

# Banana Shire Flying-fox Management Plan



**Prepared by Balance! Environmental**  
**On behalf of Banana Shire Council**  
**6 April 2017**

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## ACRONYMS

ABLV	Australian Bat Lyssavirus
BFF	Black Flying-fox
BQ	Biosecurity Queensland
BSC	Banana Shire Council
COP	Code of Practice
DAF	Department of Agriculture and Fisheries
DEHP	Department of Environment and Heritage Protection
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)</i>
FF	Flying-fox
FFRMP	Flying-fox Roost Management Permit
GHFF	Grey-headed Flying-fox
LRFF	Little Red Flying-fox
MNES	Matters of National Environmental Significance
NCA	<i>Nature Conservation Act 1992 (Qld)</i>
QH	Queensland Health
RE	Regional Ecosystem
SoMI	Statement of Management Intent (for flying-fox roosts in urban areas)
UFFMA	Urban Flying-fox Management Area
VMA	<i>Vegetation Management Act 1999</i>

# 1 INTRODUCTION

## 1.1 BACKGROUND

Flying-foxes are native bats that play a significant role in the healthy functioning of natural ecosystems; however, their propensity to roost in large numbers sometimes causes health and safety concerns for affected residents and land-managers, particularly where roosts establish in urban areas. Under current Queensland legislation, the regulatory responsibility for flying fox management rests with the Department of Environment and Heritage Protection (DEHP) with an as-of-right authority provided to Local Government for urban flying-foxes management. Generally, the community places an expectation on Local Government to manage flying foxes on private land. Banana Shire Council (BSC) wishes to strike a balance between ecologically sustainable management of flying-foxes and the protection of people, their domestic animals and property within the Shire.

This Flying-fox Management Plan (FFMP) builds upon BSC's Statement of Management Intent (SOMI) for flying-foxes in the Banana Shire and is based on a scientific understanding of flying-fox ecology and management. The development of the plan was guided significantly by flying-fox management plans available for other local government areas (e.g. NRA 2016; SCRC 2016; TRC 2016; Ecosure 2015) as well as the Queensland Government's *Flying-fox Roost Management Guidelines* (DEHP 2015).

## 1.2 ECOLOGICAL SIGNIFICANCE OF FLYING-FOXES

Flying-foxes are key pollinators and seed dispersers of numerous Australian tree species (Hall & Richards 2000), so they play a pivotal role in the reproduction and regeneration of woodlands and forests. Their long-range movements across the landscape (30-50 km per night) means that flying-foxes are able to disperse pollen and seed over a significantly greater area than most other dispersers (e.g. insects and birds), which contributes to the maintenance of genetic diversity in forests. Some of our prime hardwood resources (e.g. spotted-gum forests) rely on flying-foxes to maintain genetic diversity (Hall & Richards 2012). The pollination and seed-dispersal services provided by flying-foxes are critical for maintaining ecosystem health, which has important flow-on effects for all other species that inhabit forests and woodlands.

## 1.3 PURPOSE AND OBJECTIVES OF THE FFMP

The purpose of the FFMP is to guide BSC's response and management of flying-foxes present within the shire, particularly in residential and other sensitive areas. The key objectives of the FFMP are:

- To ensure BSC's flying-fox management activities meet legal obligations and are based on scientific knowledge of flying-fox ecology and management;
- To enable BSC to address community concerns relating to flying-foxes whilst ensuring Council's obligations for flying-fox welfare and conservation needs are met;
- To enable BSC to make sound management decisions that mitigate current flying-fox impacts on local communities and minimise the risk of future impacts arising;
- To ensure flying-fox management activities do not transfer and/or exacerbate flying-fox problems; and
- To promote community understanding of flying-fox conservation, ecology and health risks, and encourage improved community engagement in flying-fox management.

## 1.4 LEGISLATIVE FRAMEWORK

### 1.4.1 Australian Government

*Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The EPBC Act provides for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the Act as matters of national environmental significance (MNES). Any action that has the potential to impact upon MNES is subject to the EPBC Act assessment and approvals process.

Neither of the flying-fox species that are commonly encountered in the Banana Shire is listed as threatened under EPBC Act; however, the Grey-headed Flying-fox (GHFF), which is listed as Vulnerable under the EPBC Act, may occasionally venture into the Shire.

Any management actions directed at the GHFF will require a determination of significance through the EPBC referral process. Similarly, a management action at any flying-fox roost that may impact on other EPBC-listed species or ecological communities may require a determination of significance through the EPBC referral process.

### 1.4.2 Queensland Government

*Nature Conservation Act 1992 (NCA) and Nature Conservation (Wildlife Management) Regulation 2006 (NC Regulation)*

- Protection of all flying-foxes and their roosting habitat
- Listing of species' conservation status
- Provides Local Government (Councils) 'as of right' authority to manage flying-fox roosts on Council-owned (freehold) or Council-managed (trustee) land, and on private land (subject to landholder consent), within defined Urban Flying-fox Management Areas (UFFMAs)
- Limits flying-fox roost management activities in UFFMA to those set out in the *Code of Practice – Ecologically sustainable management of flying-fox roosts*
- Allows any land manager to conduct defined low-impact management activities at a flying-fox roost in accordance with the *Code of Practice – Low impact activities affecting flying-fox roosts*
- Prohibit land managers to destroy or disperse a flying-fox roost on land not owned or managed by Councils unless they have a Flying-fox Roost Management Permit (FFRMP) approved by the Department of Environment and Heritage Protection
- *Flying-Fox Roost Management Guidelines* are provided to assist Councils and other land managers in their decision-making in relation to flying-fox management activities

Section 88C of the NCA restricts actions at flying fox roosts and provides the platform for penalties of non-compliance.

*Vegetation Management Act 1999 (VMA)*

Management of flying-fox roosts must not impact on remnant vegetation communities. A clearing permit may be required if roost management activity is likely to significantly alter the integrity of a vegetation remnant Regional Ecosystem, in particular those listed as Endangered or Of Concern.

### *Animal Care and Protection Act 2001 (ACPA)*

The purpose of the ACPA and the Queensland Government's animal welfare program is to:

- promote the responsible care and use of animals;
- provide standards for animal care and use that
  - balance the welfare of animals and the interests of people whose livelihood depends on animals
  - allow for the advancements in scientific knowledge and allow for changes in community expectations about practices involving animals;
- protect animals from unjustifiable, unnecessary or unreasonable pain; and
- ensure that the use of animals for scientific purposes is accountable, open and responsible.

The third dot point, above, is particularly relevant to flying-fox management. It refers to an offence of 'cruelty' under the Act, with 'pain' including distress and mental or physical suffering.

## **1.5 STAKEHOLDERS**

### **1.5.1 Banana Shire Council (BSC)**

Council is responsible for providing services such as land-use planning, public land management and ensuring community well-being. The NCA provides BSC 'as-of-right' authority to manage flying-fox roosts in the UFFMA that have been identified in the Shire. The SoMI (Section 2.1) describes BSC's roles, responsibilities and intentions in relation to flying-fox management in the Shire.

### **1.5.2 Department of Environment and Heritage Protection (DEHP)**

DEHP administers the NCA and Regulations and is responsible for ensuring that flying-fox management, whether on Council, State or privately managed lands, is done in a sustainable manner. The *Code of Practice – Ecologically sustainable management of flying-fox roosts* requires Councils to notify DEHP of any roost management activities in UFFMA at least two business days prior to commencement of the action.

### **1.5.3 Biosecurity Queensland**

Situated within the Department of Agriculture and Fisheries (DAF), Biosecurity Queensland (BQ) administers the ACPA and is responsible for investigating breaches of the cruelty provisions of that Act. It is also responsible for responding to bat-borne diseases such as Hendra Virus and Australian Bat Lyssavirus (ABLV).

### **1.5.4 Queensland Health**

The Health department (QH) responds to outbreaks of notifiable diseases, such as Hendra and ABLV in the human population and works closely with BQ to understand and manage those diseases.

### **1.5.5 Ergon Energy**

Ergon Energy supplies electricity and manages the electricity distribution network throughout the Banana Shire. Line maintenance on the network sometimes involves the removal of electrocuted flying-foxes that have come into contact with overhead electricity cables. Flying-fox roosts in urban areas presents an increased risk of such encounters in the urban distribution grid.

### 1.5.6 Affected residents

Affected residents may be separated into two groups:

- Primary affected residents, who are directly affected by a flying-fox roost established on or within 100m of their residential property, place of work or other sensitive area (e.g. a playground, kindergarten, school or church); and
- Secondary affected residents, who are indirectly affected by a roost more than 100m from their property, place of work or sensitive area.

In most cases, primary affected residents are adversely-affected by the odour and noise emanating from the roost. Other affects include: perceived disease risk; damage to trees used by roosting bats; and harm caused by bat droppings. (e.g. staining and damage to paintwork). Secondary affected residents' concerns are more likely to be related to perceived disease risk or other harm caused by droppings or bats foraging in their backyard trees. People affected by actions taken in response to a flying-fox roost (e.g. those impacted by the move of the Moura Kindy in 2016 from its permanent location to the temporary location in the old Post Office) are also regarded as Secondary affected residents.

### 1.5.7 Special interest groups

These groups may include: those that share a common goal for the conservation and management of flying foxes (e.g. Australasian Bat Society, Ecological Society of Australia); those who rescue and care for injured and orphaned bats (e.g. Bats Queensland, local wildlife carers, RSPCA); and those with specific concerns regarding human and/or livestock health (e.g. equestrian and racing organisations, resident's/community action groups).

### 1.5.8 Other community members

People not particularly affected but expressing concern (either for or against flying-foxes); people potentially affected if roosts establish in alternative sites.



## 1.6 FLYING-FOXES IN THE BANANA SHIRE

Two flying-fox species are known to occur in the Banana Shire: Little Red Flying-fox (LRFF) and Black Flying-fox (BFF). Both species are listed as *Least concern* under the NCA and neither is listed as threatened under the EPBC Act. A third species – Grey-headed Flying-fox, or GHFF (*Pteropus poliocephalus*) – may occasionally venture into the region.

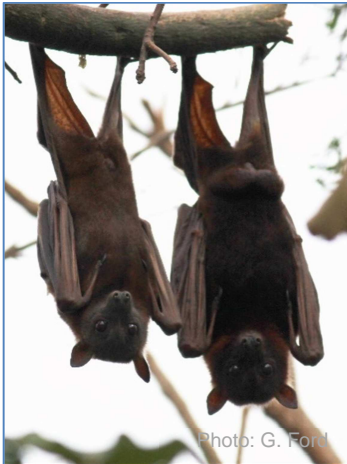


Photo: G. Ford

### 1.6.1 Little Red Flying-fox - *Pteropus scapulatus*

The LRFF has reddish to dark-brown fur, sometimes with a paler, yellowish collar or “mantle” on the neck and shoulders. The wing membranes are reddish-brown and translucent when seen in flight. It is the smallest of Australia’s flying-foxes, weighing only 250-500 grams (Churchill 2008).

The LRFF is the most widespread of the four flying-fox species that occur on the Australian mainland, occurring much further inland than any of the other species (**Figure 1**). It is seasonally nomadic within its range, often moving large distances in response to the availability of food resources.

The LRFF feeds primarily on nectar from blossoming native trees and shrubs, particularly those in the family Myrtaceae (e.g. *Eucalyptus*, *Corymbia*, *Melaleuca* and *Callistemon* species). When the supply of such blossom is abundant in a local area, LRFF may arrive in large numbers to capitalise on this food resource; however, as the food supply becomes depleted (often within a few weeks), their numbers in the local area will rapidly dwindle as they move on in search of an alternative energy supply. Consequently, most LRFF roosts are temporary, although some may be used on a semi-regular basis.

LRFF roosts are notable for their often-large, tight clusters of bats hanging like large bunches of grapes from tree branches. This clustering behaviour, along with the large numbers often occurring in LRFF roosts frequently results in extensive roost-tree damage as branches break under the significant combined weight of the bat clusters.

The breeding cycle of LRFF is out of sync with other Australian flying-fox species. Birthing and lactation-dependence occurs through autumn and winter (April-August), with the young beginning to forage independently from late winter through early spring (August-September). From about one-month of age until independence, the young are left in nursery trees overnight while their mothers leave the roost to forage.



Photo: B. Thomson

### 1.6.2 Black Flying-fox - *Pteropus alecto*

At 600-900 grams, the BFF is considerably larger than the LRFF. The fur and wings are generally black and there is frequently a reddish mantle over the neck and shoulders (Churchill 2008). It has a primarily coastal distribution in the northern half of the Australian mainland (**Figure 1**), with occasional movements inland in response to abundant food resources.

Like the LRFF, the BFF feeds principally on the nectar and blossom of trees in the eucalypt family, along with fleshy rainforest fruits. It will also eat fruit and flowers of introduced species such as mangoes and Cocos palms.

Its response to food availability results in the BFF’s sporadic occurrence in inland areas, usually occupying temporary roosts for relatively short periods (often only a few weeks), while the food supply lasts in the local area. In

contrast, BFF roosts in coastal areas tend to be more permanent due to the more continuous and reliable supply of food resources.

Unlike the LRFF, the BFF does not roost in large, tight clusters (they tend to prefer a little personal space), so extensive tree damage is not so common in BFF roosts. The two species often share the same roosts, but usually remain segregated.

The breeding cycle is approximately six-months out of phase with the LRFF, with BFF giving birth in late spring. The young are initially carried by their mothers while foraging, but from about one month of age, the dependent young are left in a nursery roost overnight. These dependent young remain in the roost until they are able to fly and forage independently, usually in late summer.



### 1.6.3 Grey-headed Flying-fox – *Pteropus poliocephalus*

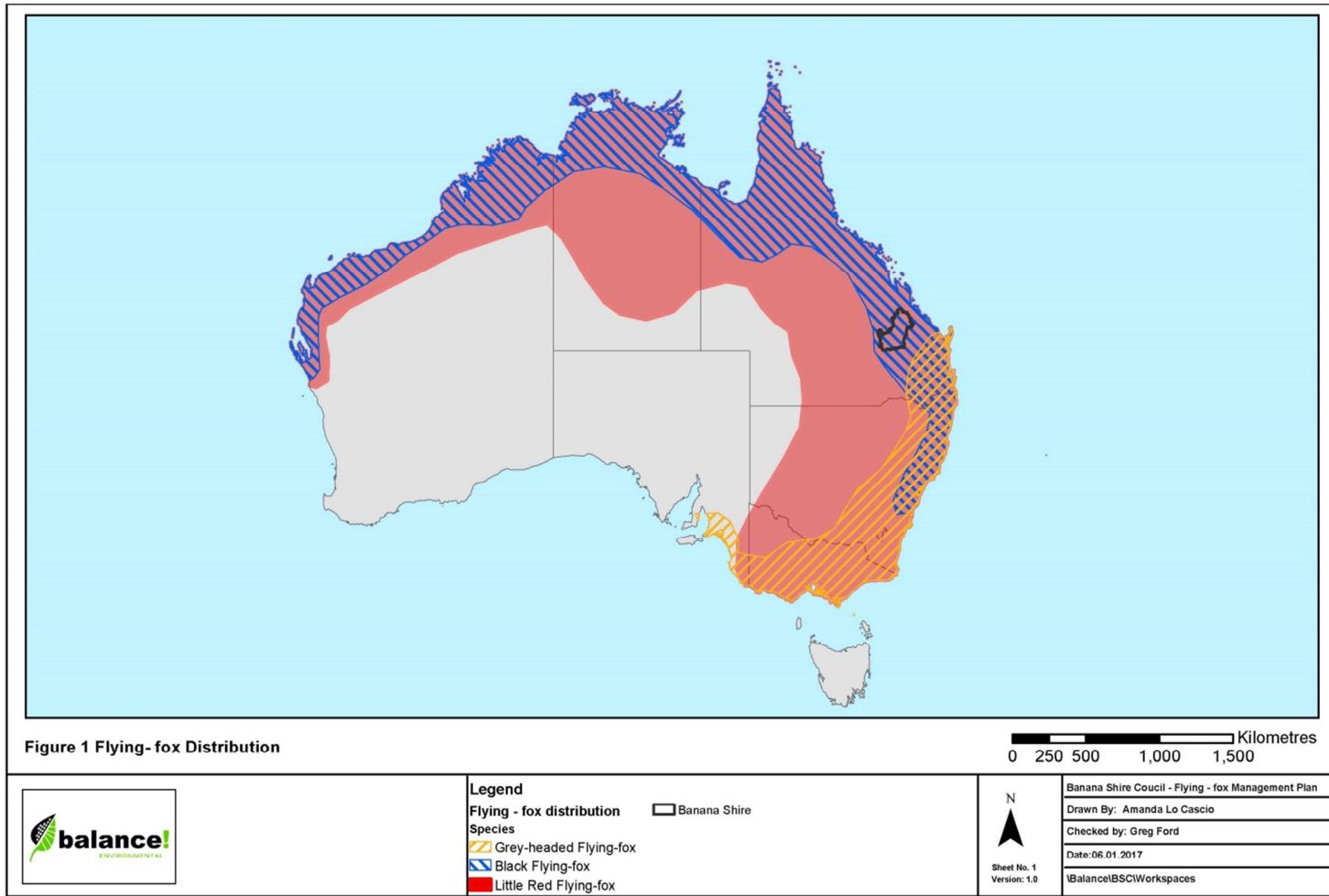
The GHFF is considered to be an infrequent visitor to the Banana Shire and is unlikely to require management under this plan; however, it is included here for awareness purposes, since it is listed as Vulnerable under both the NCA and EPBC Act.

It occurs primarily in near-coastal areas, from about Maryborough south to Melbourne (**Figure 1**), with recent occurrences also in Adelaide. The Atlas of Living Australia shows two records of GHFF within the Banana Shire: one near Biloela during the 1960s; and one near Taroom in 1991. However, the Biloela record appears to have been incorrectly attributed to GHFF, because the quoted source (Nelson 1965) refers only to a record of BFF (then known as *Pteropus gouldii*) "...on Callide Creek 4 miles north of Biloela (about 1954) ...".

The GHFF is Australia's largest flying-fox, with large males often weighing over 1 kg. It has grey fur on the back, belly and head, with a distinct rusty-brown mantle encircling the neck (Churchill 2008). Once occurring from Rockhampton to the north-eastern corner of Victoria, the range of the GHFF has shifted south by about 500 km and it now rarely occurs north of about Bundaberg.

Like the other species, GHFFs feed predominantly on the blossom of eucalypts and related species, although they will also take fruits (e.g. figs).

Their breeding cycle is similar to that of the BFF.



**Figure 1** Distribution of Little Red, Black and Grey-headed Flying-foxes.  
Adapted from Richards & Hall (2002)

## 2 FLYING-FOX MANAGEMENT IN THE BANANA SHIRE

### 2.1 URBAN FLYING-FOX MANAGEMENT AREAS (UFFMA)

Urban Flying-fox Management Areas (UFFMA) are defined under the NCA for the purpose of authorising local governments to exercise their 'as-of-right' authority to manage flying-fox roosts in defined urban areas within their jurisdiction. Management actions by local government in these UFFMAs may be undertaken without the need for a Flying-fox Roost Management Permit (FFRMP), provided those actions comply with the *Code of Practice – Ecologically sustainable management of flying-fox roosts*.

There are 12 UFFMAs defined for the Banana Shire (see **Figure 2**), at least half of which have had active flying-fox roosts in the last few years (see Section 2.3).

A Statement of Management Intent (SOMI) has been developed by BSC to address Council's intentions for the management of flying-foxes in the UFFMA within Banana Shire.

### 2.2 STATEMENT OF MANAGEMENT INTENT (SOMI)

Council's *Statement of Management Intent for Flying-fox Roost Management in Banana Shire* was endorsed by Council on 29 June 2016. The SoMI articulates the approach that BSC will take to the management of flying-fox roosts in Banana Shire, identifying Council's responsibilities and defining the actions that Council will take to address flying-fox roost management issues on Council-managed land and other land not under Council control.

The SoMI is available on Council's website: <http://www.banana.qld.gov.au/>.

The definitions, actions and prescriptions set out in the SoMI form the basis of this FFMP and specific reference is made to key components of the SoMI in the following sections.



Figure 2 Urban Flying-Fox Management Areas (UFFMA) in the Banana Shire.

## 2.3 KNOWN URBAN ROOST SITES IN BANANA SHIRE

Flying-fox roosts have been recorded in a number of urban areas within the Banana Shire since 2012. Towns that have been affected by the establishment of these roosts include: Taroom, Theodore, Moura, Baralaba, Wowan and Dululu. All of these roosts have been occupied temporarily (i.e. for a few months at most), primarily by LRFF but with some BFF also recorded at sites in the north of the Shire. There are historic records of roosts in the Callide Dam area and at creek-side sites near Biloela and Moura. It is also likely that there are other undocumented historic occurrences of flying-foxes roosting in township areas throughout the Shire.

The following discussion of problematic roosts at Moura, Wowan and Theodore provides an insight into the extent and dynamic nature of urban roosts in the Banana Shire. While these roosts have received considerable attention in the BSC community, BSC intends to take a strategic approach to the management of all urban roosts that may occur in the Shire. This FFMP provides a platform for assessing and managing the region's urban roosts as expediently as possible whenever and wherever they become established.

### 2.3.1 Moura

Recurrent flying-fox roosting has been experienced over a number of years in the township of Moura, with roosts having been recorded in several locations (refer **Error! Reference source not found.**):

- In 2013, up to 6000 LRFF roosted in backyard trees on a number of residential properties in the vicinity of Davey, Jules and Rogers Streets. The bats were present from October to December, having departed by January 2014. It is understood that a number of bats also returned to this roost briefly during 2015.
- During winter 2016, a LRFF roost established in the grounds of the Uniting Church, Moura Community Kindergarten ('the kindy') and adjoining residential properties in the vicinity of Scenic and Hewitt Streets. The colony size at this roost grew from fewer than 1000 bats in May 2016 to around 9000 in August, with numbers diminishing to about 4000 by early September and the roost being vacated by early-October 2016.
- Approximately 6500 LRFF were again present in large trees on several properties in Becker Street during December 2016.

During peak periods of activity at these roosts, Council and EHP provided fact-sheets to affected residents and advised them that the flying-foxes were expected to move on once food supplies were depleted in the local area.

The colony at the kindy roost in 2016 required additional management (under Council's as-of-right management authority for the UFFMA) to deter the LRFF from roosting close to the kindy. This *in situ* management included use of laser/strobe lighting to deter bats from landing and also removal of branches that were overhanging the kindy yard; however, the LRFF roost persisted and arrangements were made to vacate the kindy premises and set up operations in an alternative location.



Figure 3 Known flying-fox roosts in Moura

0 50 100 200 Metres



Legend  
 Known Urban Roost Locations  
 — QLD Roads  
 DCDB



Banana Shire Council - Flying - fox Management Plan
Drawn By: Amanda Lo Cascio
Checked by: Greg Ford
Date: 06.01.2017
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Data: QLD Property, LGA, Roads and Streams - Land and Property Information, Department of Finance & Services. Project data created from Client supplied Information Imagery - Google Earth 24/04/2003. Projection WGS 1984

Figure 3 Location of recent flying-fox roosts in the township of Moura.

### 2.3.2 Wowan

Flying-foxes use three adjacent roost areas in the vicinity of Wowan State School, including: Pocket Creek, behind the school; vacant Department of Education land near to the Principal's house; and trees along the gully in the Wowan parkland, north-east of the school (see **Figure 4**). Both BFF and LRFF have been recorded in these roosts, with the LRFF generally constituting more than 75% of individuals present. Roost occupation is intermittent, being used predominantly in spring and early summer; and bat numbers vary greatly, ranging from a few hundred individuals in some periods to around 15,000 at peak count. Bats move freely between the three roosts and may occupy only one site, typically when numbers are low, or all three during peak roost occupation.

Previous management activity has focussed on the Pocket Creek roost site, with tree-trimming conducted (under a Damage Mitigation Permit) while the bats were absent in September 2012. This action deterred roosting for only a short period, and a large roost of about 8000 bats re-established during October-December 2013. During this period, the roost was occupied by both LRFF (75%) and BFF (25%), with the latter including many females carrying their young. The bats dispersed naturally from the roost over December 2013, leaving it empty by mid-January 2014.

The Pocket Creek roost was again occupied by up to 4500 bats in October-December 2016.

Management actions in the land next to the Principals residence has included tree trimming and/or removed; and public access has been restricted to the Wowan Park roads and facilities to the during roost occupation, when numbers are very high. Bats have previously been recorded roosting at these two sites during February-April 2014, December 2015, February-May 2016 and September-December 2016. The roost population in December 2016 was made up of approximately 1600 BFF and 14,000 LRFF.

In response to the 2016 influx of flying-foxes to the town, a Wowan community working group was established to collaborate with EHP and BSC on the management of the Wowan roosts.





Figure 4 Known flying-fox roosts in Wowan



Legend

- Known Urban Roost Locations
- QLD Roads
- DCDB



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Figure 4 Location of recent flying-fox roosts in the township of Wowan.

### **2.3.3 Theodore**

The long-term history of the Theodore roost is not well documented; however, in October-December 2013 a colony of up to 30,000 LRFF camped in trees along the banks of Castle Creek, just upstream from its junction with the Dawson River (**see Figure 5**). The majority of the roost was on public land, although some “spill-over” occurred with a small number of flying-foxes roosting in the backyards of neighbouring properties.

The roost caused significant concern for local residents, with Council receiving a large number of complaints about smell, bat droppings and health concerns. A petition was instigated by the local community, requesting Council to take action to disperse the roost.

Council officers and DEHP staff engaged with affected residents, providing fact sheets and other information to advise that the bats would move on once local food resources became depleted.

The roost eventually dispersed naturally during late November-early December 2013.

Flying foxes returned to the roost in December 2016 for a short period however numbers were unconfirmed.

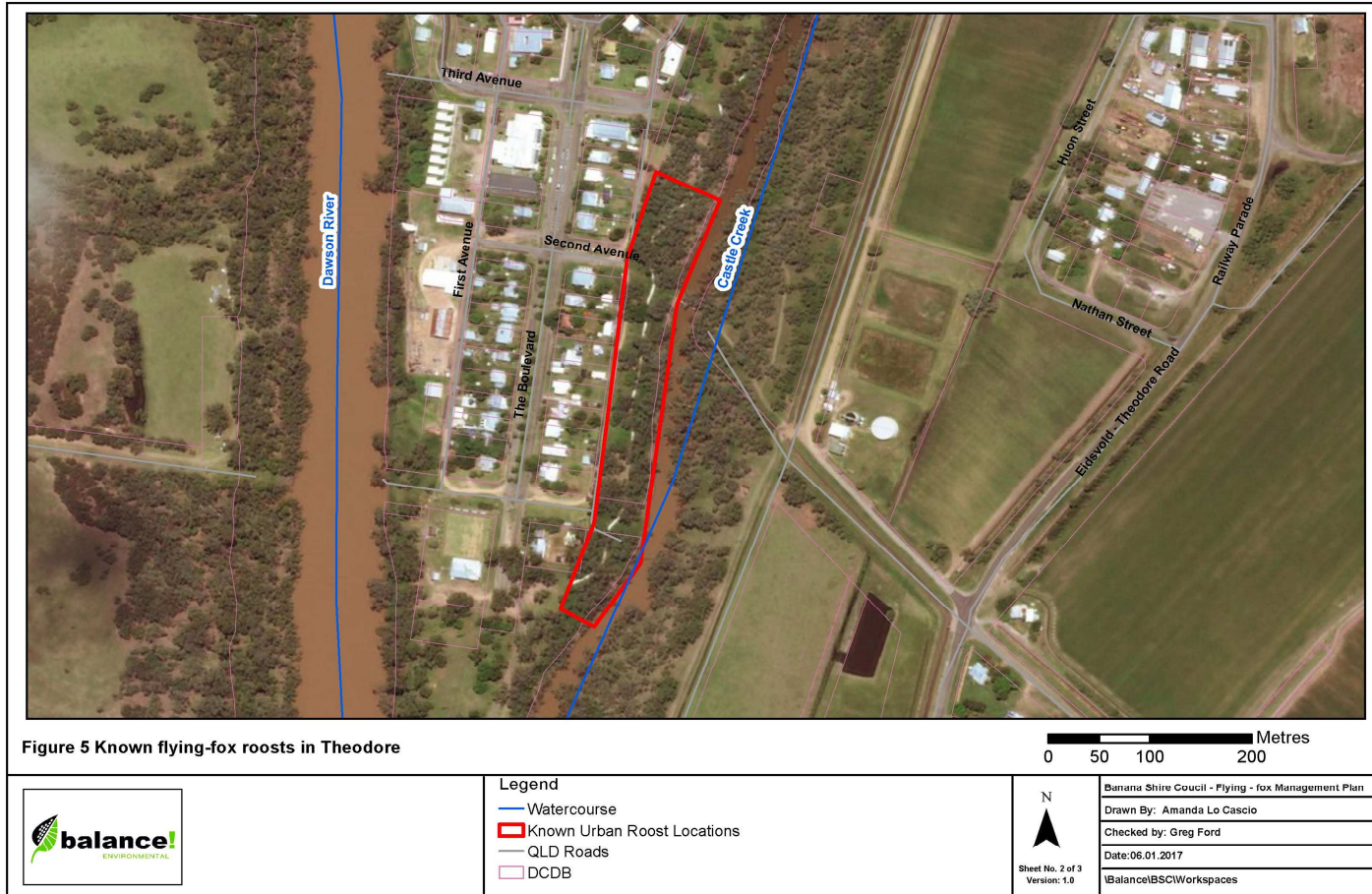


Figure 5 Location of recent flying-fox roosts in the township of Theodore.

## 2.4 POTENTIAL ROOST SITES WHERE CONFLICT MAY ARISE

There is a high probability that flying-foxes may turn up at new or previously-undocumented roost sites in response to disturbance at, or loss of existing roost sites and/or due to sudden influxes of bats following seasonal food supplies. By identifying potential roost sites on Council-managed land, especially those in close proximity to sensitive areas where human-bat conflict is likely to arise, Council can plan for and activate more timely and appropriate roost management responses.

Roost habitat preferences of flying-foxes are poorly understood, although factors such as vegetation structure, patch size and proximity to a water course are important, at least for the two larger species (GHFF and BFF) in south-eastern Queensland (Roberts 2005). Roost preferences in LRFF are difficult to define, as they sometimes roost in the same sites as the other species, but equally may be found in single trees or small patches of relatively open vegetation some distance from water. The LRFF roost at Moura Kindergarten is a typical example of such an 'unpredictable' roost site.

Potential roost sites on BSC-managed land in three Banana Shire UFFMA's were identified via a subjective assessment of woody vegetation structure evident in spatial imagery. For the Moura, Theodore and Wowan UFFMA's, potential roost sites were identified by comparing the structure of vegetation patches on BSC-managed land with the vegetation structure at known roost sites. A similar process was followed for the other UFFMA's in the Shire; however, it was difficult to obtain a direct comparison with known roost sites.

Roost potential was considered HIGH on those council-managed parcels that had extensive mature woody vegetation cover or clusters of large trees similar to those at known roosts. Cleared land, obviously-immature regrowth and sparse woody vegetation were considered LOW roost potential.

Likelihood of conflict (if potential roosts become occupied) was classified using the proximity buffers defined in the SoMI. Conflict potential was considered to be HIGH if a potential roost is within 50m of a sensitive site, MODERATE at 50-100m from a sensitive site and LOW for areas >100m from a sensitive site.

For the purpose of mapping potential conflict sites on Council-managed land in the FFMP, the HIGH and MODERATE conflict classes were combined, thus producing the following categories:

- Category PR-A HIGH roost potential with HIGH or MODERATE likelihood of conflict
- Category PR-B HIGH roost potential with LOW likelihood of conflict
- Category PR-C LOW roost potential with HIGH or MODERATE likelihood of conflict
- Category PR-D LOW roost potential with LOW likelihood of conflict

Mapping derived using the above categories (e.g. see Figures 6-8) serves two purposes with regard to roost management decision-making in the Banana Shire UFFMA's.

1. 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.
2. 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.

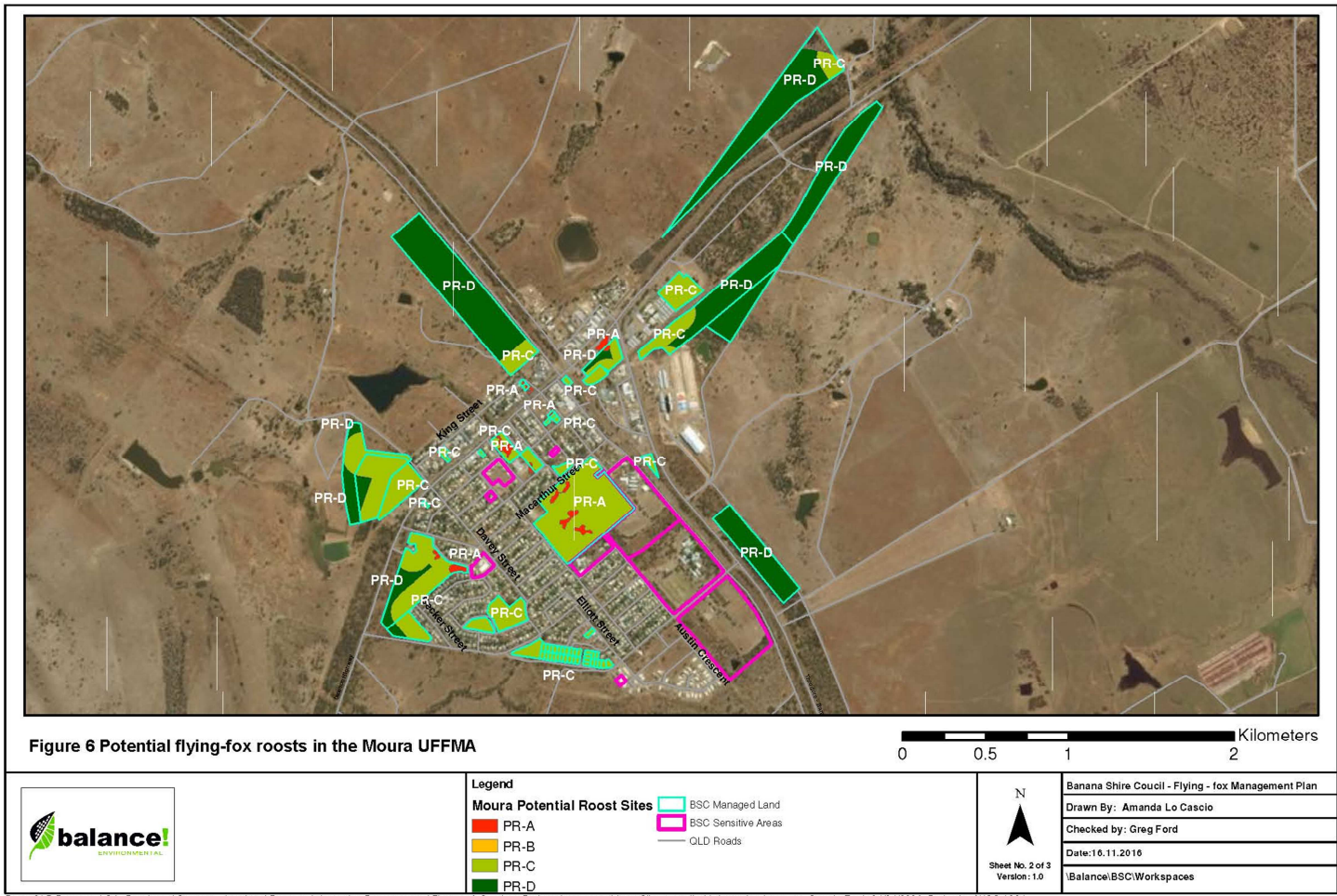


Figure 6 Potential flying-fox roost sites in the Moura UFFMA.

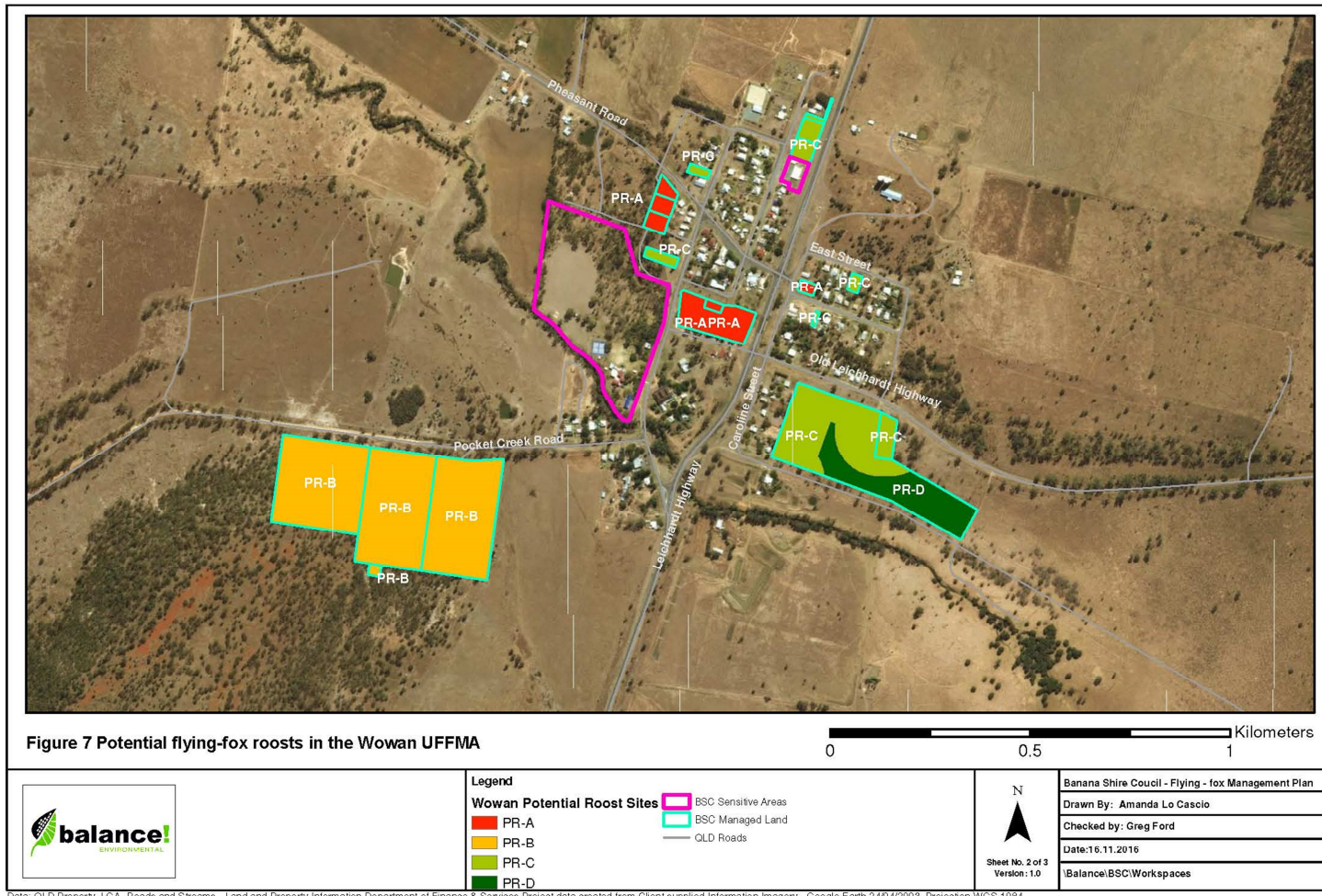


Figure 7 Potential flying-fox roost sites in the Wowan UFFMA.

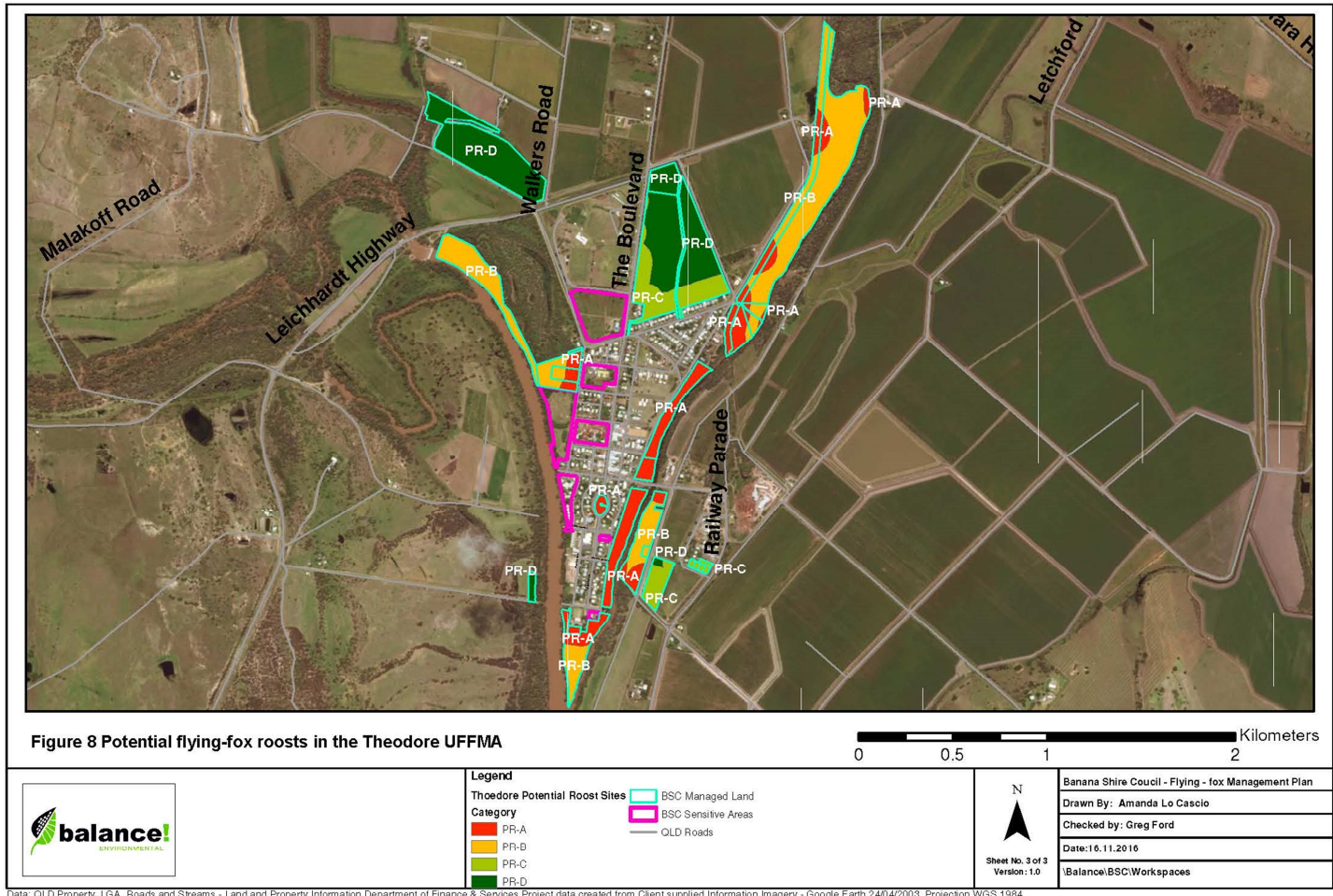


Figure 8 Potential flying-fox roost sites in the Theodore UFFMA.

### 3 FLYING-FOX ROOST MANAGEMENT OPTIONS

Roost management options that meet Council's legal obligations under the relevant legislation range from minimal intervention, through in-situ management to active dispersal. The amount of effort required and associated financial costs increases substantially as more interventionist approaches are undertaken, as do the risks to flying-foxes, Council and community.

#### 3.1 MINIMAL INTERVENTION

Minimal intervention means that an established flying-fox roost will not be interfered with directly. It may include a "do nothing" approach, but more appropriately involves activities such as:

- education (e.g. of affected land-holders, council workers) to improve community appreciation of flying-fox ecology, health risks, management options and associated risks;
- monitoring of flying-fox roosts to enable forward-planning of management responses;
- providing and/or enhancing alternative roost sites that could attract flying-foxes to roost away from sensitive urban conflict areas; and
- management of the urban tree-scape to reduce the availability (or prevent further proliferation) of large trees such as mangoes and figs that attract flying-foxes for both foraging and roosting.

#### 3.2 IN SITU MANAGEMENT

In situ management refers to non-lethal management activities undertaken at an active flying-fox roost to reduce undesirable impacts on the neighbouring community, while retaining the roost and minimising impact on the flying-foxes. Management actions may include:

- modifying and/or temporarily changing usage patterns of neighbouring buildings and infrastructure to reduce impacts of flying-fox noise, odour and excrement; and
- modifying the roost habitat to increase separation between the roost and neighbouring property and infrastructure (i.e. creation of a buffer between roost and affected premises).

Modification of buildings (e.g. by double glazing and/or adding carports) would likely require significant financial outlay and has not been well-received by the community in other regions (GeoLINK 2012). Similarly, temporary changes in use of infrastructure beside a roost (such as was required when the Moura Kindergarten was moved to a new location) results in significant cost and inconvenience to the community.

Modification of the roost must comply with the *Code of practice – Ecologically sustainable management of flying-fox roosts* and generally focusses on creating a buffer zone between the roost and neighbouring properties by removing or modifying vegetation in part of the roost. Alternative non-lethal management options outside of the scope of the COP require a permit from DEHP. Example: Sprinkler systems installed in roost tree canopies have also been successfully used in other regions to create buffers by making part of the roost unsuitable for roosting (SCRC 2016).

Where in-situ management is applied, roost monitoring must be undertaken by a suitably-qualified person to ensure impacts on the flying-foxes are avoided. Population counts and observations on the presence and age of juvenile bats are required before, during and after management actions occur.



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### 3.3 DISPERSAL

Roost dispersal creates significant disturbance within the roost area with the express aim of forcing the flying-foxes to vacate the roost. It is a resource-intensive exercise, requiring significant numbers of staff and substantial financial expense to:

- drive away the flying-foxes (e.g. using smoke, light and noise);
- modify roost vegetation to make it unsuitable for roosting;
- ensure flying-foxes do not settle in other undesirable locations; and
- monitor both the operation and the bats to ensure compliance with codes of practice and animal welfare legislation.

Along with the significant costs involved in flying-fox roost dispersal, come the risks of:

- flying-fox injury and mortality due to inappropriate dispersal methods;
- legal action against Council due to animal welfare non-compliance; and
- establishment of new flying-fox roosts in other sensitive areas, thereby exacerbating the impacts on the community.

Dispersal activities must comply with the prescribed methods in the *Code of practice – Ecologically sustainable management of flying-fox roosts* and must align with the principles outlined in the *Flying-Fox Roost Management Guideline*

#### 3.3.1 Effectiveness of dispersal

Dispersal of flying-foxes from established roost sites is a costly undertaking that frequently succeeds only in moving the “problem” to another undesirable location in the local area.

A study of 17 flying-fox roost dispersals between 1990 and 2013 (Roberts and Eby 2013) showed that dispersed flying-foxes rarely move more than 600m from the disturbed roost and that conflict is generally not resolved when dispersal is undertaken. The study also showed that repeat dispersal action is often required, which results in high ongoing costs in the order of tens of thousands to hundreds of thousands of dollars for each dispersal attempt.

In the few cases where dispersal has been successful, it has only been possible with an abundant supply of human and financial resources and/or favourable landscape features (such as good habitat linkages that allowed the bats to be “mustered” to a new roost and encouraged to stay there over a lengthy period of time).

The low success rate and high costs of flying-fox dispersal means that this approach should only be considered if all other roost management options fail to satisfactorily resolve conflict associated with a roost. However, where a newly-established roost is identified in a location with no known history of flying-fox roosting (i.e. Category F roost; see Table 1, Section 5), it may be feasible to undertake early-intervention dispersal to prevent the roost becoming problematic for nearby residents.

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## 4 DECISION SUPPORT FRAMEWORK

Managing flying-fox roosts is a complex issue, requiring careful consideration of a range of management options to achieve a realistic balance between economic factors, public health and safety, animal welfare issues and ecological sustainability. To this end, a suite of decision support tools have been developed to guide Council through the difficult process of determining relevant management approaches to flying-fox issues across the Shire.

The principal document underlying this decision support framework is the SoMI. Key definitions, prescriptions and stated management responsibilities set out in the SoMI are built into the decision support tools described below.

### 4.1 OVER-ARCHING DECISION FACTOR – FLYING-FOX ECOLOGY

Whilst Council will make every attempt to address community concerns in regard to flying-foxes, including, where necessary, making direct contributions to the active management of flying-fox roosts, it must be remembered that the ecological adaptations of flying-foxes are the primary driving force in their appearance at and usage of roosts in both urban and rural areas.

This is especially the case for the LRFF, which displays highly unpredictable patterns of seasonally nomadic behaviour. As a consequence of their adaptations to unpredictable seasonal food availability, LRFF may suddenly arrive in large numbers, create a nuisance for a short period (typically a few months) and equally as suddenly disappear again for many months or even years. The occurrence of the other flying-fox species in inland areas, along with the longevity of their roosts, is also somewhat less predictable than in their coastal range.

The nomadic behaviour of flying-foxes, and the temporary nature of the ‘problems’ that it results in, will be a key factor in Council’s decisions regarding management of flying-fox roosts in Banana Shire. This factor, combined with the high costs and limited success rates for roost dispersal activities (Roberts and Eby 2013), is likely to favour non-dispersal management actions in the majority of roost management scenarios.

### 4.2 PRIMARY DECISION TREE

When Council becomes aware of flying-fox roost management issues in the BSC community, it will determine an appropriate course of action based on a range of factors, including:

- Location of the roost and history of roost occupation (i.e. long-term or short term and seasonality of use);
- Management responsibility for the land on which the roost is established;
- Proximity of the roost to residences and/or sensitive sites, such as child-care centres, hospitals, schools and frequently-used public facilities (e.g. pools and parks);
- Community concerns regarding public health and safety;
- Flying-fox ecology, breeding cycle and population dynamics; and
- Costs and risks associated with legally-available management options and the probability of successful resolution of the relevant issues

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A decision tree (**Appendix 1**) has been developed to provide guidance through this process. The decision tree provides a logical series of steps to:

1. Identify if Council should take an active role in managing a reported flying-fox issue;
2. Assess the severity of conflict resulting from flying-fox presence and determine the likelihood of conflict escalating;
3. Review management options and determine the degree of intervention required; and
4. Assess the risks involved and likelihood of the various management options resulting in successful conflict resolution.

At key decision points within the primary tree (see blue boxes in **Appendix 1**), where additional decision support is required, the decision-maker is referred to secondary decision tools. These are outlined below, with the relevant decision tools included as a further series of Appendices.

### 4.3 IDENTIFYING COUNCIL RESPONSIBILITY

In the SoMI, BSC states that it will take an active role in flying-fox roost management in the following circumstances:

1. Where a roost is established wholly or partly on Council-managed land; OR
2. At the discretion of the Director of Council Services, where a roost is established wholly on State and/or private land; AND
  - a. It is a newly established roost; AND
  - b. when the affected premises:
    - i. is on land owned by a community organisation, and is a highly sensitive area (e.g. kindergarten or child care centre); or
    - ii. involves numerous intensively affected private residences, and a coordinated approach is required; AND
  - c. early intervention is necessary, due to health and wellbeing concerns, or significant damage to property; AND
  - d. where minimal involvement of Council is required, *i.e.*
    - i. Council provides as-of-right authority notification to EHP
    - ii. Council coordinates and directs management actions
    - iii. Landholder undertakes management actions
    - iv. Landholder bears all costs associated with the management actions.

Determining Council's responsibilities for flying-fox roost management is a critical step early in the decision process and the above factors are explored in the decision sub-tree at **Appendix 2**.

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#### 4.4 ASSESSING POTENTIAL FOR HUMAN/FLYING-FOX CONFLICT

A number of factors contribute to the level of concern expressed within the community in relation to flying-fox roost management. Foremost among these is the proximity of the roost to residences or schools and child-care centres, with nearby roosts generating significant conflict due to the impacts of noise, odour and excrement, as well as raising concerns for public health and safety. Other key factors include the size of the flying-fox colony using the roost, along with its potential to increase and the number of properties or people affected directly by the flying-fox roost.

These factors are incorporated into a sub-tree in the decision process to determine the level of conflict likely to arise if a roost is left unmanaged (see **Appendix 3**).

Potential for conflict is rated as 'high', 'medium' or 'low', with the primary determinant being distance of the roost from 'sensitive sites'. 'Sensitive sites' are defined as residential dwellings (excluding a shed or similar out building that is detached from the residential building), child-care facilities, school classrooms, nursing homes, motels and similar accommodation facilities. Public use facilities, such as swimming pools, parks, halls and churches, may also be regarded as 'sensitive sites', depending upon usage patterns (i.e. frequency and type of use; number of people affected).

Roosts within 50m of a sensitive site are considered to have 'high' potential for human/flying-fox conflict, whereas those greater than 100m from sensitive sites are rated as having a 'low' likelihood of conflict. At intermediate distance (50-100m) from a sensitive site, a roost will generally be considered to have 'medium' conflict potential, unless it affects relatively few properties and is unlikely to expand in population size or extent, in which case it is rated as a 'low' conflict roost.

#### 4.5 EVALUATING MINIMUM INTERVENTION OPTIONS

Council will apply a minimum intervention approach to the management of most flying-fox roosts that come to its attention. These will range from 'do nothing' to information sharing, community education and guiding affected land-managers to relevant authorities or sources of further information. Where necessary, Council may facilitate meetings between affected residents and relevant authorities, such as DEHP, QH, BQ and DAF.

A guide to determining appropriate actions for roosts requiring minimum intervention management is provided in **Appendix 4**. This decision support tool summarises relevant management actions under the minimum intervention approach and describes the risks and benefits associated with those actions.

#### 4.6 DETERMINING FEASIBILITY OF IN SITU MANAGEMENT OPTIONS

In situ management will generally be considered for roosts with a high likelihood of community/flying-fox conflict, or in sites where minimum intervention methods fail to prevent or reduce conflict. A number of factors need to be considered when assessing the feasibility of undertaking in situ management. Most notable of these factors is the increased costs involved in management activities at the roost site, but the probability of providing relief to affected residents and the risk of transferring the problem to another location (i.e. if the flying-foxes move to an alternative roost nearby) are also important.

**Appendix 5** outlines the risks and benefits of in situ management options for consideration in the decision process. In situ management activities will only be undertaken if the risks involved can be controlled to an acceptable level and all actions comply with the *Code of practice – Ecologically sustainable management of flying-fox roosts*.

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#### 4.7 ASSESSING RISK AND PROBABILITY OF SUCCESS FOR DISPERSALS

Flying-fox roost dispersal is almost always a very costly exercise and rarely solves human/flying-fox conflict issues in the local area (Roberts and Eby 2013). Consequently, roost dispersal is regarded as a last resort option for the management of flying-fox roosts in the Banana Shire. It will be considered only where all other approaches have failed to satisfactorily resolve issues in sites of high human/flying-fox conflict.

A risk/benefit matrix for the roost dispersal management option is provided in **Appendix 6**. These risks and benefits will be carefully considered prior to committing any Council resources to roost dispersal, through the application of a thorough risk analysis procedure (see **Appendix 7**).

### 5 MANAGEMENT STRATEGIES – OVERVIEW

Based on the potential outcomes of the decision process, flying-fox roosts in the Banana Shire may fall into one of six categories (Table 1). For all roost categories the management approach will follow a sequence from least to most interventionist management options, i.e.:

- Minimum intervention will be the initial, preferred approach, followed by
- In situ management, if minimum intervention is unlikely to resolve or prevent conflict arising, and
- Non-lethal dispersal, which will be considered only when a combination of minimum intervention and in situ management is unable to resolve conflict arising from a flying-fox roost.

Three roost categories (A, C and D) are likely to only require management according to minimum intervention principles, while Category E roosts are unlikely to need management beyond in situ actions. The remaining two categories (B and F) will receive highest priority for direct management, which may include management in situ or consideration for dispersal actions.

An outline of management strategies available for each roost management category is provided in the following sections and summarised in Table 1.

**Table 1** Summary of management options for six flying-fox roost categories in the Banana Shire

Roost management category	Roost description	Management options	Potential management strategies (see Appendix 4 for detail)
<b>Category A</b>	New or existing roosts on <u>non-Council</u> land, where Council involvement is not warranted	Minimum intervention	Education Refer to EHP
<b>Category B</b>	New roosts on <u>non-Council</u> land with a <b>high</b> likelihood of conflict	Minimum intervention In situ management Dispersal	Education Monitoring Refer to EHP Council will not fund or directly undertake any roost management actions
<b>Category C</b>	New or existing roosts on Council-managed land with <b>low</b> likelihood of conflict	Minimum intervention	Education Monitoring Low-impact maintenance Roost enhancement
<b>Category D</b>	New or existing roosts on Council-managed land with <b>medium</b> likelihood of conflict	Minimum intervention	Education Monitoring Maintenance of buffer zone Low-impact maintenance
<b>Category E</b>	Existing roosts on Council-managed land with a <b>high</b> likelihood of conflict	Minimum intervention  In situ management  Dispersal	Education Monitoring Low-impact maintenance  Infrastructure and/or usage modification Roost modification to create & maintain a buffer zone  Roost modification to make unsuitable for roosting Roost removal Disturbance to force FF to leave roost or prevent return
<b>Category F</b>	New roosts on Council-managed land with a <b>high</b> likelihood of conflict	Minimum intervention  In situ management  Dispersal	Education Monitoring Low-impact maintenance  Infrastructure and/or usage modification Roost modification to create & maintain a buffer zone  Roost modification to make unsuitable for roosting Roost removal Disturbance to force FF to leave roost or prevent return

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## 5.1 MINIMUM INTERVENTION APPROACH

Minimum intervention is Council's preferred approach to all flying-fox management issues in Banana Shire, except in cases of high human/flying-fox conflict, where roosts become established in close proximity to residential or other sensitive sites. Minimum intervention strategies for the low-medium conflict roost categories are discussed below.

### 5.1.1 Roosts on non-council land, not warranting Council involvement (Category A)

Where a flying-fox roost is

- a) not on Council-managed land and
- b) determined at Council discretion to not warrant Council involvement,

Council will generally take a "do nothing approach" to the management of the roost; however, Council may provide relevant information resources to the affected land-manager/s and will refer them to EHP for further guidance and advice on roost management.

### 5.1.2 Roosts on Council-managed land with low likelihood of conflict (Category C)

A minimum intervention approach will also be taken to any roost on Council-managed land that is rated as having a low potential for causing human/flying-fox conflict (i.e. is more than 100m away from the nearest sensitive site). In relation to such roosts, Council may:

1. Actively discourage disturbance to the flying-fox roost; and/or
2. provide relevant information resources to affected land-managers; and/or
3. undertake a community awareness and education campaign on flying-fox management; and/or
4. choose to monitor flying-fox movement and population dynamics at the roost in order to be prepared for any changes in roost status or location; and/or
5. choose to maintain intact and/or enhance the roost environment to
  - a. discourage the flying-foxes from seeking alternative, potentially-controversial roost sites and/or
  - b. provide a suitable roost site that may attract flying-foxes away from other sites that may already be causing conflict.

### 5.1.3 Roosts on Council-managed land with medium likelihood of conflict (Category D)

If a roost becomes established within 100m of, but more than 50m away from a sensitive site, a minimum intervention approach will be undertaken to ensure that the flying-foxes remain largely undisturbed, but which prevents the roost from encroaching closer to the sensitive site.

Crucial to this approach will be the maintenance of a buffer zone within an acceptable distance between the current roost and nearby sensitive sites. No activity will be undertaken within 50m of the roost in order to establish or maintain such buffer

Ideally such buffer zone would be managed to ensure no vegetation suitable for flying-fox roosting is available; however, where there is a desire to retain vegetation that may also be suitable for roosting, regular monitoring will be required to give early warning of any advancement of the flying-fox roost toward the sensitive sites. If such incursion were to occur, the roost management options would be re-assessed using the decision-support tools.

In addition to buffer maintenance, the minimum intervention approach for these roosts may include regular monitoring, Code-compliant low-impact site maintenance, community education and information sharing. Council will actively discourage disturbance at Category B roosts.

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## 5.2 IN SITU MANAGEMENT STRATEGIES

This approach involves taking direct action on the roost or affected properties to reduce impacts on affected residents, whilst retaining flying-foxes in the roost. In situ management options will only be undertaken if minimum intervention options fail to resolve problems encountered by the community at high conflict roost sites (categories B, E and F).

### 5.2.1 Existing roosts on Council-managed land with high likelihood of conflict (Category E)

Where a roost occurs on Council-managed land, and has been present there, even intermittently, for a number of years, Council's preferred option is to leave the roost undisturbed.

Should the periodic or ongoing occupation of the roost result in undesirable outcomes for nearby residents or public facilities, and if minimum intervention methods cannot reduce those impacts, Council may investigate the feasibility of minor roost management works to 'push back' the flying-foxes to an acceptable distance from the affected premises. At sites where there is a history of seasonal roost occupation, Council will endeavour to undertake the 'push-back' works, or buffering, while the roost is unoccupied, so as to minimise the likelihood of impacting negatively on the bats.

Where push-back buffering is not feasible, or has been unsuccessful, Council may also consider approaches to alter sensitive-site usage or modify buildings to reduce the impacts of the roost on residents and other users.

### 5.2.2 New roosts with a high likelihood of conflict (Categories B and F)

If a new roost starts to establish on land within 50m of a sensitive site and with no history of flying-fox occupation, whether on Council-managed or non-Council land, an early-intervention approach may be required to prevent the escalation of conflict between the community and the roost.

In the first instance, Council will investigate the risks and likelihood of success for a dispersal attempt at the new roost (see Section 5.3); however, if dispersal is found to be an unacceptable option, an in situ management approach may be adopted. On Council-managed land, Council may undertake vegetation management to push-back flying-fox roosting to an acceptable distance from the sensitive site. On non-Council land, Council may provide basic advice and information to support land-managers' to undertake such work and facilitate required discussions with DEHP.

## 5.3 DISPERSAL STRATEGIES

Flying-fox roost dispersal (using non-lethal methods) will generally be considered only as a last resort if less intrusive management options at high conflict roosts (categories B, E and F) are demonstrably ineffective in resolving conflict arising from the presence of the roost. The only exception to this rule will be where it can be demonstrated that early-intervention dispersal is necessary to prevent a newly-established roost (categories B and F) from becoming a high conflict roost.

In all cases, dispersal will only be undertaken if the associated risks and likelihood of success are deemed acceptable through application of the dispersal risk assessment decision tool (**Appendix 7**).

Dispersal may only be attempted at roosts where a suitably-qualified person has determined that:

- a) there are no female flying-foxes in late-stage pregnancy; AND
- b) there are no dependant juveniles that remain in the camp during the night; AND
- c) the bats are showing no signs of stress due to heat events or food shortage.



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### 5.3.1 Roosts on Council-managed land with a high likelihood of conflict (Categories E and F)

Dispersal will generally be approached in two stages:

- Stage 1 Dispersal
  - Vegetation management to reduce the availability of roost space and make the site less attractive to roosting bats.
  - May involve extensive pruning, lopping and/or complete removal of roost trees, as well as thinning or clearing of understorey vegetation.
  - In extreme cases, complete removal of the vegetation patch may be warranted; however, community values and legal implications (under the VMA) would need to be taken into account prior to taking such drastic action.
  - Will be undertaken when flying-foxes are absent from the roost (i.e. at night time or when the bats are seasonally absent).
- Stage 2 Dispersal
  - Implementation of disturbance activities to drive away the flying-foxes and prevent their return to the roost.
  - May involve noise, light, smoke, foggers, BirdFrite and 'scarecrow' devices.
  - Will be carried out only in the early evening or early morning, when flying-foxes are leaving or returning to the roost, respectively.

Council will generally commence with Stage 1 Dispersal and only progress to Stage 2 Dispersal if Stage 1 activities fail to deter flying-foxes from roosting.

The only cases where a Stage 2 Dispersal may be undertaken without first attempting Stage 1 will be:

- where legal implications prevent extensive vegetation management at the roost (e.g. vegetation management would risk changing remnant regional ecosystems (RE) to non-remnant status); or
- where there is significant community opposition to the impacts of the proposed vegetation management activities (e.g. loss of amenity, valuable tree-scapes, loss of fauna habitat).

### 5.3.2 New roosts on non-Council land with a high likelihood of conflict (Category B)

Where dispersal is identified as the best option for a high-conflict roost on land not managed by Council, the dispersal activities are to be undertaken by, and at the cost of, the affected land-owner/s; however, Council may:

- provide advice and information to assist in decision making and dispersal planning; and
- act as liaison between affected residents and EHP in relation to the dispersal.

Dispersal strategies will be as for high-conflict roosts on Council-managed land.

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## 5.4 MANAGING ENVIRONMENTAL STRESS EVENTS

Flying-foxes are occasionally exposed to extreme environmental events (e.g. prolonged drought, heat waves, cyclones, hail storms), which may lead to a marked increase in morbidity and/or mortality of bats. Perhaps the most prominent of these are heat stress events, with tens of thousands of flying-foxes dying in a number of heat-related mass-mortality episodes in the last two decades (Welbergen *et al.* 2008).

Where roosts are located on Council-managed land, such events pose a significant management issue for Council. Other than coordinating the clean-up and disposal of dead bats resulting from such an event, Council may also need to manage community expectations and access (including pets) at the roost, as well as collaborate with wildlife rescue services in their efforts to reduce mortality of stressed bats. Council also has a role to play in the monitoring of urban roosts to detect the potential onset of such events, determine appropriate actions and coordinate resources to respond to an impending event.

In order to achieve expedient and appropriate responses to environmental stress events at flying-fox roosts in the Banana Shire, BSC may:

- Establish and maintain regular communication with animal welfare groups in relation to the potential onset of stress events;
- Monitor signs of stress in bats in urban camps as part of Council's regular roost monitoring program;
- Collaborate with animal welfare groups in the planning and delivery of response actions should a stress event arise;
- Refer to relevant guidelines (e.g. Stanvic *et al.* 2013) when developing a stress event response;
- Provide and/or coordinate appropriate resources to support the response effort; and
- Cooperate with welfare groups and Government agencies in the monitoring and reporting of outcomes from the stress event.

## 5.5 RESEARCH AND DEVELOPMENT

Council is committed to participating in ongoing research opportunities that may be useful in the development of flying fox management strategies for the Shire. To facilitate this Council may:

- Contribute monitoring data to the National Flying Fox Monitoring Program
- Seek grant funding for long term flying fox management projects where available
- Collaborate with other agencies within the Central Queensland (CQ) region including participating and at times facilitating the CQFF group meetings between CQLG's and DEHP
- Make comment on State or Federal Government legislation changes related to flying fox management
- Share flying fox monitoring data and roost history with other research organisations upon request (i.e. Universities, etc.)

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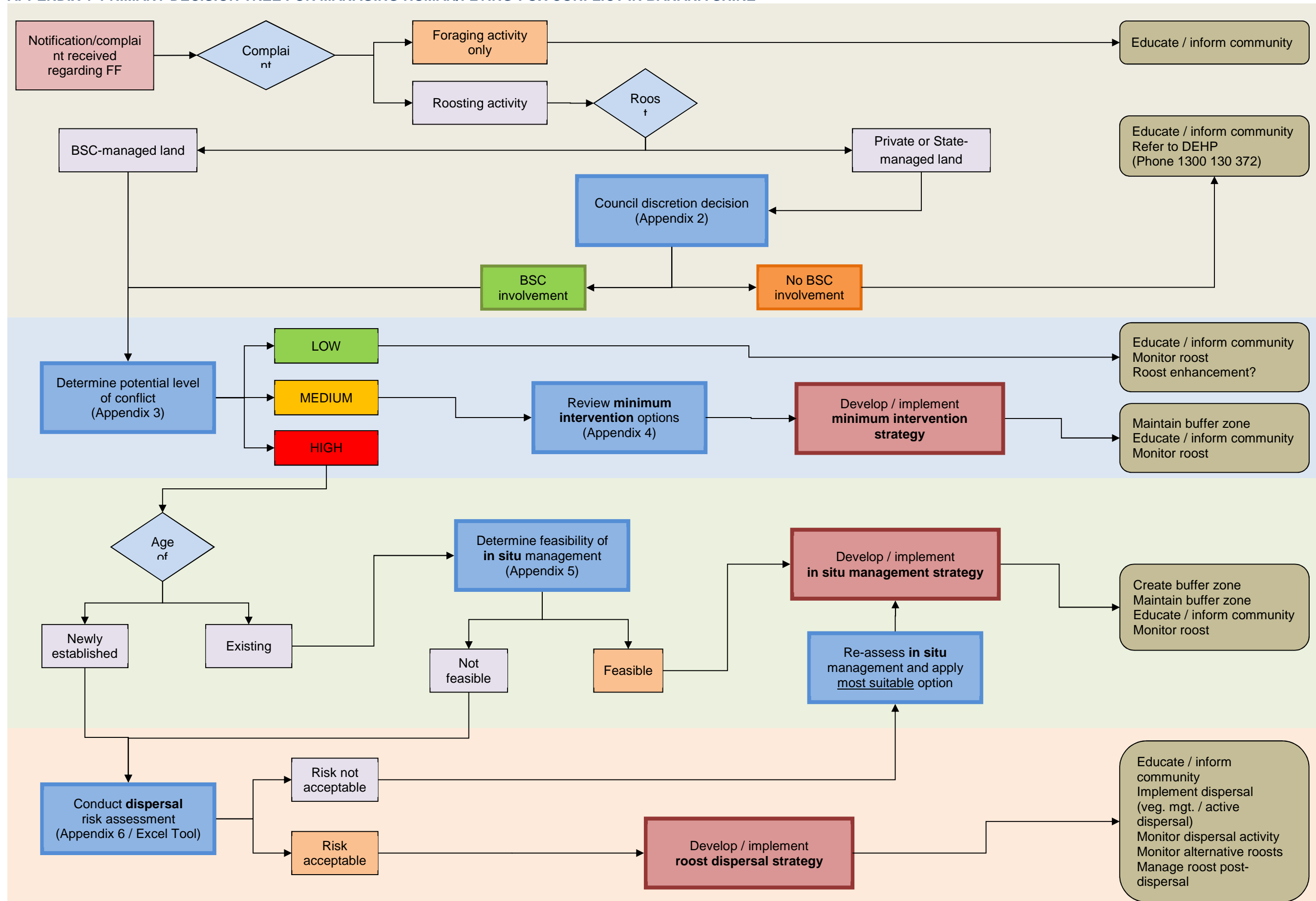
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## 7 GLOSSARY

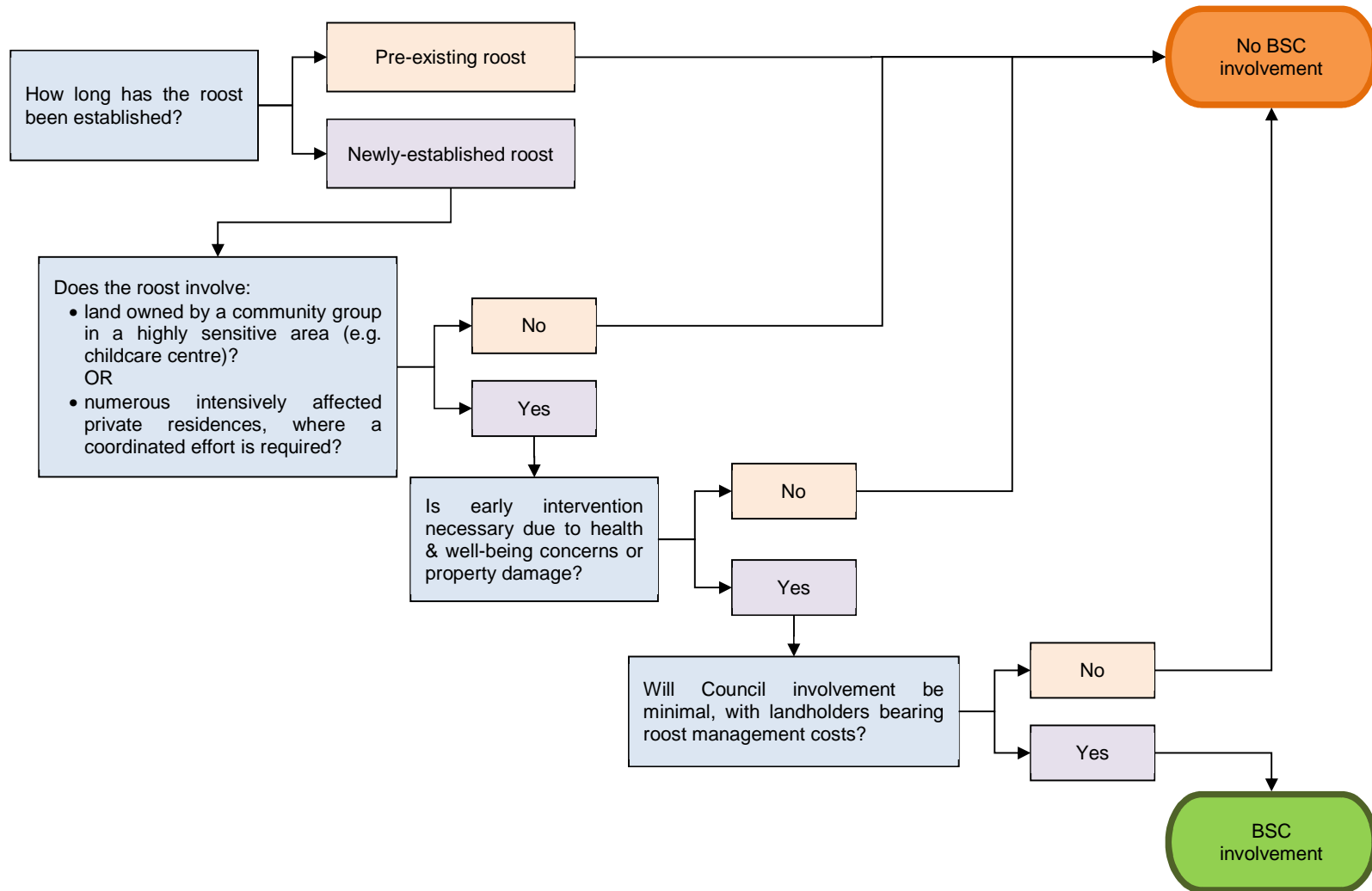
Acceptable distance	relating to creation of a buffer zone between a flying-fox roost and a sensitive site; the lesser of 50m and a distance negotiated between Council and the affected residents
Buffer	an area of land between a flying-fox roost and a sensitive site that acts to reduce the likelihood of the roost impacting negatively on residents and facility users
Buffer distance	the distance from a sensitive site to the nearest roost tree occupied by flying-foxes; defined as three zones - <50m, 50-100m and >100m
Council-managed land	Land owned or leased by Council; Land under Council control such as reserves with Council as trustee; and Local government roads
Flying-fox roost	defined by the <i>Nature Conservation Act 1992</i> , Section 88C(6), as a tree or other place where flying-foxes congregate from time to time for breeding or rearing their young
Public facility	community infrastructure used on a regular basis by members of the public (e.g. swimming pools, halls, libraries, playgrounds)
Sensitive site	residential dwellings (excluding shed or other outbuilding detached from the dwelling); nursing homes; child care facilities; school classrooms; and public facilities
Suitably-qualified person	means a person knowledgeable about flying-fox biology and behaviour, with skills in <ul style="list-style-type: none"><li>• Classifying flying-fox species</li><li>• Assessing flying-fox population size at a roost</li><li>• Identifying evidence of breeding activity, including pregnancy and presence/approximate age of juveniles</li><li>• Recognising signs of distress or harm to flying-foxes</li></ul>

## 8 APPENDICES

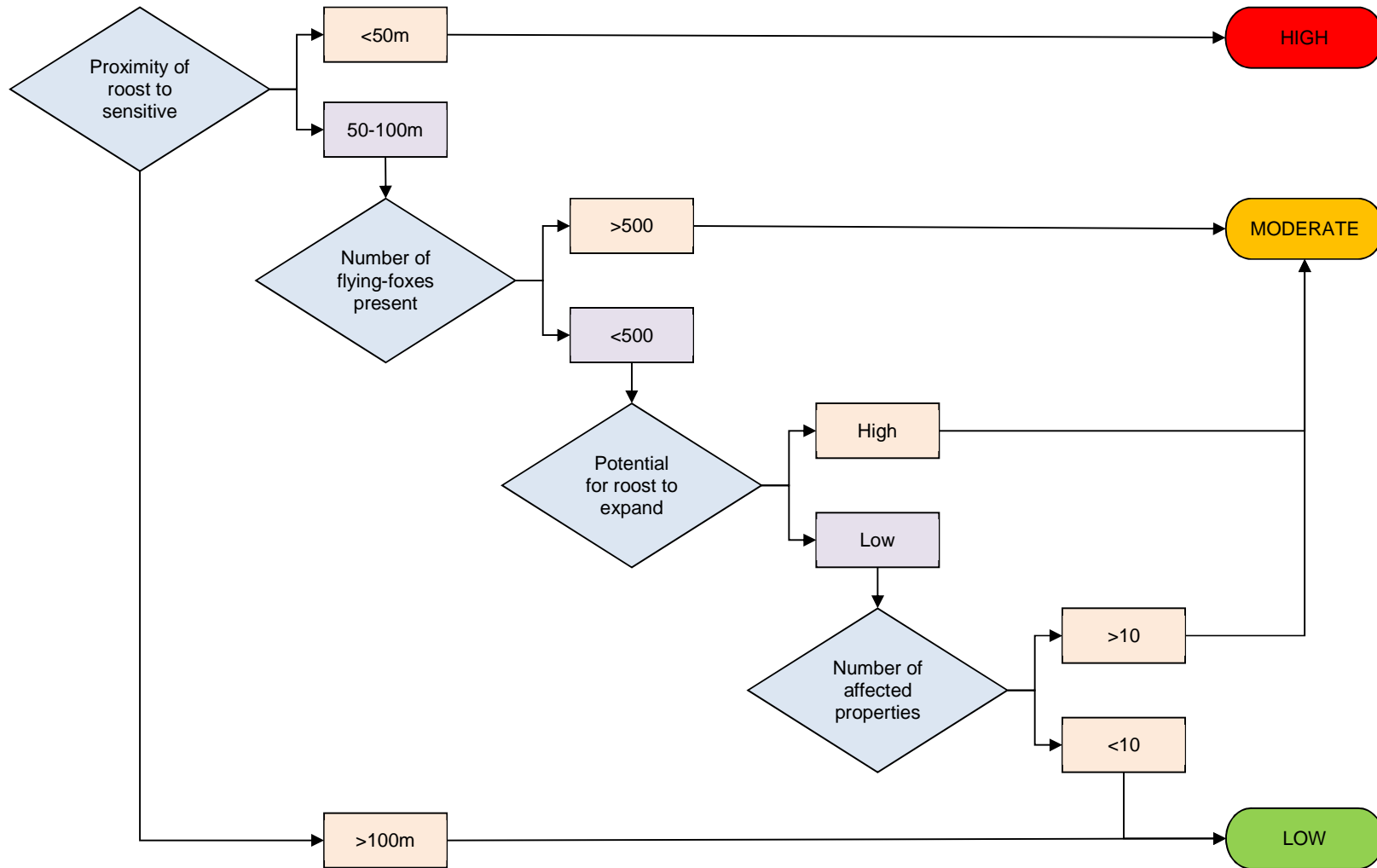
**APPENDIX 1 PRIMARY DECISION TREE FOR MANAGING HUMAN/FLYING-FOX CONFLICT IN BANANA SHIRE**



**APPENDIX 2 DETERMINING IF A FLYING-FOX ROOST ON NON-COUNCIL LAND WARRANTS COUNCIL INVOLVEMENT**



**APPENDIX 3 DETERMINING POTENTIAL LEVEL OF HUMAN/FLYING-FOX CONFLICT IN THE BANANA SHIRE**





**APPENDIX 4 GUIDE TO MINIMUM INTERVENTION OPTIONS**

Option	Description	Risks	Benefits
Do nothing	Take no action at all Only applicable for low conflict roosts, including those remote from UFFMA	Negative community perception Potential for roost to move to higher conflict site Inconsistent with a pro-active management approach Impact on Council's 'green credentials'	No costs No legislative compliance requirements
Education	Provide community with information about flying-fox biology and behaviour ecological significance of flying-foxes health risks location and history of roosts in region management options and likelihood of success Through means such as Council website leaflets / fact-sheets local press workshop / community forum presentation to schools, community groups, etc. local planning information Collaboration opportunities through DEHP	Costs associated with producing materials and/or running events Negative community perception – Council not doing enough	Pro-active approach Costs low compared with interventionist options Improved community awareness of flying-fox ecology and management Greater likelihood of community accepting and/or cooperating with Council on FF management Improved planning outcomes to prevent encroachment of development on known/potential roost sites
Monitoring	Regular direct observation and recording of known roost sites and/or FF activity Documentation and review of FF reports/complaints coming in from community	Cost associated with Council staff or contractors undertaking monitoring & reporting	Pro-active approach that may provide early warning signals for impending FF incursion and/or increasing conflict

Option	Description	Risks	Benefits
Maintain sensitive site buffers	<p>Applies only where roost is already &gt;100m away from sensitive sites</p> <p>Identify potential roost sites within 50m of sensitive site and manage to prevent (or reduce likelihood of) FF from roosting within buffer zone</p>	<p>Costs associated with vegetation management</p> <p>Community resistance to vegetation management (e.g. don't want large trees lopped or removed)</p>	<p>Pro-active approach that has potential to significantly decrease risk of future conflict</p> <p>Opportunity to engage with community to undertake preventive management</p>
Protect low impact roost	<p>Manage existing low-impact roost site to maintain and/or enhance suitability to FF, e.g.</p> <p>Control fire and weeds, especially while FF are absent, to maintain vegetation structure</p> <p>Supplementary planting of woody species to enhance and/or enlarge existing roost area</p>	<p>Costs associated with weed/fire control</p> <p>Costs for additional planting</p> <p>Potential for roost to provide "splinter groups" that might form new roosts in nearby high-conflict areas</p> <p>Negative community perception – exacerbating the 'problem' by helping FF survive locally</p>	<p>Provide permanent roost location that attracts FF away from high conflict areas</p> <p>Opportunity to engage and educate community in FF ecology and management → improved community perception and acceptance of FF</p> <p>Improve Council's 'green credentials'</p>
Provide alternative roost habitat	<p>Establish and maintain additional roost habitat in low impact areas</p>	<p>Costs for site preparation and planting</p> <p>Potential for roost to provide "splinter groups" that might form new roosts in nearby high-conflict areas</p> <p>Negative community perception – exacerbating the 'problem' by helping FF survive locally</p>	<p>Provide permanent roost location that attracts FF away from high conflict areas</p> <p>Opportunity to engage and educate community in FF ecology and management → improved community perception and acceptance of FF</p> <p>Improve Council's 'green credentials'</p>

**APPENDIX 5 GUIDE TO IN SITU MANAGEMENT OPTIONS**

Option	Description	Risks	Benefits
Changes to roost	<p>Vegetation management to create and maintain buffer between roost and affected properties – generally includes some pruning of roost trees, removal of understorey, weed control, etc.</p> <p>No roost tree may be destroyed or modified when there are flying-foxes in the tree, or when flying-foxes are near to the tree and likely to be harmed as a result of the destruction or modification.</p> <p>May also include other non-lethal methods such as the installation of canopy-mounted sprinklers or an acoustic fence, but these methods are not listed under the <i>Code of practice – Ecologically sustainable management of flying-fox roosts</i> and require DEHP permit approval</p>	<p>Cost of works and on-going maintenance</p> <p>Exposure of work crews to FF in roost</p> <p>Community perception – Council not doing enough; should be getting rid of FF</p> <p>Community opposition to vegetation change and/or expenditure of Council funds</p> <p>Community opposition to impacts on bat welfare</p> <p>Community opposition to potential outcomes – especially if FF “move camp”</p> <p><u>Impacts on welfare of bats</u></p> <p>Increased stress levels if bats in roost during works – especially if already stressed (e.g. through heat event or food shortage)</p> <p>Potential to cause abortion if females in late-stage pregnancy</p> <p>Potential abandonment of dependent juveniles</p> <p>Reduced suitability of roost (insufficient remaining area and/or changed structure)</p> <p>EPBC Act implications if GHFF present</p> <p><u>Impacts on welfare of residents</u></p> <p>Potential for FF to move to alternative roost/s due to disturbance</p> <p>Vegetation management may reduce visual and acoustic screening of roost</p>	<p>Lower costs than dispersal activities</p> <p>Likely to have lower costs than infrastructure change</p> <p>Minimum impact on FF in roost, if timing/methods appropriate, so low likelihood of legal/welfare issues</p> <p>Favourable community response from sectors opposed to disturbing FF</p> <p>Maintain Council's ‘green credentials’</p>

Option	Description	Risks	Benefits
<p>Infrastructure change - usage</p>	<p>Changing usage of non-residential infrastructure such as playgrounds, kindergartens, etc. (including move to alternative location) – may be temporary or permanent</p>	<p>Disruption and costs to users of moving to alternative usage pattern or new location                      Costs of finding, fitting out and providing access to alternative property                      Ongoing costs (rental, maintenance, etc.) at alternative site                      Cost of maintaining affected infrastructure despite no use or underutilisation                      Opposition from non-affected residents regarding use of Council funds</p>	<p>No direct impacts on FF in roost, so no welfare or legal implications                      May be opportunity to improve location and/or facilities for aging infrastructure</p>
<p>Infrastructure change - physical</p>	<p>Alteration of buildings, including residential (e.g. double-glazing, acoustic insulation, adding outdoor shelter such as carports)</p>	<p>High initial costs plus on-going maintenance requirements                      Opposition from non-affected residents regarding inequitable use of Council funds                      Unlikely to solve issues relating to FF roost impacts on outdoor lifestyle of residents                      Potentially high on-going costs where roosts are temporally and spatially variable (i.e. LRFF)</p>	<p>No direct impacts on FF in roost, so no welfare or legal implications                      Secondary benefits for treated buildings (e.g. improved thermal insulation and reduced heating/cooling costs)</p>

**APPENDIX 6 GUIDE TO DISPERSAL OPTIONS**

Option	Description	Risks	Benefits
<p>Dispersal stage 1 – roost modification</p>	<p>May range from pruning/lopping or removal of individual roost trees to destruction of all vegetation in the roost area.</p> <p>Must adhere to <i>Code of practice – Ecologically sustainable management of flying-fox roosts</i>.</p> <p>No roost tree may be destroyed or modified when there are flying-foxes in the tree, or when flying-foxes are near to the tree and likely to be harmed as a result of the destruction or modification.</p> <p>Aim is to make roost unsuitable for use by FF and therefore avoid or minimise the need to force FF to leave using dispersal stage 2 methods.</p>	<p>Cost of works – staff, contractors, equipment</p> <p>Cost of managing the process – staff, community, media attention, etc.</p> <p>Exposure of work crews to FF in roost</p> <p>Other safety risks to staff/contractors and public during works</p> <p>Increased safety risks if night works required</p> <p>VMA implications if roost vegetation being destroyed or substantially modified (i.e. sufficient to change from remnant to non-remnant condition)</p> <p>EPBC Act implications if GHFF present</p> <p>Potential for some/all bats to abandon roost and move into vegetation at other high-conflict sites</p> <p>Community opposition to vegetation change and/or expenditure of Council funds</p> <p>Community opposition to impacts on bat welfare</p> <p>Community opposition to potential outcomes – especially if FF “move camp”</p> <p>If long-term roost and not completely removed, high probability of bats returning once regrown</p> <p><u>Impacts on welfare of bats</u></p> <p>Increased stress levels if bats in roost during disturbance – especially if already stressed (e.g. through heat event or food shortage)</p> <p>Loss of roost in close proximity to important foraging area</p>	<p>Relief for affected residents if successful</p>

Option	Description	Risks	Benefits
<p>Dispersal stage 2 – flying-fox disturbance</p>	<p>Generally applied only if FF persist in the roost area after dispersal stage 1 (roost modification) has been attempted. May also be applied if/where roost modification is undesirable (e.g. highly valued vegetation such as in a botanical park)</p> <p>Must adhere to <i>Code of practice – Ecologically sustainable management of flying-fox roosts</i></p> <p>Disturbance limited to non-lethal methods, including smoke, noise, light, foggers, BirdFrite and ‘scarecrow’ type devices.</p>	<p>Cost of disturbance methods – staff, contractors, equipment – usually high</p> <p>Cost of monitoring before, during and after</p> <p>Potential on-going costs to keep FF away</p> <p>Cost of managing the process – staff, community, media attention, etc.</p> <p>Safety factors for night works and exposure of staff/contractors to FF</p> <p>Community opposition to expenditure of Council funds</p> <p>Community opposition to disturbance methods (i.e. it disturbs them too)</p> <p>Community opposition to impacts on bat welfare</p> <p>Community opposition to potential outcomes – especially if FF “move camp” to other high conflict sites</p> <p>EPBC Act implications if GHFF present</p> <p>Potential for litigation in relation to animal welfare outcomes and/or impacts on residents</p> <p><u>Impacts on welfare of bats</u></p> <p>Increased stress levels – especially if already stressed (e.g. through heat event or food shortage)</p> <p>Potential to cause abortion if females in late-stage pregnancy</p> <p>Potential abandonment of dependent juveniles</p> <p>Mortality due to inappropriate disturbance methods</p> <p>Increased risk of predation on disturbed bats</p>	<p>Relief for affected residents if successful</p>

## **APPENDIX 7 DECISION TOOL – IN SITU MANAGEMENT AND DISPERSAL**

The Decision Tool is a Microsoft Excel interactive worksheet, which incorporates the in situ management and roost dispersal options and associated hazards described in Appendices 5 and 6. It is designed to be used after the operator has worked through the Primary Decision Tree (Appendix 1) and arrived at a key decision point regarding the evaluation of in situ management or dispersal options.

The Decision Tool uses a weighted average approach to determine the risks associated with and feasibility of undertaking in situ management Actions (on roost and/or infrastructure) or dispersal Actions (roost alterations and/or active disturbance). Hazards for each Action are grouped according to their impact on Council, community and flying-foxes.

For a chosen Action, the user scores each Hazard by selecting from a number of potential impact statements for each. The tool then applies a weighting to each score (according to significance of each Hazard relative to other Hazards), calculates a weighted average score for the management Action in question, and provides a risk rating and comment on the feasibility of undertaking the Action.

The tool is designed to be intuitive, dynamic and user-customisable. As such, the current version (BSC-FFMP\_DecisionTool\_v2.xlsx) allows the user to adjust all Hazard weightings to suit administrative needs at the time of running an assessment. The number of choices, scores and wording of relative impact statements for each Hazard are currently locked, but these are easily unlocked for editing. However, any editing of this part of the Tool must be done by a competent Excel operator so as to ensure the weighted averaging system and consequent decision outputs are not forced into error.