Did the local population reduce in size?	How far did they move?	Were new camps formed (number of new camps if known)?	Number of separate actions	Cost (if known)	Was conflict resolved at the original site?	Was conflict resolved for the community?	Source+
Royal Botanic Gardens, Melbourne, Vic	G	30,000	NS	no	no	6.5 km	yes (2)	approx daily for 6 mths	$3 million	yes	yes, ongoing management required	m
Royal Botanic Gardens, Sydney, NSW	G	3,000	LNPOW	no	no	4 km	no	ongoing daily actions for 12 mths	>$1 million and ongoing	yes	yes	m,s,t
Singleton, NSW	GR	500	LNUW	no	no	<900 m	no (returned to original site	>3	$117,000 and ongoing	no	no	n,u
Townsville, Qld	BR	35,000	BNS	no	no	400 m	no (returned to original site)	5		no	no	n
Warwick, Qld	GRB (dispersal targeted R)	200,000	NLBP	no	no	≈1 km	no (site known to be previously occupied by GB)	5 days	$28,000	yes	no (complaints persisted until migration)	h,v,w
Young, NSW	L	<5000	VN	no	no	<600 m	yes (1)	uk		yes	no	x

* G = grey-headed flying-fox; B = black flying-fox; R = little red flying-fox

B = "birdfrite"; F = fog; H = helicopter; L = lights; N = noise; P = physical deterrent; O = odour; S = smoke; U = ultrasonic sound; V = extensive vegetation removal; W = water.

[a] Storm Stanford (Wildlife carer, pers. comm. 2013); [b] Louise Saunders (BCRQ, pers. comm. 2013); [c] Phillips *et al.* (2007) Displacement of Black flying-foxes *Pteropus alecto* at Batchelor, Northern Territory *Australian Zoologist* 34: 119-124; [d] John McCarthy (Northern Territory Government, pers. comm. 2010); [e] Roberts (2006) *Management of Urban Flying-fox Camps: Issues of Relevance to Camps in the Lower Clarence, NSW.* Valley Watch Inc., Maclean; [f] Information from Gladstone Regional Council in 2010 and 2013; [g] Joe Adair (formerly DEHP, pers. comm. 2010); [h] Trish Wimberly (Australia Bat Clinic pers. comm. 2013); [i] Information obtained from Department of Environment and Heritage Protection (DEHP) in 2013; [j] Billie Roberts unpublished data; [k] Information from Ecosure [l]Scott Sullivan (DEHP, pers. comm. 2010); [m] Information from Charters Towers Regional Council in 2010 and 2013; [n] Roberts *et al.* (2012b) and additional references within; [o] Perry Deeds (Central Highlands Regional Council, pers. comm. 2013); [p] Jarmaine (2010) *Species Management Plan,* Mackay Regional Council; [q] Heidi Jarmaine (Mackay Regional Council, pers. comm. 2013); [r] Daryl Barnes (Walkerston resident, pers. comm. 2013) [s] Peggy Eby (Ecologist, pers. comm. 2013) [t] John Martin (Sydney RBG, pers. comm. 2013); [u] Singleton Council Meeting Minutes; [v] Information from the Southern Downs Regional Council in 2013; [w] Tim Low (pers. comm. 2013); [x] Young Shire Council.

12 Appendix C – Flying-fox Management Code of Practice, DES

Code of Practice

Ecologically sustainable management of flying-fox roosts

Nature Conservation Act 1992

Queensland Government

Human Rights compatibility
The Department of Environment and Science is committed to respecting, protecting and promoting human rights. Under the *Human Rights Act 2019*, the department has an obligation to act and make decisions in a way that is compatible with human rights and, when making a decision, to give proper consideration to human rights. When acting or making a decision under this code of practice, officers must comply with that obligation (refer to Comply with Human Rights Act).

1. Purpose and operation of this code

1.1 The purpose of this Code of Practice— Ecologically sustainable management of flying-fox roosts ('the Code') is to ensure that the chance of *management actions* under this code resulting in harm to flying-foxes is minimised and all appropriate welfare standards are upheld.

1.2 This code sets out how local governments operating under section 61 of the Nature Conservation (Animals) Regulation 2020, may undertake *management actions*, which may:

1.2.1 destroy a flying-fox roost

1.2.2 drive away, or attempt to drive away, a flying-fox from a flying-fox roost

1.2.3 disturb a flying-fox in a flying-fox roost.

1.3 This code should be read in conjunction with the Flying-fox Roost Management Guideline and the Code of Practice – Low impact activities affecting flying-fox roosts.

1.4 This code is made under section 174A of the *Nature Conservation Act 1992* ('the Act').

2. Prescribed methods for management actions

2.1 The Department of Environment and Science (DES) must be notified at least two business days prior to commencing any *management actions* by completion of the flying-fox roost management notification form (available on the DES website). However, management actions may be commenced earlier than two business days following completion of the flying-fox roost management notification form on the DES website if an *authorised person* gives written notice to that effect (email wildlife.management@des.qld.gov.au).

2.1.1 This notification is valid for a four week period from the date of notification and states all *management actions* conducted in relation to a roost, including dispersal activities conducted at a different location which are required to manage any impacts arising from dispersing the target roost.

2.1.2 If commencement or continuation of activities is delayed beyond this four week timeframe, a further notification form, including the new proposed commencement date and time is required.

2.1.3 If the notified *management actions* involve driving away, or attempting to drive away flying-foxes from a roost, local governments within a 50km radius of the roost must also be notified in writing (e.g. by email) prior to commencing *management actions*.

2.2 No roost tree may be—

2.2.1 destroyed when there are flying-foxes in the tree, or when flying-foxes are near the tree being destroyed (for example, within 20 metres).

2.2.2 trimmed when there are flying-foxes near the trimming (for example, within 10 metres). Note that in cases where trimming or removal of whole trees is necessary for the purposes of protecting public health and safety (e.g. removal of a dangerous branch over a footpath) local governments are authorised (in accordance with this code) to move a flying-fox that is nearby, to another part of the site to allow the trimming to occur.

2.3 All *management actions* must immediately cease, and DES be immediately notified if a flying-fox is killed, injured, or found on the ground as a result of *management actions* (email wildlife.management@des.qld.gov.au). *Management actions* may only recommence after—

2.3.1 the flying-fox has been removed by an *appropriately trained person*, and

2.3.2 the *person in charge* determines, after receiving advice from a *person knowledgeable about flying-fox behaviour,* that resuming *management actions* poses no risk to other flying-foxes at or near the roost.

2.4 Any attempts to move flying-foxes within a roost site (e.g. 'nudging" flying-foxes from one tree to another immediately neighbouring tree), should be undertaken using methods that cause as little disturbance to flying-foxes as possible (e.g. using tree-mounted water sprinklers or floodlights), and must be properly coordinated and led by the *person in charge* to ensure all actions are lawful and in compliance with this code. To remove any doubt, methods that result in flying-foxes being driven away are not authorised under this condition.

2.5 Any driving away, or attempting to drive away flying-foxes from a roost—

2.5.1 must be properly coordinated and led by the *person in charge* to ensure all actions are lawful and in compliance with this code.

2.5.2 may only occur when a *person knowledgeable about flying-fox behaviour* is—

2.5.2.1 for the first two days, *present* at the time of driving away or attempting to drive away flying-foxes and able to provide advice directly to the *person in charge*, and

2.5.2.2 available (e.g. by phone or in person) for the remainder of the time of driving away or attempting to drive away flying-foxes, to provide advice to the *person in charge* as needed.

2.5.3 may only occur in the early evening and/or early morning i.e. during 'fly-out' and/or 'fly-in'.

2.5.4 when being carried out in the early evening, must commence immediately prior to 'fly-out' at a roost and continue for no longer than 3 hours.

2.5.5 when being carried out in the early morning, must commence during 'fly-in' and continue for no longer than 3 hours.

2.5.6 must be limited to non-lethal deterrence methods only, for example, non-lethal use of smoke, noise, light, foggers, water sprinklers, and/or 'scarecrow' type devices. To remove any doubt, methods that physically injure flying-foxes (e.g. high-pressure hoses, caustic soda, paint ball guns) are not authorised.

2.6 N.B. While *management actions* that are in accordance with this code of practice may be undertaken at any time of the year, the *person in charge* must consider avoiding *management actions*—

2.6.1 where possible during certain periods of the year, for example—when females are in the late stages of pregnancy or there are dependant young (e.g. creched young, pups) that cannot sustain independent flight, and

2.6.2 during or immediately after climatic extremes, or weather events that may cause food shortages, such as periods of unusually high temperatures or humidity, cyclones and fires, and

2.6.3 which may negatively impact the conservation of flying-fox species which are listed as *threatened wildlife* under the Act.

2.7. DES must be sent a flying-fox roost management evaluation form (available on the DES website) within six weeks of the date of notification. Should the outcome of the management actions on site

not be fully known in this timeframe, further information may be submitted at a later date by emailing wildlife.management@des.qld.gov.au.

3. Definitions

Act— the *Nature Conservation Act 1992*.

Appropriately trained person— means a person with experience and training in the safe handling of flying-foxes, who is appropriately vaccinated.

Authorised person— means any of the following:
(a) the chief executive, performing functions under the Act;
(b) a public service employee of the department performing functions under the Act for the chief executive;
(c) a conservation officer who is not an employee of the department and who is performing functions under the Act for the chief executive.

Management actions— means non-lethal actions intended to stop flying-foxes from making use of a site or part of a site, and include destroying and/or trimming vegetation at a site, as well as coordinated action to drive flying-foxes away from a site or move flying-foxes within a roost site.

Person in charge— means
(a) if the *management actions* are being performed by a local government— the local government officer on site and leading the *management actions* (or the local government officer directing a contractor to undertake the *management actions*)*;* or
(b) if the *management actions* are being performed by a person under an approved flying-fox roost management permit— the person on site who is leading the *management actions.*

Person knowledgeable about flying-fox behaviour— means a person, who may also be the *person in charge*, able to demonstrate experience in successfully:
(a) classifying flying-fox species; and
(b) assessing flying-fox population numbers in particular roosts; and
(c) identifying flying-fox breeding cycles including evidence of breeding and rearing activity in particular roosts; and
(d) recognising signs of (and circumstances which may result in)—
- i) distress in flying-foxes, and
- ii) harm to flying-foxes, and
- iii) abandoned dependent young flying-foxes.

Present— means on site, or, with chief executive approval (e.g. for remote areas, or urgent management actions), connected by video call or phone call.

Roost or **flying-fox roost**— means a tree or other place where flying-foxes congregate from time to time for breeding or rearing their young.

Threatened wildlife— means native wildlife that is prescribed under the Act as:
(a) extinct wildlife; or
(b) extinct in the wild wildlife; or
(c) critically endangered wildlife; or
(d) endangered wildlife; or
(e) vulnerable wildlife.

13 Appendix D – Flying-fox Management Code of Practice (Low impact activities), DES

Code of Practice

Low impact activities affecting flying-fox roosts

Nature Conservation Act 1992

Queensland Government

Human Rights compatibility
The Department of Environment and Science is committed to respecting, protecting and promoting human rights. Under the *Human Rights Act 2019*, the department has an obligation to act and make decisions in a way that is compatible with human rights and, when making a decision, to give proper consideration to human rights. When acting or making a decision under this code of practice, officers must comply with that obligation (refer to Comply with Human Rights Act).

1. Purpose and operation of this code

1.1 The purpose of this Code of Practice— Low impact activities affecting flying-fox roosts ('the Code') is to ensure that the chance of low impact activities under this code resulting in harm to flying-foxes is minimised and that appropriate welfare standards are upheld.

1.2 This code sets out how a person may undertake low impact activities at, or near, a flying-fox roost anywhere in the State of Queensland in accordance with section 62 of the Nature Conservation (Animals) Regulation 2020.

1.3 This code should be read in conjunction with the Flying-fox Roost Management Guideline and the Code of Practice – Ecologically sustainable management of flying-fox roosts.

1.4 This code is made under section 174A of the *Nature Conservation Act 1992* ('the Act').

2. Prescribed methods for low impact activities

2.1 No roost tree may be trimmed when there are flying-foxes near to the trimming (for example, within 10 metres).

2.2 Any trimming of roost trees must be limited to 10% (in any 12 month period) of the total canopy of the roost tree.

2.3 Low impact activities must immediately cease, and DES be immediately notified, if a flying-fox is killed, injured, or found on the ground as a result of *management actions* (email wildlife.management@des.qld.gov.au). In this circumstance, *low impact activities* may only recommence after—

2.3.1 the flying-fox has been removed by an *appropriately trained person*, and

2.3.2 activities have been ceased for at least the remainder of the day, or, if activities are being undertaken by local government and a *person knowledgeable about flying-fox behaviour* agrees, after a minimum of 2 hours, and

2.3.3 the *person in charge* determines that resuming *low impact activities* poses no risk to other flying-foxes at or near the roost.

2.4 Where *low impact activities* are required to be undertaken during the daytime, works must immediately cease and DES be immediately notified if 30% or more of the adult flying-foxes leave the roost and remain airborne for five minutes or more (email wildlife.management@des.qld.gov.au). In this circumstance, *low impact activities* may only recommence after *low impact activities* have been ceased for a minimum of 2 hours, or, if activities are being undertaken by local government and a *person knowledgeable about flying-fox behaviour* agrees, at any time.

2.5 Any necessary installation, maintenance, or removal of infrastructure in close proximity to roost trees (e.g. fences, underground pipes, high-pressure hosing of footpaths), or mulching, mowing, weeding, or watering under or near roost trees, should be undertaken with as little disturbance to flying-foxes as possible (for example, using low impact and low noise equipment, or after the dusk fly-out is complete).

2.6 N.B. While *low impact activities* that are in accordance with this code of practice may be undertaken at any time of the year, the *person in charge* must consider avoiding *low impact activities* **—**

2.6.1 where possible during certain periods of the year, for example—when females are in the late stages of pregnancy or there are dependant young (e.g. creched young, pups) that cannot sustain independent flight, and

2.6.2 during or immediately after climatic extremes, or weather events that may cause food shortages, such as periods of unusually high temperatures or humidity, cyclones, or fires, and

2.6.3 which may negatively impact the conservation of flying-fox species which are listed as threatened wildlife under the Act.

3. Definitions

Act— the *Nature Conservation Act 1992*.

Appropriately trained person— means a person with experience and training in safe handling of flying-foxes, who is appropriately vaccinated.

Low impact activities— means mulching, mowing, weeding, watering under or near roost trees, minor trimming of roost trees, and installation, maintenance or removal of infrastructure, where the activities are not directed at destroying a flying-fox roost, driving away, or attempting to drive away, a flying-fox from a flying-fox roost, or disturbing a flying-fox in a flying-fox roost.

Person in charge— means
(a) if the *low impact activities* are being performed by a local government— the most senior local government officer on site and leading the *low impact activities* (or the local government officer directing a contractor to undertake the *low impact activities*); or
(b) if the *low impact activities* are being performed by a person— the person on site who is leading the *low impact activities*.

Person knowledgeable about flying-fox behaviour— means a person, who may also be the *person in charge*, able to demonstrate experience in successfully:
(a) classifying flying-fox species; and
(b) assessing flying-fox population numbers in particular roosts; and
(c) identifying flying-fox breeding cycles including evidence of breeding and rearing activity in particular roosts; and
(d) recognising signs of (and circumstances which may result in)—
- i) distress in flying-foxes, and
- ii) harm to flying-foxes, and
- iii) abandoned dependent young flying-foxes.

Roost or **flying-fox roost**— means a tree or other place where flying-foxes congregate from time to time for breeding or rearing their young.

Threatened wildlife— means native wildlife that is prescribed under the Act as:
(a) extinct wildlife; or
(b) extinct in the wild wildlife; or
(c) critically endangered wildlife; or
(d) endangered wildlife; or
(e) vulnerable wildlife.

14 Appendix E – Kooloonbung Creek flying fox camp noise assessment.

Kooloonbung Creek Flying Fox Camp Noise Assessment

Information Brochure 2021

Background

The Kooloonbung flying-fox camp was established in the 1990s and is occupied by three different species: the Grey-headed Flying-fox (*Pteropus poliocephalus*), the Black Flying-fox (*P. alecto*) and the Little Red Flying-fox (*P. scapulatus*). The Grey-headed Flying-fox is a threatened species listed as Vulnerable to extinction under both the NSW *Biodiversity Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. This legal status provides protection to this species and their habitat.

The behaviour of flying-foxes means that the number of individuals present in a camp at any given time can change significantly. Camps often occur in favourable habitat and near food resources. Changes in availability and seasonality of these food resources can lead to changes in the number of individual flying-foxes present in a camp. Flying-fox camps may be permanently occupied by some individuals, but only seasonally or temporarily visited by others. For these reasons, the number of individual flying-foxes present in a camp can change quite significantly depending on the time of year. Counts of flying-foxes in the Kooloonbung Creek camp carried out over several years show that the number of individuals in the camp can range from around 1,000 flying-foxes over a relatively small area to around 170,000 flying-foxes spread over 77 hectares.

Flying-foxes can make a lot of screeching noises during the day and throughout the night. They are typically most noisy when they leave at dusk to feed and when they return at dawn to find a roost. The greatest noise impacts to residents tend to occur at dawn roosting times. During the day-time flying-foxes continue to make some noise, and are noisiest when stressed or scared, such as when they are disturbed by people (e.g. people mowing the lawn). At night-time they can also be noisy if there is a small group of flying-foxes feeding on fruiting or flowering trees, including palm trees.

What was the Purpose of the Noise Assessment?

The Kooloonbung Creek Flying-fox Camp Management Plan prepared in 2019 provides a number of management actions that aim to manage community concerns in relation to the camp whilst at the same time conserving flying-foxes and their habitat. Amongst other things, the Plan recommends a combination of property modifications and land use planning to manage noise impacts to residents of existing and proposed development near the camp.

The purpose of the noise assessment project was to quantify and map the noise impacts of the flying-fox camp and to develop recommendations for potential property modifications to manage noise impacts based on the extent to which individual properties are impacted. It is intended that the noise assessment provide a scientific foundation for decision making by Council and residents.

Noise Assessment Methodology

The noise assessment was carried out by a team of specialist acoustic engineers and involved the following steps:

- Monitoring of the actual noise levels around the camp over a period of seven days in February 2021, which is the time of year the camp is usually at its largest;
- Counts of the number of flying-foxes in the camp were also undertaken at the start and end of this period to verify the noise model. There were around 26,500 individuals on the 9 February and 57,000 on 18 February 2021;
- 3D computer-based noise modelling based on the measured noise levels, number of flying-foxes present, site topography and taking into account the location of buildings in the study area. Two scenarios were considered – a typical camp represented by the average camp size for February 2021 and a ‘worst case scenario’ adopting a camp size of 170,000 individuals;
- Identification of a suitable internal noise objective, being the noise level beyond which noise mitigation would be recommended;
- Generation of noise contour maps for each scenario showing the level of noise impact in different locations; and
- Identification of property modifications that would potentially be effective in reducing the flying-fox noise levels inside residential dwellings (in particular bedrooms) to meet the internal noise objective.

Noise Assessment Methodology (*cont.*)

Noise is the sound pressure level measured in decibels (dB), and overall noise includes sounds with frequencies in the audible hearing range. For humans, assessments normally consider the overall noise level for sounds between the 63 Hz and 8,000 Hz single octave bands. Humans are generally more sensitive to higher frequencies of noise, such as those made by flying-foxes (at 2,000-4,000 Hz).

There are no guidelines specific to assessing impacts of animal noise on humans, and therefore the noise assessment considered the NSW Department of Planning's Development Near Rail Corridors and Busy Roads - Interim Guidelines (2008). Residents have advised that the flying-foxes are noisiest at dawn and this was supported by the noise measurements, which found they were noisiest between 5:45AM and 6AM. For this reason, the criteria from the Guidelines relating to sleep areas was adopted as the internal noise objective for this assessment. The Guideline recommends that noise levels in sleeping areas be limited to 35 dBA where feasible so as to minimize the risk of occupants being woken from sleep.

Painful	120	Jet take off at runway edge
	110	Rock concert
	100	225mm angle grinder at 1 metre
	90	Heavy industrial factory interior
Noisy	80	Shouting at 1 metre
	70	Freeway at 20 metres
	60	Normal conversation at 1 metre
	50	A running refrigerator
Quiet	40	Office air-conditioning, background noise level in a standard place of worship
Very Quiet	20	Whisper, broadcast studio
	10	Human breathing at 3 metres
	0	Threshold of typical hearing

Table 1. Range of typical Noise Levels, dBA relative to 20 microPascals

Noise assessment results

Figures 1 and 2 show the results of the noise modelling. Figure 1 shows the results for Scenario 1, which corresponds to the average camp size during the noise monitoring period. Figure 2 (see overpage) shows the results for Scenario 2, which is the 'worst case scenario' of a maximum camp size.

The extent of the camp adopted in the noise model is shown in blue hatching on the figures. The colour-coded contours show the noise levels.

The results show that dwellings close to the parts of the camp with larger numbers of flying-foxes are being impacted by noise levels between 55-75 dBA.

It is noted that, based on a typical residential dwelling construction, noise levels as measured at the façade of a building may be up to around 20 dBA lower inside the building with the windows and doors closed. That is, if the noise levels at the façade of the building are 55dBA, the internal noise levels would likely achieve the internal noise objective of 35 dBA.

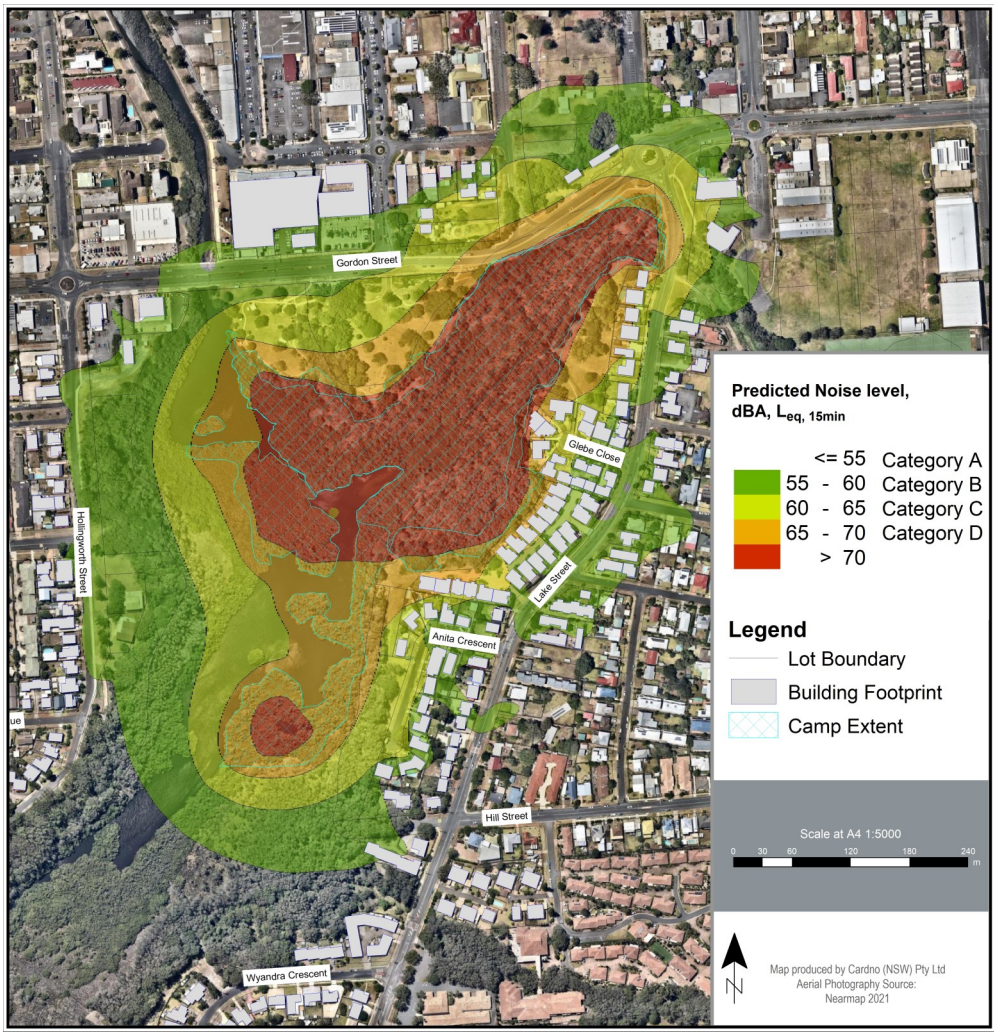


Figure 1. Predicted noise level from Scenario 1 which represents the average camp extent

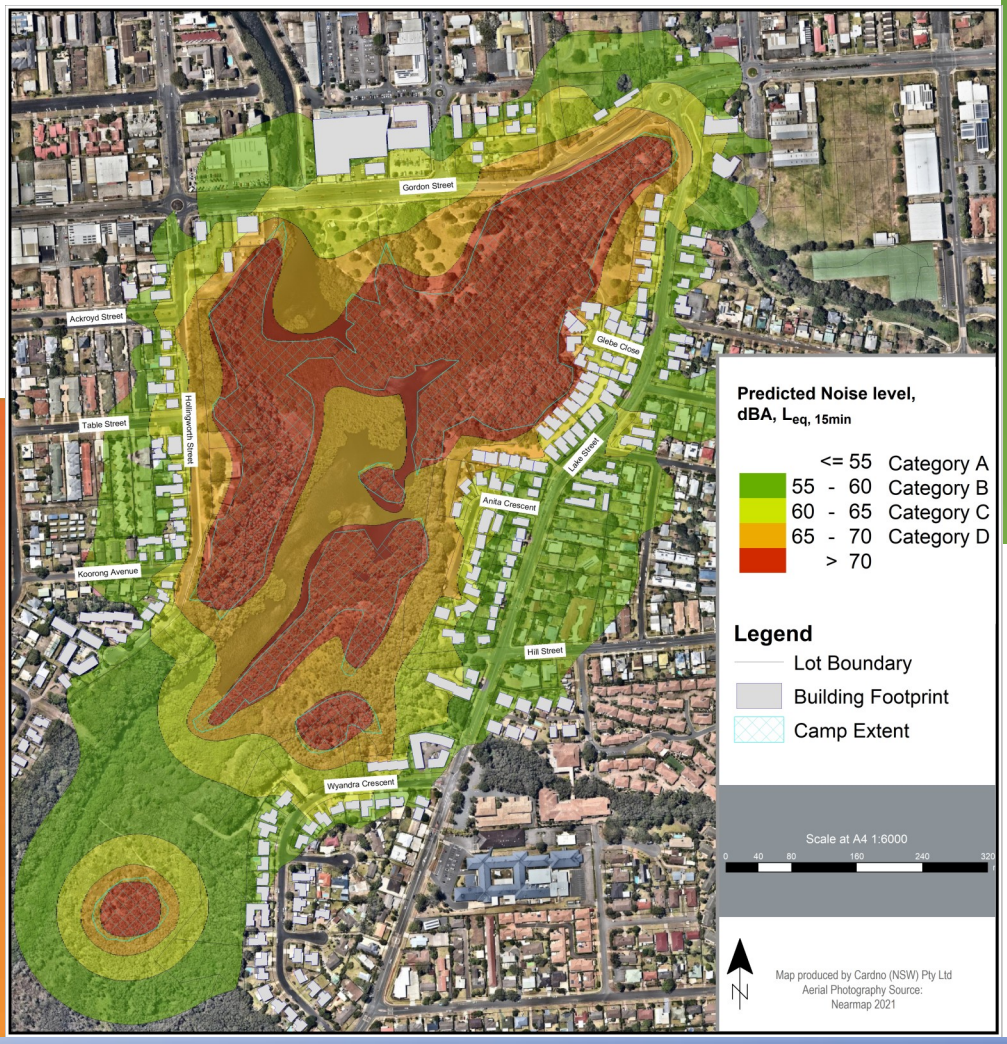


Figure 2. Predicted noise levels from Scenario 2 which represents the maximum camp extent

What can be done to reduce the impacts of noise on residents?

Property modifications can be undertaken to reduce the impact of noise inside a building. Due to the time of day the flying-foxes disturb residents, it was considered appropriate to target sleeping areas, as this is where the greatest benefit to residents can be achieved. These include:

- Window glazing, with thicker glazing achieving greater noise reductions;
- Using acoustic seals where noise could get in, such as around windows and doors; and
- Installation of insulation in the ceiling void.

To ensure the property modifications are effective, windows and doors should be closed, which may result in the need for mechanical ventilation (e.g. air conditioning) to provide fresh air. Dwellings with mechanical ventilation may have increased energy consumption and potentially higher electricity bills. There is also potential for any air conditioning units (or similar devices) to create additional noise nuisance to nearby residences. It may be necessary to shield any new air conditioners or locate them so that they cannot be heard inside neighbouring residences.

Based on the noise modelling results, the required property modifications to achieve the internal noise objective for different levels of external noise impact are provided in Table 2. The building treatment categories in Table 2 align with the noise mapping in Figures 1 and 2:

- Residences located within the orange or red contours are Category D;
- Residences located within the yellow zone are Category C;
- Residences within the green zone are Category B; and
- Residences in all other areas are Category A.

It is recommended that typical glazing in the range of 4-6 mm be avoided for buildings that are most affected by noise from flying-foxes. This is because it does not perform as well for noise frequencies similar to that made by flying-foxes. For buildings that are more impacted by noise, glazing of 10-10.38 mm thickness may provide better outcomes while avoiding more expensive options such as double glazing or upgrading of the external walls and ceilings.

What can be done to reduce the impacts of noise on residents? *cont.*

Table 2. Recommended property modifications to reduce noise impact. The weighted sound reduction index (Rw), is the single number acoustic rating for sound transmission loss, determined by laboratory testing in accordance with ISO 717-1. It is used to compare the acoustic performance for different partitions. A higher Rw rating indicates better acoustic performance (that is, more noise reduction) than a lower Rw rating.

Category	External noise level	Glazing treatment	Building Façade Treatment
Existing residential development – Sleeping areas			
A	<55 dBA	No treatment needed	No treatment needed
B	55-60 dBA	Rw 29 – 6mm float glass with acoustic seals	Seal gaps and holes
C	60-65 dBA	Rw 31 - 6.38mm laminate glass with acoustic seal	Seal gaps and holes Insulation to ceiling void
D	>65-70 dBA	Rw 35 - 10.38mm laminate glass with acoustic seals	Seal gaps and holes Insulation to ceiling void
Future residential development – Sleeping areas			
A	<55 dBA	No treatment needed	No treatment needed
B	55-60 dBA	Rw 29 – 6mm float glass with acoustic seals	External wall system to achieve Rw 35 External roof/ceiling system to achieve Rw 35
C	60-65 dBA	Rw 31 - 6.38mm laminate glass with acoustic seal	External wall system to achieve Rw 38 External roof/ceiling system to achieve Rw 38
D	>65 dBA	Rw 35 - 10.38mm laminate glass with acoustic seals	External wall system to achieve Rw 40 External roof/ceiling system to achieve Rw 38

How do I find out more information?

For more information about the Kooloonbung Creek flying fox camp noise assessment please contact Port Macquarie Hastings Council.

PORT MACQUARIE HASTINGS COUNCIL

Contact information

Phone: 02 6581 8111

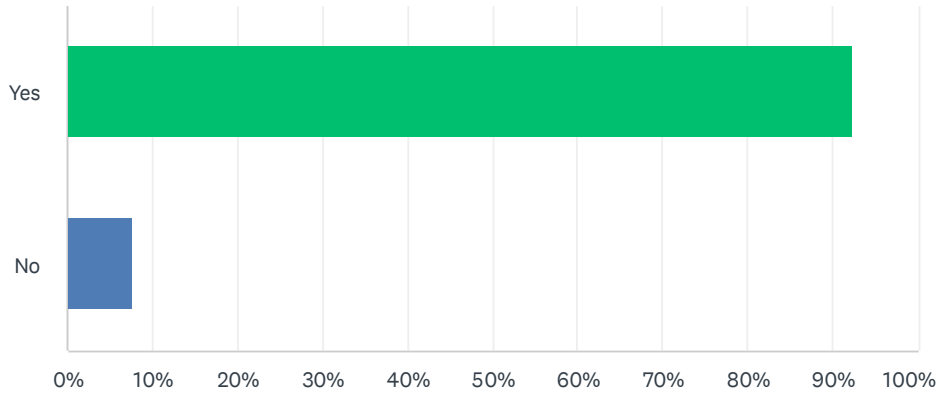
Email: council@pmhc.nsw.gov.au

Website: www.pmhc.nsw.gov.au

15 Appendix F – Flying Fox Survey Results

Q1 Are you a resident of Blackbutt?

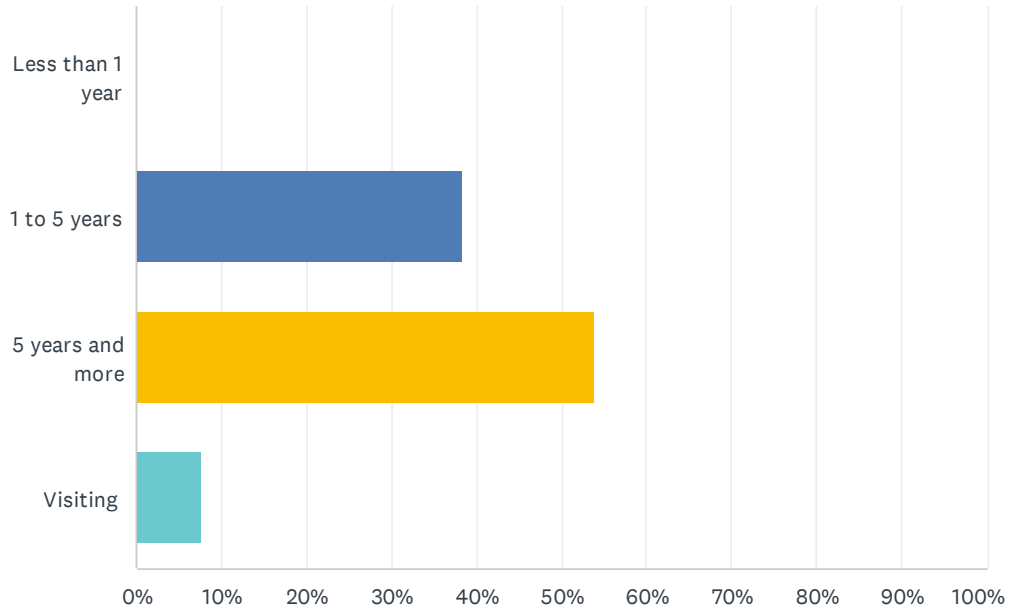
Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	92.31%	12
No	7.69%	1
TOTAL		13

Q2 How long have you resided in Blackbutt?

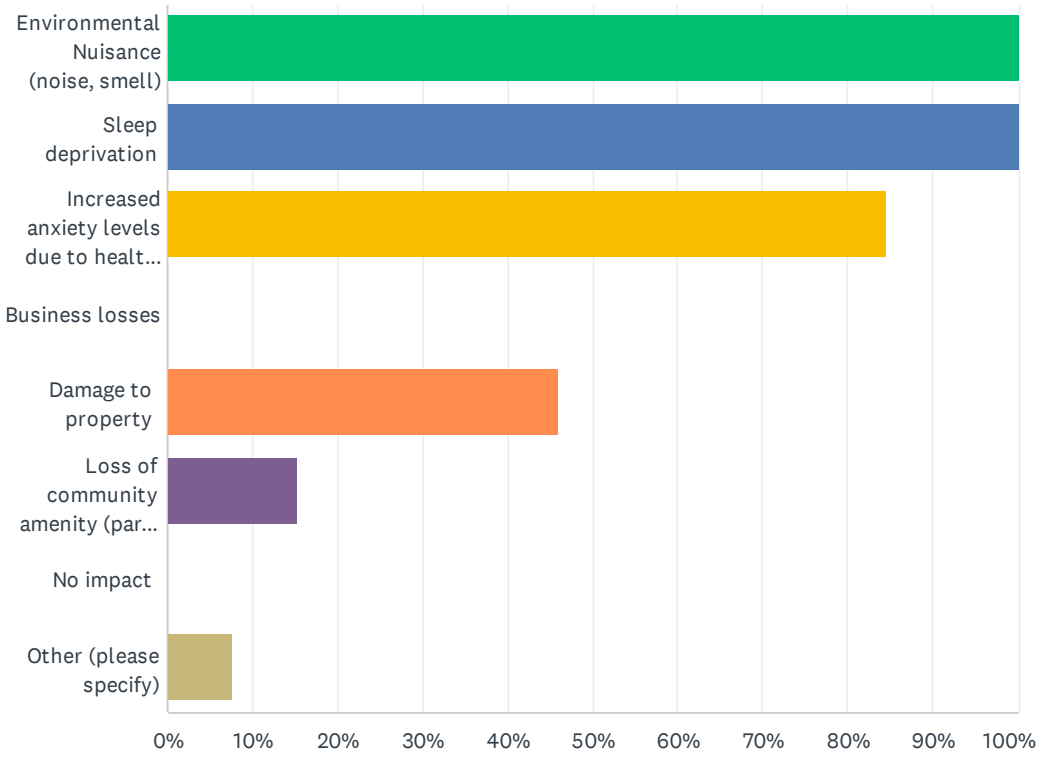
Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Less than 1 year	0.00%	0
1 to 5 years	38.46%	5
5 years and more	53.85%	7
Visiting	7.69%	1
TOTAL		13

Q3 Are you impacted by any of the following when flying foxes visit Blackbutt?

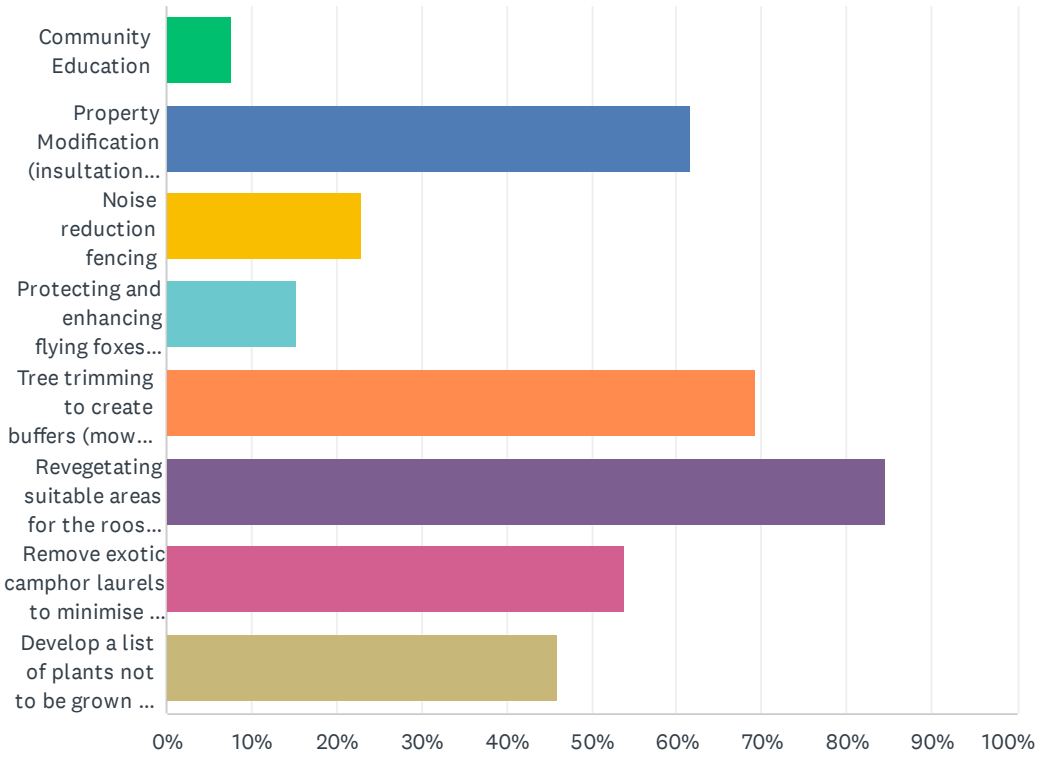
Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Environmental Nuisance (noise, smell)	100.00%	13
Sleep deprivation	100.00%	13
Increased anxiety levels due to health concerns	84.62%	11
Business losses	0.00%	0
Damage to property	46.15%	6
Loss of community amenity (parks, playgrounds)	15.38%	2
No impact	0.00%	0
Other (please specify)	7.69%	1
Total Respondents: 13		

Q4 Which of the following management options do you support?

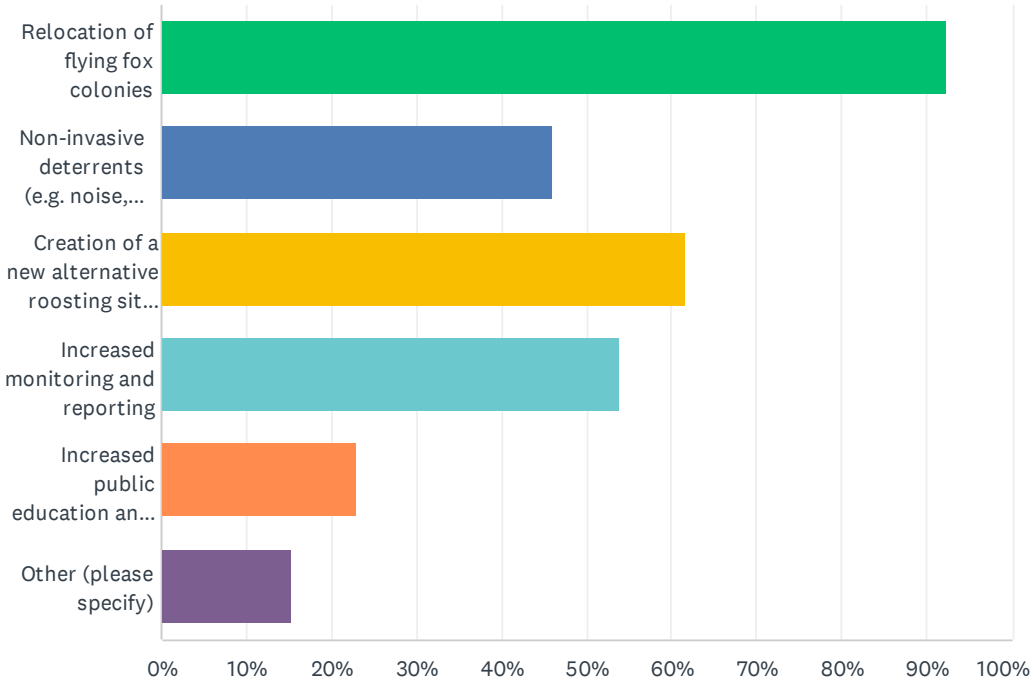
Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Community Education	7.69%	1
Property Modification (insultation, double glazed windows, planting trees as a screen)	61.54%	8
Noise reduction fencing	23.08%	3
Protecting and enhancing flying foxes roost habitat in low conflict areas	15.38%	2
Tree trimming to create buffers (mowed grass between flying foxes roost and dwellings)	69.23%	9
Revegetating suitable areas for the roost to relocate to in the long term	84.62%	11
Remove exotic camphor laurels to minimise the colony splitting into these trees	53.85%	7
Develop a list of plants not to be grown in urban areas that suitable roosting trees near houses, schools, childcare centres etc	46.15%	6
Total Respondents: 13		

Q5 What methods would you like to see Council adopt in managing flying fox populations?

Answered: 13 Skipped: 0



ANSWER CHOICES	RESPONSES	
Relocation of flying fox colonies	92.31%	12
Non-invasive deterrents (e.g. noise, light, sprinklers)	46.15%	6
Creation of a new alternative roosting site in Blackbutt with 50-100m buffer from the roost to the nearest house	61.54%	8
Increased monitoring and reporting	53.85%	7
Increased public education and awareness programs	23.08%	3
Other (please specify)	15.38%	2
Total Respondents: 13		

16 Appendix G – Site Photos

Dense understorey in Site 3.

Flying fox in tree adjacent to Site 7.

Sparse vegetation in Site 16.

Dense vegetation in Site 5.

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