



# Ingham Memorial Gardens

Roost Remediation Works – Final  
March 2018

HINCHINBROOK SHIRE COUNCIL



ecology / vegetation / wildlife / aquatic ecology / GIS



## Acronyms and abbreviations

BFF	black flying-fox ( <i>Pteropus alecto</i> )
COP	Code of Practice
Council	Hinchinbrook Shire Council
DES	Department of Environment and Science
EHP	Department of Environment and Heritage Protection (former)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GHFF	grey-headed flying-fox ( <i>P. poliocephalus</i> )
LRFF	little red flying-fox ( <i>P. scapulatus</i> )
NC Act	<i>Nature Conservation Act 1992</i>
SFF	spectacled flying-fox ( <i>P. conspicillatus</i> )
UFFMA	Urban flying-fox management area

# Contents

Acronyms and abbreviations .....	i
List of figures .....	iii
List of tables.....	iii
1 Introduction .....	1
1.1 Scope of works .....	1
1.2 Legislative requirements .....	1
1.3 Flying-foxes in urban areas.....	2
1.4 Flying-fox breeding season .....	2
2 Site assessment .....	3
2.1 Roost characteristics.....	3
2.2 Impacts of flying-foxes on vegetation and the site .....	4
2.3 Proximity to residential areas and sensitive sites. ....	5
2.4 Other ecological values.....	5
3 Recommendations .....	6
3.1 Code requirements .....	6
3.2 Risk management.....	6
3.2.1 Personnel and community.....	6
3.2.2 Flying-fox welfare.....	8
3.2.3 Avoiding inadvertent dispersal .....	8
3.3 Responsibilities .....	9
3.4 Resources .....	9
3.5 Sequencing.....	10
4 Work plan .....	12
4.1 Post management options .....	15
4.1.1 Education.....	15
4.1.2 Odour reduction .....	15
4.1.3 Canopy mounted sprinklers .....	15
4.1.4 Minimising maintenance .....	15
5 Conclusion.....	16
References .....	17
Appendix 1 UFFMA.....	18
Appendix 2 Summary of dispersals in Australia 1990 to 2013.....	20

## List of figures

Figure 1 Site location and flying-fox roost extent .....	1
Figure 2 Flying-fox breeding season showing key birthing and dependant young months (source: P. Ingerson HSC 2018) .....	2
Figure 3 Main roost in Lee Park .....	3
Figure 4 Memorial Gardens roost trees on McIlwraith Street.....	3
Figure 5 Remediation works staged areas .....	11

## List of tables

Table 1 Signs of stress in flying-foxes .....	8
Table 2 Proposed personnel roles on site .....	9
Table 3 Stages of works.....	10
Table 4 Staged work plan .....	12

# 1 Introduction

Hinchinbrook Shire Council (Council) engaged Ecosure Pty Ltd to provide advice for conducting remediation works within the Ingham Memorial Gardens flying-fox roost. The roost has historically contained four species of flying-fox:

- grey-headed flying-fox (*Pteropus poliocephalus*) (GHFF)
- spectacled flying-fox (*P. conspicillatus*) (SFF)
- black flying-fox (*P. alecto*) (BFF)
- little red flying-fox (*P. scapulatus*) (LRFF).

All of these species are protected under Queensland legislation (*Nature Conservation Act 1992*; NC Act). The GHFF and SFF are also listed as Vulnerable under Commonwealth legislation (*Environment Protection and Biodiversity Conservation Act 1999*; EPBC Act), affording them additional protection. Flying-foxes have been recorded in Ingham in the National Flying-fox Monitoring Program since 2012 (DoE 2017) and in the Memorial Gardens for two and a half years (Figure 1).

## 1.1 Scope of works

A section of the Memorial Gardens has become damaged, overgrown and weedy due to the presence of flying-foxes. The proposed remediation works will need to utilise a variety of plant and motorised equipment under and near the roost to in order to:

- remove vegetation and debris from pond
- remove fallen vegetation and dead and dying trees
- slash, mow and whipper-snip overgrown vegetation
- clean the existing concrete footpath and bridge.

## 1.2 Legislative requirements

Local governments are authorised as-of-right under the NC Act to manage flying-fox roosts in defined urban flying-fox management areas (UFFMA). UFFMA mapping for Ingham is shown in Appendix 1. As-of-right management activities must be undertaken in accordance with Code of practice (COP): ecologically sustainable management of flying-fox roost (EHP 2013a) which outlines how Council may:

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

The COP for low impact activities affecting flying-fox roosts (EHP 2013b) sets out how low

impact activities may be undertaken at a flying-fox roost in accordance with section 41B of the Nature Conservation (Wildlife Management) Regulation 2006. Under this code, low impact activities are; mulching, mowing or weeding under or near roost trees, and/or minor trimming of roost trees, 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.

The following actions in or near GHFF/SFF camps are defined as being unlikely to have a significant impact and therefore are unlikely to require approval under the EPBC Act:

- minor, routine camp management at any camp
- clearing vegetation, dispersal of animals, *in situ* flying-fox management or other impacts on flying-fox camps, that are not nationally important flying-fox camps, that is carried out in accordance with state or territory regulatory requirements.

### 1.3 Flying-foxes in urban areas

Flying-foxes appear to be roosting and foraging in urban areas more frequently. There are many possible drivers for this, as summarised by Tait et al. (2014):

- loss of native habitat and urban expansion
- opportunities presented by year-round food availability from native and exotic species found in expanding urban areas
- disturbance events such as drought, fires, cyclones
- human disturbance or culling at non-urban roosts or orchards
- refuge from predation
- movement advantages, e.g. ease of manoeuvring in flight due to the open nature of the habitat or ease of navigation due to landmarks and lighting.

Flying-foxes roosting and foraging in urban areas more frequently can give the impression that their populations are increasing however, GHFF and SFF are in decline across their range (Westcott 2016). There is a wide range of ongoing threats to the survival of the GHFF and SFF, including:

- habitat loss and degradation
- conflict with humans (including culling at orchards)
- infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.)
- predation by native and introduced animals
- exposure to extreme natural events such as cyclones, drought and heat waves.

Flying-foxes have limited capacity to respond to these threats and recover from large population losses due to their slow sexual maturation, small litter size, long gestation and extended maternal dependence (McIlwee & Martin 2002).





**Figure 1: Site location and flying-fox roost extent**

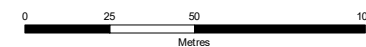
Hinchinbrook Shire Council

Ingham Memorial Gardens Flying Fox Assessment

- Roost extent (as at 20 Feb 2018)
- Property boundary



Job number: PR3312  
Revision: 0  
Author: KF  
Date: 27/02/2018



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

## 1.4 Flying-fox breeding season

Young BFF, GHFF and SFF are born from September to November (Churchill 2008), although the birthing season becomes progressively earlier, albeit by a few weeks, in more northerly populations (McGuckin & Blackshaw 1991) and out of season breeding is common. Key mating periods in the little red flying-fox are between November and January, with birthing peaks in April to June (BCC 2010) (Figure 2). GHFF and SFF young are usually weaned by six months of age around March making this time the critical window to undertake work if LRFF were to return.

Jan	BFF,SFF & GHFF Dependant young
Feb	
March	Young flying out
April	LRFF Birthing
May	
June	Dependant young
July	
August	Young flying out
Sept	BFF,SFF & GHFF Birthing
October	
November	
December	Dependant young

Figure 2 Flying-fox breeding season showing key birthing and dependant young months  
(source: P. Ingerson HSC 2018)

There is a general migration pattern in little red flying-fox, whereby large congregations of over one million individuals can be found in northern roosting sites (e.g. Northern Territory, North Queensland) during key breeding periods (Vardon & Tidemann 1999). Outside of these periods little red flying-fox undertake regular movements from north to south during winter-spring (July-October) (Milne & Pavey 2011).



## 2 Site assessment

An Ecosure Senior Wildlife Biologist undertook a site assessment at Ingham Memorial flying-fox roost on 19 and 20 February 2018. The assessment included:

- flying-fox species present, numbers, condition and breeding activity
- area occupied by flying-foxes
- public use of the roost site
- impacts of flying-foxes on the vegetation and site in general
- proximity of impacts of flying-foxes to residential areas and sensitive sites.

A risk assessment was undertaken to determine how to stage remediation works at the Memorial Gardens in a way that minimises risks to the community and ensures flying-fox welfare.

### 2.1 Roost characteristics

The area occupied by flying-foxes (the roost extent) is shown in Figure 1. The majority of the colony, around 15,000 flying-foxes are roosting in large trees in Lee Park along Palm Creek on Council and private land (Figure 2). A much smaller portion of the colony, approximately 2,000 flying-foxes, are roosting in the Memorial Gardens near McIlwraith Street (Figure 3) and towards the railway line.



Figure 3 Main roost in Lee Park



Figure 4 Memorial Gardens roost trees on McIlwraith Street

Three species of flying-foxes were present during the site assessment:

- ~16,000 BFF
- 54 SFF with several dependent young
- 61 GHFF with several dependent young.

The majority of the BFF in the roost appeared to comprise young bats, most likely last year's and this year's young. Whilst most of these juveniles were able to fly and leave the roost for the night's foraging, flying-foxes likely to be creching or learning to fly were heard to remain behind at the roost area in the Memorial Gardens. Despite the young demographic of the roost, flying-foxes appeared in good health with only two BFF carcasses observed.

During the assessment, a mother (likely GHFF) was seen flying with a pup attached in the Lee Park section of the roost. Of note, there are up to 10 SFF mothers with young at various ages roosting near the pond in the Memorial Gardens. This will be an area of focus for the knowledgeable person during works.

LRFF were noted by Council to have left about a week before the assessment. This is advantageous to the proposed works because:

- more space is created within a limited roosting area for flying-foxes to move to during and after remediation works
- the LRFF were due to give birth in April; so works may potentially be extended into April which would not have been possible with LRFF young present. However, LRFF may return at any time, and as such it is recommended that works are scheduled in March as planned.

## 2.2 Impacts of flying-foxes on vegetation and the site

Large number of flying-foxes roosting in the Memorial Gardens necessitated that pathways around the pond be cordoned off from public access. Vegetation exhibited defoliation, striped bark from branches and trunks, broken branches and tree fall. Without regular maintenance, much of the ground cover and understory has become overgrown and unsightly.

During the assessment, Ecosure also met with Council staff on site as well as Ingham Councillors to understand their concerns and issues, which included:

- damage to council asset, reduction in value and aesthetic
- damage to vegetation
- closure of part of the gardens including footpaths
- closure of bus stop
- complaints from surrounding business regarding smell
- pathways covered in faeces

- that memorial gardens are in a presentable condition for upcoming ANZAC day ceremony.

## 2.3 Proximity to residential areas and sensitive sites.

The location of the roost along Palm Creek acts as natural buffer to other sensitive receptors such as residential areas, hospitals and medical facilities, child care centres, aged care homes, schools, equine facilities and aviation facilities and as such, no significant community conflict or impact to human health and well-being is occurring. Flying-foxes when dispersed from a roost almost always create a splinter roost within 600 m (Appendix 2). Sensitive sites within 600 m of Memorial Gardens include:

- Ingham State School
- Our Lady of Lourdes Primary School
- Ingham Preschool
- Ingham Health Services.

An electrical storm early in the early hours of Wednesday 21 February, appeared to effect a small number of flying-foxes that were found roosting in trees at two of the nearby schools. When changing the structural composition of a roost, flying-foxes are likely to be deterred from roosting there however where they move to cannot be absolutely determined.

Careful monitoring of the surrounds is critical during and immediately following these works to identify any splinter roosts. Any new roosts will need to be assessed by the knowledgeable person to determine whether the location is appropriate or not. If a new location is likely to cause risk, or the landholder is not amenable to a flying-fox roost at the location, flying-foxes may need to be dispersed. A dispersal plan should be developed in this scenario prior to dispersal.

## 2.4 Other ecological values

During the site assessment, several different frog calls could be heard around the Memorial Gardens pond. Council staff have also reported the presence of two large pythons. Previously, the pond was drained to deter the flying-foxes, however the water level in the pond has increased and could contain aquatic fauna such as turtles or eels. Due to the need for heavy machinery, the presence of other wildlife will need to be taken into consideration during remediation works including the provision of a fauna spotter catcher (FSC) to relocate animals in the impact area.



## 3 Recommendations

Remediation works will be undertaken in accordance with Code of Practice – ecologically sustainable management of flying-fox roosts (EHP 2013a), and ideally also aligned with the Flying-fox Roost Management Guidelines (EHP 2013c).

Whilst the preferred intention would be to work within the COP for low impact activities, some works may inadvertently drive away flying-foxes from the roost, so therefore DES will need to be notified at least two business days prior to work commencing as a precaution.

### 3.1 Code requirements

The following conditions from the COP – ecologically sustainable management of flying-fox roosts and recommendations from the best practice guidelines should be followed:

- that a person knowledgeable about flying-fox behavior be present
- schedule activity when the roost is unoccupied at night
- commence work from the furthest end
- clearly identify trees to be retained, minimise unnecessary removal
- seek arborist advice regarding dangerous or dying trees
- no roost tree may be destroyed or modified when there are flying-foxes in a tree, or when flying-foxes are near a tree and likely to be harmed as a result of the destruction or modification.
- all management actions must immediately cease, and Department of Environment and Science (DES) (formally EHP) be immediately notified if flying –foxes appear to have been killed or injured
- minimise use of large machinery
- suggest starting chainsaws away from roost and allowing flying-foxes to adjust.

### 3.2 Risk management

It is recommended that Council take a risk-based approach to remediation works based on:

- potential health, safety, wellbeing and economic implications for the community
- potential flying-fox welfare and conservation impacts
- risk of splintering the roost to other locations that are equally or more problematic.

#### 3.2.1 Personnel and community

Flying-foxes may carry pathogens that have the potential to cause disease in humans. Flying-foxes are the natural host for Hendra Virus (HeV), which can be transmitted from flying-foxes

to horses. Infected horses sometimes amplify the virus and can then transmit it to other horses and humans. There is no evidence that the virus can be passed directly from flying-foxes to humans (or dogs) (Queensland Health 2015).

ABLV is a rabies-like virus that may be transmitted to humans through exposure to saliva of an infected flying-fox (or other bat). All known cases have been through a bite or scratch, however exposure to mucous membranes (eyes, mouth) could potentially also lead to infection. The disease in humans can easily be prevented by avoiding direct contact with bats. Pre- and post-exposure vaccinations are also available that will prevent the disease.

Under no circumstances should any contractor personnel attempt to touch or handle a flying-fox. If a flying-fox needs to be rescued, the flying-fox specialist must be contacted immediately. If a flying-fox is on or near the ground, an exclusion area should be established and clearly demarcated to prevent human interaction with the animal. The following precautions should be adopted when working in the known roost areas:

- all personnel inducted and briefed prior to works commencing each night
- all personnel debriefed at the end of each night of works to allow methods to be adapted if required
- all personnel to wear appropriate PPE: long sleeves and pants, eye protection, gloves, broad-brimmed hat, dust mask.
- all personnel working underneath the roost during machine operations that disturb the substrate (cause dust) or could aerosol flying-fox excrement to also wear protective breathing equipment (P3 breathing mask)
- adopt appropriate hygiene practices such as hand washing with soap and water before eating or smoking
- all personnel working underneath the active roost to wash clothes daily. Work crews should also have a spare set of clothes to change into at end of shift in the event clothes are contaminated with flying-fox urine and/or faeces.
- if a person is bitten or scratched by a bat, the wound should immediately be washed (**not scrubbed**) with soap and water for at least five minutes, followed by application of an antiseptic with anti-viral action (i.e. Betadine) and immediate medical attention (post-exposure vaccinations may be required).
- medical attention should also be immediately sought if a person is exposed to an animals' saliva or excreta through the eyes, nose or mouth.
- signage be erected around the site to notify the public about the purpose of works, the intention to avoid disturbing flying-foxes, and the flying-fox management framework under which Council is working.
- all public should be kept out of the site during works.

Council should notify surrounding residents of forthcoming management actions. Residents should also be encouraged to report any unusual flying-fox sightings to Council, particularly in the morning after works. Information could be provided on what to do if a flying-fox is

encountered and requires rescuing. Further information on bats and human health is provided by Queensland Health.

### 3.2.2 Flying-fox welfare

Along with the code requirements, these general measures will minimise the potential for animal welfare impacts:

- at least one day per week (i.e. Sunday) where works are not scheduled to allow flying-foxes to rest
- a wildlife carer and veterinarian should be on stand-by to accept injured or orphaned flying-foxes if required.

A knowledgeable person will have the following understanding of signs of stress in flying-fox behaviour (Table 1) and may call for works to cease to ensure flying-fox welfare and compliance with legislation.

Table 1 Signs of stress in flying-foxes

Potential impact	Signs
Initial signs of stress	<ul style="list-style-type: none"> <li>• flying-foxes are generally agitated and likely to take flight</li> </ul>
Unacceptable levels of stress	<ul style="list-style-type: none"> <li>• panting</li> <li>• saliva spreading</li> <li>• located on or within 2 m of the ground</li> <li>• unusual vocalisations</li> <li>• &gt;50% of the roost take flight</li> <li>• flying-foxes in flight for more than 2 minutes</li> <li>• flying-foxes leave the roost during daylight hours</li> </ul>
Dependent young at risk	<ul style="list-style-type: none"> <li>• adults moving away from dependent young</li> <li>• adults carrying young being disturbed</li> </ul>
Injury/death	<ul style="list-style-type: none"> <li>• a flying-fox appears to have been injured/killed on site (including aborted fetuses)<sup>1</sup></li> </ul>

### 3.2.3 Avoiding inadvertent dispersal

Whilst the COP – ecologically sustainable management of flying-fox roosts allows significant areas of a roost to be modified or destroyed (section 6.3.5), minimising the amount of canopy removed will reduce the risk of flying-foxes dispersing. The staged approach to the works will help habituate the flying-foxes to the noise and minimise the risk of flying-foxes moving to a new site. The staged approach also aims to nudge the flying-foxes roosting in the Memorial

<sup>1</sup> The Code of Practice for the ecologically sustainable management of flying-fox roosts requires all management actions to cease immediately and the Qld Department of Environment and Heritage Protection to be informed immediately if flying-foxes appear to have been killed or injured.



Gardens toward the core roosting area in Lee Park.

A contingency plan may be required for splinter groups that end up in neighbouring properties after vegetation works. Dispersal actions such as noise or smoke may need to be used to return flying-foxes back to the main roost early in the morning.

### 3.3 Responsibilities

Due to the unpredictable behaviour of flying-foxes as well as the necessity to undertake works at night, establishing positive communications between personnel with the use of hand held radios is advised. The following roles are recommended for remediation works at the Memorial Gardens (Table 1).

Table 2 Proposed personnel roles on site

Role	Who	Responsibilities
Site supervisor	Council rep	Oversees project Works with arborist to approve trees to be trimmed and felled Direct clearing team Receives advice from knowledgeable person regarding flying-fox behaviour, welfare or injuries
Knowledgeable person	Paula Ingerson	Observes flying-fox welfare Daily count of flying-fox colony Determine where works can occur in relation to presence of flying-fox – use flagging tape to notify clearing team of flying-fox presence Rescues injured flying-foxes Can stop work under the code of practice if required
Clearing team	Sub-contractors	Licensed operators of plant and machinery Takes direction from site supervisor and arborist where necessary Can consult with FF knowledgeable person if unsure
Fauna spotter catcher	Sub-contractors	Person authorised under a Rehabilitation Permit to rescue and relocate any wildlife displaced or injured during course of works (and dewatering if required) and take to veterinary care if required. May assist Knowledgeable person with observations
Arborist	Sub-contractors	Provides advice to site supervisor and clearing team regarding tree trimming and felling
Monitor	Council	Checks on flying-foxes returning from foraging on their response to remediation works at Memorial Gardens. Have flying-fox rescue/carer contact details

### 3.4 Resources

Additional considerations to ensure safe and efficient process of works include:

- flood lights required to illuminate the work site at night can also be used to shine in the canopy to ensure flying-foxes are not present in trees to be trimmed or felled. Torches can also be used by knowledgeable person or FSC to light up obscured vegetation.
- if using smoke drums as a means to deter flying-foxes from returning to Memorial Gardens, ensure personnel are allocated to properly extinguish fire.
- establish which colour flagging tape will be used to communicate to site personnel either tree for removal or tree containing flying-foxes - avoid!

## 3.5 Sequencing

The remediation works will be undertaken in four stages (Figure 5 and Table 2) in a manner intended to nudge the flying-foxes from the Memorial Gardens north towards the main roost in Lees Park. Stage 1 comprises areas 1a and 1b; Stage 1 works will only begin with clear communication between on site personnel in order to habituate the flying-foxes to noise, monitor their reaction to works in the roost and make efficient use of time for on-ground crew and equipment.

Table 3 Stages of works

Stage	Description	Details
Stage 1	Comprises two areas: Stage 1a area: Isolated garden bed next to cenotaph Stage 1b area: Section along McIlwraith Street near bus stop and on the southern side of the pond.	Remediation works will begin in Stage 1a area to prevent flying-foxes leap frogging into garden bed next to cenotaph, as well as to make efficient use of time and resources if flying-foxes remain in Stage 1b roost after fly out.
Stage 2	Northern side of pond	Contains the highest amount of woody debris Flying-foxes not currently using this area.
Stage 3	The pond	A large concrete pipe lies under the soil in the pond. Council is concerned large machinery driven over this pipe may break it. Therefore, it is recommended to clean out the pond by accessing from Stage 1 and Stage 2 areas i.e. either side of the pipe. The pond may require dewatering.
Stage 4	Behind disused child care centre	If flying-foxes show strong site fidelity to the Memorial Gardens pond, this area will be worked on last, depending on time and weather as well as flying-fox behaviour.



**Figure 4: Remediation works staged areas**

Hinchinbrook Shire Council

Ingham Memorial Gardens Flying Fox Assessment

Property boundary



Job number: PR3312  
Revision: 0  
Author: KF  
Date: 27/02/2018



0 12.5 25 50  
Metres

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



## 4 Work plan

Note the following work plan is indicative only. Flying-fox behaviour will need to be monitored and the plan must be adaptive in response to flying-fox behaviour, as advised by the knowledgeable person on site.

Table 4 Staged work plan

Stage	Aspect	Requirement	When	Responsible person
All stages	Avoid impacts to flying-foxes	Undertake pre-clear survey after flyout Locate remaining flying-foxes Flag/mark any trees with flying-foxes present	1900-1930	FSC Knowledgeable person
All stages	Felling trees	Mark trees to be felled	1900-2000	Arborist & Site supervisor
All stages	Avoid impacts to flying-foxes	Start chainsaw or motorised equipment 50 m from work area as a starting point for noise, then slowly bring closer	1930	Clearing crew authorised by Site supervisor
All stages	Avoid impact to wildlife	Relocate displaced wildlife found in impact area Determine if first aid treatment required Correct handling technique to prevent further injury or pain to wildlife	1900-2200	FSC
All stages	Noise restrictions	Stop work	2200	Site supervisor
All stages	Injured flying-foxes or wildlife	Do not touch – report to FSC or knowledgeable person	All	All
All stages	Avoid impacts to flying-foxes	Every morning after remediation works - check FF behaviour upon returning to roost - have they relocated? Should Stage 2 commence? Monitor potential flying-fox habitat within at least 600 m of the Gardens for splinter roosts. Report to knowledgeable person and/or Site supervisor	600-700	Monitor

Stage	Aspect	Requirement	When	Responsible person
1 (Stage 1a & 1b areas)	Avoid impacts to flying-foxes	Assess flying-foxes response and movements to noise and report to site supervisor	1930-2200	Knowledgeable person assisted by FSC
1 (Stage 1a area)	Vegetation works	Clear understorey in Stage 1a area first if safe to do so	from 1945	Clearing team authorised by site supervisor
1 (Stage 1b area)	Vegetation works	Clearing crew work in Stage 1b area if safe to do so	from 2000	Clearing crew authorised by site supervisor
1 (Stage 1a and 1b areas)	Avoid impacts to flying-foxes	Clean up and removal of vegetation and waste – location of mulcher Check in with Site supervisor regarding flying-fox welfare	negotiable if off site	Clearing crew
Do not begin stage 2 until stage 1 is complete				
2	Avoid impacts to flying-foxes	Assess flying-foxes response to noise and report to site supervisor	1930-2200	Knowledgeable person
2	Vegetation works	Clearing crew work in Stage 2 area	1945-2200	Clearing crew
2	Avoid impacts to flying-foxes	Clean up and removal of vegetation and waste – location of mulcher Check in with Site supervisor regarding flying-fox welfare	negotiable if off site	Clearing crew
Do not begin stage 3 until stage 2 is complete				
3	Avoid impact to wildlife	Dewater pond (FSC must be present during dewatering)	daytime	Council / subcontractor
3	Avoid impact to wildlife	Relocate wildlife found in pond during dewatering	daytime	FSC
3	Avoid impacts to flying-foxes	Assess flying-foxes response and movements to noise and report to site supervisor	1930-2200	Knowledgeable person assisted by FSC
3	Avoid damage to pipe	Mobile plant to remove debris from pond by accessing pond from the side in Stage 1 and 2 areas and minimise heavy loading over underground pipe		Clearing crew
3	Vegetation works	Clearing crew work in Stage 3 area	1945-2200	Clearing crew
Do not begin stage 3 until stage 4 is complete				

Stage	Aspect	Requirement	When	Responsible person
4	Avoid impacts to flying-foxes	Assess flying-foxes response to noise and report to site supervisor	1930-2200	Knowledgeable person
4	Vegetation works	Clearing crew work in Stage 4 area	1945-2200	Clearing crew
4	Avoid impacts to flying-foxes	Clean up and removal of vegetation and waste – location of mulcher Check in with Site supervisor regarding flying-fox welfare	negotiable if off site	Clearing crew



## 4.1 Post management options

### 4.1.1 Education

Education and awareness programs should always be a key component of any management approach to alleviate concerns about health and safety issues associated with flying-foxes. Excluding those people whose occupations require contact with bats, such as wildlife carers and vets, human exposure to ABLV, HeV and Menangle virus, their transmission and frequency of infection is extremely rare. These diseases are also easily prevented through vaccination, personal protective equipment, safe flying-fox handling (by trained and vaccinated personnel only) and appropriate horse husbandry. Therefore, despite the fact that human infection with these agents can be fatal, the probability of infection is extremely low and the overall public health risk is also judged to be low (Qld Health 2017).

### 4.1.2 Odour reduction

Planting aromatic plants that do not attract flying-foxes may serve as a practical way to assist with odour suppression during the hotter months when smell may be stronger (due to pheromones used flying-fox communication, which increase during the breeding season). Potential species include:

- *Petalostigma pubescens* (quinine)
- *Jasminum didymium* (native jasmine)
- *Hibiscus heterophyllus* (native hibiscus).

An odour neutralising trial through a specialist company (e.g. Odour Pro [www.odours.com.au](http://www.odours.com.au)) could also be considered, provided it does not interfere with flying-foxes' ability to communicate with each other. Note this is outside the scope of the Code of Practice and a Flying-fox Roost Management Permit would be required.

### 4.1.3 Canopy mounted sprinklers

Trials in Queensland have been successful to deter flying-foxes from areas of conflict using canopy mounted sprinklers. This option can be logistically difficult (installation and water sourcing) and may be cost-prohibitive. Design and use of sprinklers need to be considerate of animal welfare and features of the site. For example, misting may increase humidity and exacerbate heat stress events, and overuse may impact other environmental values of the site. It is not the intention to disperse flying-foxes away from the roost but to move flying-foxes away from problem locations which means sprinklers could be used to nudge the bats away from the bus stop and Memorial cenotaph back to the main roost area.

### 4.1.4 Minimising maintenance

To reduce the level maintenance and labour required at the site, landscaping materials around the pond could be replaced with larger stones, coarse gravel, mulch and a variety of low maintenance ground covering plants.

## 5 Conclusion

The departure of the LRFF from Ingham has reduced the risks associated with undertaking remedial works at the Memorial Gardens. There are limited opportunities throughout the year to undertake work because of the overlapping breeding periods of all four species of flying-foxes. However it is still advised to undertake works during the month of March because of the unpredictable nature of flying-foxes and the potential return of nursing LRFF to the site.

The four staged approach to works provides a means of managing flying-fox welfare because flying-foxes with young and juvenile flying-foxes currently occupy both the main roost and trees at the Memorial Gardens. Personnel undertaking remedial works at the Memorial Gardens will be required under the COPs to take direction from a person knowledgeable in flying-fox behaviour.

Following the four staged work plan will reduce the likelihood of flying-foxes splintering throughout the community to other locations that are equally or more problematic. However there is still some risk of splintering, and monitoring the surrounds and adaptive management are required.

Post management options may be considered to reduce the costs associated with maintaining the value and public amenity of the site in the future.

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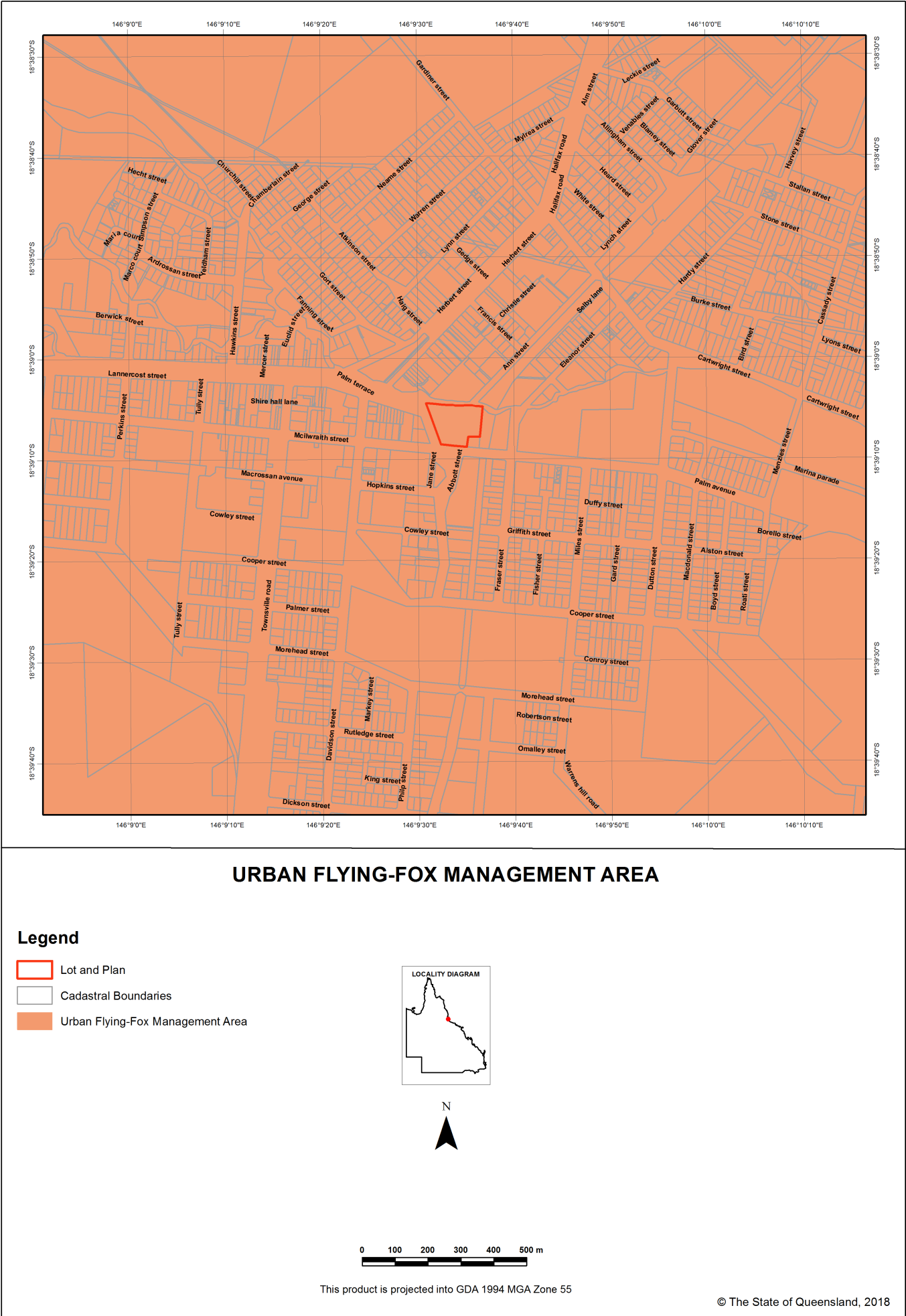
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## Appendix 1      UFFMA





URBAN FLYING-FOX MANAGEMENT AREA

Legend

- Lot and Plan
- Cadastral Boundaries
- Urban Flying-Fox Management Area



This product is projected into GDA 1994 MGA Zone 55

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## Appendix 2 Summary of dispersals in Australia 1990 to 2013

Roberts and Eby (2013) summarised 17 known flying-fox dispersals between 1990 and 2013, and made the following conclusions:

1. In all cases, dispersed animals did not abandon the local area.
2. In 16 of the 17 cases, dispersals did not reduce the number of flying-foxes in the local area.
3. Dispersed animals did not move far (in approx. 63% of cases the animals only moved <600 m from the original site, contingent on the distribution of available vegetation). In 85% of cases, new camps were established nearby.
4. In all cases, it was not possible to predict where replacement camps would form.
5. Conflict was often not resolved. In 71% of cases conflict was still being reported either at the original site or within the local area years after the initial dispersal actions.
6. Repeat dispersal actions were generally required (all cases except where extensive vegetation removal occurred).
7. The financial costs of all dispersal attempts were high, ranging from tens of thousands of dollars for vegetation removal to hundreds of thousands for active dispersals (e.g. using noise, smoke, etc.).

Ecosure, in collaboration with a Griffith University Industry Affiliates Program student, researched outcomes of management in Queensland between November 2013 and November 2014 (the first year since the current Queensland state flying-fox management framework was adopted on 29 November 2013). An overview of findings is summarised below.

There were attempts to disperse 25 separate roosts in Queensland (compared with nine roosts between 1990 and June 2013 analysed in Roberts and Eby (2013)). Compared with the historical average (less than 0.4 roosts/year) the number of roosts dispersed in the year since the Code was introduced has increased by 6250%.

Dispersal methods included fog, birdfrite, lights, noise, physical deterrents, smoke, extensive vegetation modification, water (including cannons), paintball guns and helicopters.

The most common dispersal methods were extensive vegetation modification alone and extensive vegetation modification combined with other methods.

In nine of the 24 roosts dispersed, dispersal actions did not reduce the number of flying-foxes in the LGA.

In all cases it was not possible to predict where new roosts would form.

When flying-foxes were dispersed, they did not move further than 6 km away.

As at November 2014 repeat actions had already been required in 18 cases.

Conflict for the council and community was resolved in 60% of cases, but with many councils stating that they feel this resolution is only temporary.

The financial costs of all dispersal attempts, regardless of methods used were considerable, ranging from \$7500 to more than \$400,000 (with costs ongoing).

## Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	27/02/2018	Ingham memorial gardens flying-fox remediation works - draft	Emily Hatfield Senior Wildlife Biologist	Jess Bracks Principal Wildlife Biologist	
01	01/03/2018	Ingham memorial gardens flying-fox remediation works - final	Emily Hatfield Senior Wildlife Biologist	Emily Hatfield Senior Wildlife Biologist	

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Copy #	Date	Type	Issued to	Name
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