

# Byron Shire Flying-fox Camp Management Plan

2024 - 2029



**BYRON**  
SHIRE  
COUNCIL


This plan has been prepared by EarthScapes Consulting Pty Ltd



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## Acknowledgement

Byron Shire Council acknowledges Traditional Aboriginal Custodians and recognises the continuing connection to lands, waters and country. We recognise and respect the Bundjalung of Byron Bay - Arakwal and the Widjabul Wia-bal Peoples' native title rights and interests within the Shire. Byron Shire Council also acknowledges the Tweed Byron, Jali and Ngulingah Local Aboriginal Land Councils under the Aboriginal Land Rights Act NSW 1983.

We also acknowledge valuable input by BSC Biodiversity staff, local Indigenous groups, and the NSW DPIE with consultants Ecosure in developing the template on which this Camp Management Plan was based. Thanks to Peggy Eby who provided advice which was included in the template and final Plan.



Photo credit: Greg Shanahan

## Acronyms and abbreviations

ABLV	Australian bat lyssavirus
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW)
BFF	Black Flying-fox ( <i>Pteropus alecto</i> )
the Code of Practice	Flying-fox Camp Management Code of Practice 2018 (NSW)
DEE	Commonwealth Department of the Environment and Energy
DPE	Department of Planning and Environment (NSW) (formally the DPIE)
DPIE	Department of Planning, Industry and Environment (NSW) (now defunct)
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EPA	Environment Protection Authority (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
GHFF	Grey-headed Flying-fox ( <i>Pteropus poliocephalus</i> )
the Guideline	Referral guideline for management actions in Grey-headed and Spectacled Flying-fox camps 2015 (Commonwealth)
LGA	local government area
LGNSW	Local Government NSW
LRFF	Little Red Flying-fox ( <i>Pteropus scapulatus</i> )
MNES	matters of national environmental significance
NPWS	National Parks and Wildlife Service (NSW)
the Plan	Flying-fox Camp Management Plan
POEO Act	<i>Protection of the Environment Operations Act 1997</i> (NSW)
the Policy	Flying-fox Camp Management Policy 2015 (NSW)
the Roost Detail Plan	Companion document to the Plan detailing current known camp roosts
SEPPs	State Environmental Planning Policies
SIS	species impact statement
TEC	threatened ecological community

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## 1. Overview

The far northeast of New South Wales is recognised as a biodiversity ‘hotspot’ - one of the richest and most diverse regions for flora and fauna in Australia. The subtropical climate, rainfall and soil types support this biodiversity. The region once contained large areas of sub-tropical lowland rainforest, and extensive tall eucalypt forests. The remaining lowland rainforest is currently less than 0.6% of the precolonial extent. Flying-foxes are keystone species for their critical role in long-distance pollination and seed dispersal, which is particularly important over fragmented landscapes.

Two flying-fox species occur in the Byron Shire home with fewer numbers recorded in late autumn and winter.



Photo credit: Kate Friebe



Grey-headed Flying-fox (*Pteropus poliocephalus*) (GHFF)

Black Flying-fox (*P. alecto*) (BFF)

A third species, the Little Red Flying-fox (*P. scapulatus*) (LRFF), has been a more sporadic visitor, having last been observed in 2021.

The GHFF is protected under the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act) and the BC Act 2016 as a threatened species due to population decline and ongoing threats.

Flying-foxes are highly mobile, ranging between a network of camps (roosts) as they follow seasonally flowering and fruiting trees. Loss of habitat is leading to an increase in the roosting and foraging of flying-foxes in urban areas, with camps becoming smaller and more fragmented. The result of this is increased opportunity for humans to have either positive or negative interactions with the Shire’s permanent and itinerant flying-fox camps.

The term “camp” has traditionally been applied to the area in which flying-fox congregate during the daytime. There can be an association with anthropomorphism in this term, and as such many ecologists and natural resource managers are now using the term “roost” in place of camp. The current Plan seeks to connect the historical and emerging vernacular, using both terms when appropriate.

This Byron Shire Flying-fox Management Plan (the Plan) provides a framework for Council to respond to community concerns while supporting ecological values and workers. It sets out impact mitigation strategies for interactions and how Council will make decisions about managing flying-fox impacts using a transparent decision framework. It provides actions and management directions to ensure flying-foxes and their critical ecological services are conserved on the Byron Shire.

The Plan and the supplementary Roost Detail profile each known roost including site context, roost history, other ecological values, proximity to residents and adjacent sensitive sites. These site-specific aspects have been, and will continue to be, considered in determining appropriate management and conservation actions for each roost.

This Plan is consistent with the NSW Department of Planning, Industry & Environment (DPIE) Flying-fox Camp Management Plan Template 2019 to facilitate licensing of camp management actions over the next five years.

## 1.1. Objectives

The objectives of this Camp Management Plan (the Plan) are to:

- minimise impacts to the community, while conserving flying-foxes and their habitat
- aligns with and is supported by Indigenous perceptions
- provide an acceptable level of amenity for the surrounding community
- manage public health and safety risks
- clearly define roles and responsibilities of stakeholders
- enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes
- ensure management is sympathetic to flying-fox behaviours and ecological requirements
- improve community understanding and appreciation of flying-foxes, including their critical ecological role
- ensure flying-fox welfare is a priority during all roost-site management works
- provide safe work methodologies for those working on ecological restoration and flying-fox care
- ensure camp management is consistent with broader conservation management strategies that may be developed to protect threatened species/communities
- ensure camp management does not contribute to loss of biodiversity or increase threats to threatened species/communities
- implement an adaptive management approach to camp management based on evidence collected, thereby shifting to a more holistic approach
- augment and align with other relevant land use and community planning documentation

## 1.2. Indigenous Knowledge and Associations

Will be supplemented with further input from local Indigenous groups as recorded in upcoming meetings

The biological and ecological sciences and management have moved from viewing single species in isolation to a systems-based approach, with strong parallels with Indigenous land and resource management.

Holistic Indigenous perception / spirituality is systems based, and management is integrated with life and living. These practices have ensured sustainability for tens of thousands of years, and their incorporation in biodiversity policies and management plans will facilitate conservation and cultural outcomes.

Many Aboriginal and Torres Strait Islander communities in the north of Australia regard flying-foxes as totemic species, with groups having members identified as flying-fox people (Rose, 2010).

Flying-foxes have significance to Aboriginal people as a food source, as a clan totem, as an art subject and as an indicator of particular habitat associations and seasonal and climatic changes, both annually and in the dreaming cycle (Ecobiological 2009 in DAWE 2021). The literature indicates that Aboriginal people traditionally have an intimate understanding of many aspects of flying-fox ecology, such as breeding and movement patterns, and that they

carefully managed flying-fox habitat to protect and sustain the species (Ecobiological 2009 in DAWE 2021).

Local Indigenous leaders, including NPWS Rangers, shared a number of important insights for the development of the Plan.

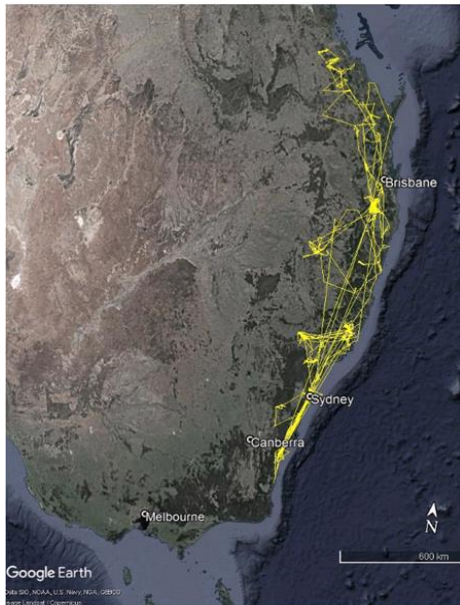
- More effective planning restrictions are required to limit future conflicts due to building in key habitat.
- Focus needs to be on community engagement and education.
- Current planning and development have detrimentally affected cultural management, with priorities shifting to commercial farming systems and construction of housing in habitat important to flying-fox.
- Every species has its role and significance within the Earth's ecosystems.
- Modern human society has tended to clear or modify natural habitats for personal gain without due regard for how other species are impacted.

Traditional owners will be encouraged throughout the life of the Plan to be involved in further consultation and implementation of management actions. All activities should be undertaken in a manner that respects the cultural traditions of Indigenous groups within the Shire.

## 2. Flying-fox Ecology and Protection

Flying-foxes are considered 'keystone' species given their contribution to the diversity, health, and maintenance of native vegetation communities. These ecosystem services ultimately contribute to the long-term protection of the biodiversity of Australia's terrestrial, aquatic and marine ecosystems. Native vegetation, particularly forests, act as carbon sinks (Roxburgh et al. 2006), provide habitat for other animals and plants, stabilise river systems and catchments, add value to production of hardwood timber, honey and fruit (e.g. bananas and mangoes; Fujita 1991), and provide recreational and tourism opportunities worth millions of dollars each year (DES 2018).

A single flying-fox can fly more than 100 km/night and on average 2500km/year. A single flying-fox tracks are highlighted in yellow for a 4 year period (Welberer et al 2020).



Long-distance pollination and seed dispersal make flying-foxes critical to the long-term persistence of many plant communities (Westcott et al. 2008; McConkey et al. 2012). Long-distance dispersal allows genetic material to be spread between geographically isolated forest patches that would normally be genetically isolated (Parry-Jones & Augee 1992; Eby 1991; Roberts 2006). This facilitation of an increase in genetic diversity assists species to adapt to environmental and climatic change. Transfer of genetic material between forest patches is particularly important in the context of contemporary fragmented landscapes.

Some plants, particularly bloodwoods and eucalyptus, have adaptations, such as cream-coloured flowers held in dense inflorescences at the ends of branches of tall trees, often producing stronger nectar at night. This suggests they rely more heavily on nocturnal species such as flying-foxes for pollination than diurnal nectarivores (Southerton et al. 2004). Many of these tree species are vital for the survival of other vertebrates, such as local koala populations (OEH 2018). The seasonal availability of fruits and blossoms in the different vegetation communities

drives the migratory or nomadic patterns observed within species of flying-foxes within the Byron Shire and nationally.

### 2.1. Under Threat

Increasing incidence of flying-fox roosting and foraging in urban areas can give the impression that their populations are increasing; however, the Grey-headed Flying-fox (GHFF) is in decline across its range and in 2001 was listed as vulnerable by the NSW Government through the *Threatened Species Conservation Act 1995* (now *BC Act 2016* see **section 2.6.2**). The species is also listed as vulnerable nationally under the Australian Federal Government's *Environmental Protection and Biodiversity Conservation Act 1999* and globally on the IUCN Red List.



The main threat to GHFF in New South Wales is clearing or modification of native vegetation (DAWE 2021). This removes roosting and breeding sites and reduces the availability of natural food resources, particularly crucial winter-spring foraging habitat in north-eastern NSW and SEQ.

There is a wide range of ongoing threats to the survival of the GHFF, including:

- habitat loss and degradation
- conflict with humans (including culling at orchards)
- infrastructure-related mortality (e.g. entanglement in barbed wire fencing and large-mesh fruit netting, power line electrocution, etc.)
- exposure to extreme natural events such as cyclones, drought, wildfires and heatwaves.

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

## 2.2. Species Profiles

The Byron Shire is home to two of the Australian mainland's four flying-fox species, with more sporadic visitations by a third species also profiled below. All three species track preferred food resources over extensive distances, particularly irregularly flowering bloodwoods and eucalypts, and the number found in Byron Shire camps varies considerably over time. The NSW Department of Planning and Environment notes that all flying-fox species occurring in NSW should be treated as a single or meta-population throughout their entire range.

### Black Flying-fox (*Pteropus alecto*)

The Black Flying-fox (BFF) is found in coastal areas across tropical and subtropical Australia, primarily foraging on fruit and blossoms of native and introduced plants. They are influenced by climatic variability and the availability of their preferred food resources, with a substantial southward shift in range down the coast of NSW in recent years. It's the largest species of Flying-fox in Australia ranging from 500-1000g. 23 - 28 cm (head and body length) and they can fly at 35 - 40 kilometres per hour.

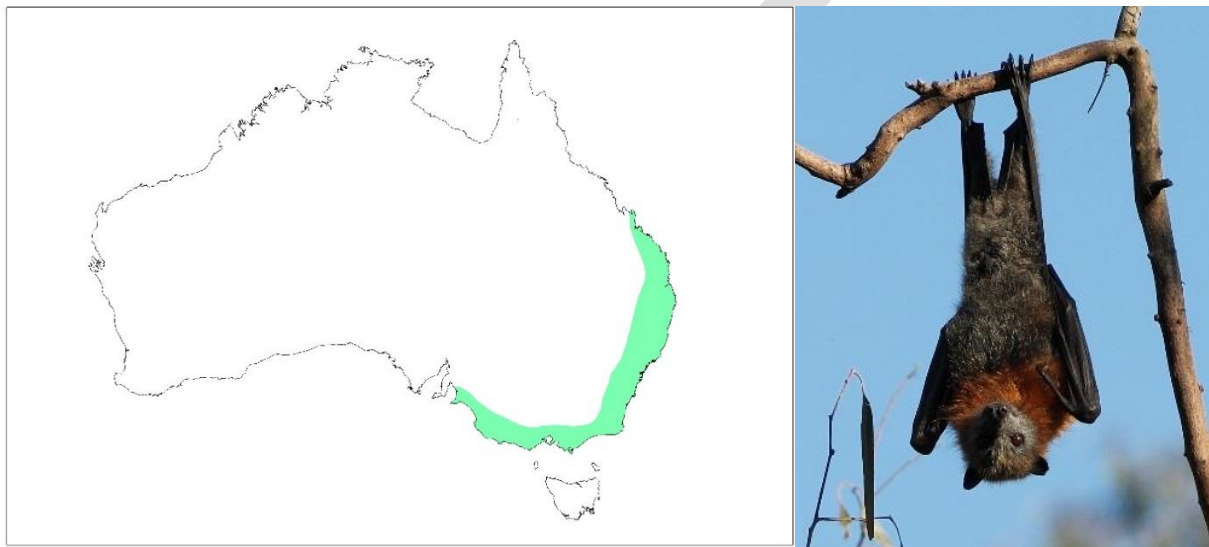


Figure 1 Black Flying-fox indicative species distribution (adapted from DPIE 2019a)

Feeding usually occurs within 20 kilometres of their camp site and they typically roost in company with GHFF beside creeks or rivers in warm and moist habitats including lowland rainforest gullies, coastal eucalypt forests and mangroves. As a native species, they are protected via each State or territories environmental legislation.

#### **Grey-headed Flying-fox (*Pteropus poliocephalus*)**

The Grey-headed Flying-fox (GHFF) is found throughout south-eastern Australia, generally within 200 kilometres of the coast (**Figure 2**). It requires foraging resources and camp sites within rainforests, open forests, closed and open woodlands (including melaleuca swamps and banksia woodlands). This species is also found in urban and agricultural areas where it feeds on introduced as well and native species and will feed in orchards at times, especially when other food is scarce (DPIE 2019a).



**Figure 2 Grey-headed Flying-fox indicative species distribution (adapted from DPIE 2019a)**

GHFF generally show a high level of fidelity to camp sites, returning year after year to the same site, and have been recorded returning to the same branch of a particular tree (SEQ Catchments 2012). This may be one of the reasons GHFF continue to return to small urban bushland blocks that may be remnants of historically used larger tracts of vegetation.

#### **Little Red Flying-fox (*Pteropus scapulatus*)**

The Little Red Flying-fox (LRFF) (**Figure 3**) is widely distributed throughout northern and eastern Australia, with populations occurring south through inland and coastal New South Wales into southern Victoria.



Figure 3 Little red Flying-fox indicative species distribution (adapted from DPIE 2019a)

The LRFF forages almost exclusively on nectar and pollen, although it will eat fruit at times and occasionally feeds in orchards (Australian Museum 2010). The LRFF is the most nomadic species of flying-fox in New South Wales. They are strongly influenced by the availability of food resources, predominantly the flowering of bloodwood and eucalypt species (Churchill 2008). This means the duration of their stay in any one place is generally very short and intermittent as observed in the Byron Shire.

Broad habitat preferences of this species are quite diverse and range from semi-arid areas to tropical and temperate areas, and can include sclerophyll forests and woodlands, melaleuca swamp forests, bamboo, mangroves and occasionally orchards (Eby & Roberts 2016). LRFF frequently roost with other flying-fox species. In some colonies, LRFF individuals can number many hundreds of thousands and they are unique among *Pteropus* species in their habit of clustering in dense bunches on a single branch. As a result, the weight of roosting individuals can break large branches and cause significant structural damage to roost trees, in addition to elevating soil nutrient levels through faecal material (SEQ Catchments 2012).

### 2.3. Flying-fox Camp Characteristics

Flying-foxes are predominantly nocturnal, typically roosting during the day in communal camps. They use vocalisation and scent to communicate with other flying-foxes, breastfeed their young, and groom themselves and each other. The camps may range in number from a few to hundreds of thousands, with individual animals frequently moving between camps within their range. Typically, the abundance of resources within a 20 to 50 kilometre radius of a camp site will be a key determinant of the size of a camp (SEQ Catchments 2012). In urban areas where camp density is high, maximum foraging distances are much shorter (Eby et al. 2022). Many rural flying-fox camps are temporary and seasonal, tightly tied to the flowering of local food trees. Animals are more likely to be present continuously in urban camps that provide an artificially diverse range of introduced and native food from gardens and street plantings. Understanding the availability of feeding resources is difficult because flowering and fruiting are not reliable every year and can vary between localities (SEQ Catchments 2012). The availability of food resources is expected to be significantly influenced by climate change (see **Section 2.4**). These are important aspects of camp preference and movement between camps and have implications for long-term management strategies.

Little is known about flying-fox camp preferences. Research indicates that apart from being in close proximity to food sources, flying-foxes choose to roost in vegetation with at least some of the following general characteristics (SEQ Catchments 2012; Eco Logical Australia 2018):

- closed canopy >5 metres high
- dense vegetation with complex structure (upper, mid- and understorey layers)
- within 500 metres of permanent water source
- within 50 kilometres of the coastline or at an elevation <65 metres above sea level
- level topography (<5° incline)
- greater than one hectare to accommodate and sustain large numbers of flying-foxes.

Optimal extent of vegetation available for flying-foxes must allow movement between preferred areas of the camp. Specifically, it is recommended that the size of a patch be approximately three times the area occupied by flying-foxes at any one time (SEQ Catchments 2012).

Camps provide resting habitat, sites of social interactions and refuge for animals during significant phases of their annual cycle, such as conception, birth and lactation (Parry-Jones and Augee 1992, Parry-Jones and Augee 2001). Camps are used as day refuges by flying-foxes that forage in surrounding areas over several weeks, as maternity camps, and as short-term stopover sites by migrating individuals or groups (Eby 1991, Eby 1995, Tidemann and Nelson 2004).

GHFF display a degree of flexibility in their choice of the extent of roost site vegetation (Tidemann 1999, Peacock 2004, Roberts 2005). Camps occur in vegetation ranging from continuous forest to patches as small as 1 hectare (Eby 2002b, West 2002).

### 2.3.1. Urban Camps

The number of camps in southeast Australia, including Byron Shire, has increased markedly in recent years and the majority of newly-established sites are located in urban areas (Eby and Lunney 2002, Williams et al. 2006, van der Ree 2006, Eby et al 2022). Timmiss et al (2021) showed that nearly three quarters of GHFF, BFF and LRFF roosts across Australia are in urban areas (72%, 73% and 69% respectively). This change in behaviour increases the risk of conflict between flying-foxes and people. 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 at non-urban roosts or culling at orchards
- urban effects on local climate
- 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.

In the Byron Shire there are both permanent urban camps with a year-round variable population of flying-foxes as well as seasonal camps. Details of each camp, including mapped locations, local ecological values, camp proximity to sensitive sites and habitat restoration works are presented in the accompanying Byron Shire Roost Detail Plan document (**Roost Detail Plan**).

Management actions which were previously identified in the 2018 to 2023 Management Plan are presented in **Table 12**.

### **2.3.2. Rural Camps**

Rural camps are located out of urban areas and typically have relatively low risk of conflict with the wider community. They are more likely to be situated on private land than urban camps which are generally located in parks and reserves.

Council supports restoration projects around those camps and will be working with landholders interested in promoting habitat improvement on those sites. If located on public land, when resources allow, Council may investigate opportunities to improve and increase habitat on those sites. Further detail for the rural camps present in the 2023 surveys are presented in the **Roost Detail Plan**.

### **2.3.3. Regional Context**

The flying-fox camps of the Byron Shire are part of a network of roost sites within the broader regional area. Given the national and local significance of flying-foxes as ecological keystone species and providers of ecological services, it is important to recognise the wider geographical value of the local urban and rural camp locations.

As part of the Australian Government's National Flying-fox Monitoring program (NFFMP), a quarterly program of regional monitoring has been conducted at 46 flying-fox camps in neighbouring LGAs to the north (Tweed), south (Ballina) and west (Lismore) from November 2012 to February 2022 (**Figure 4**). Byron and Tweed Shires continue this program of monitoring at a selection of roosts.



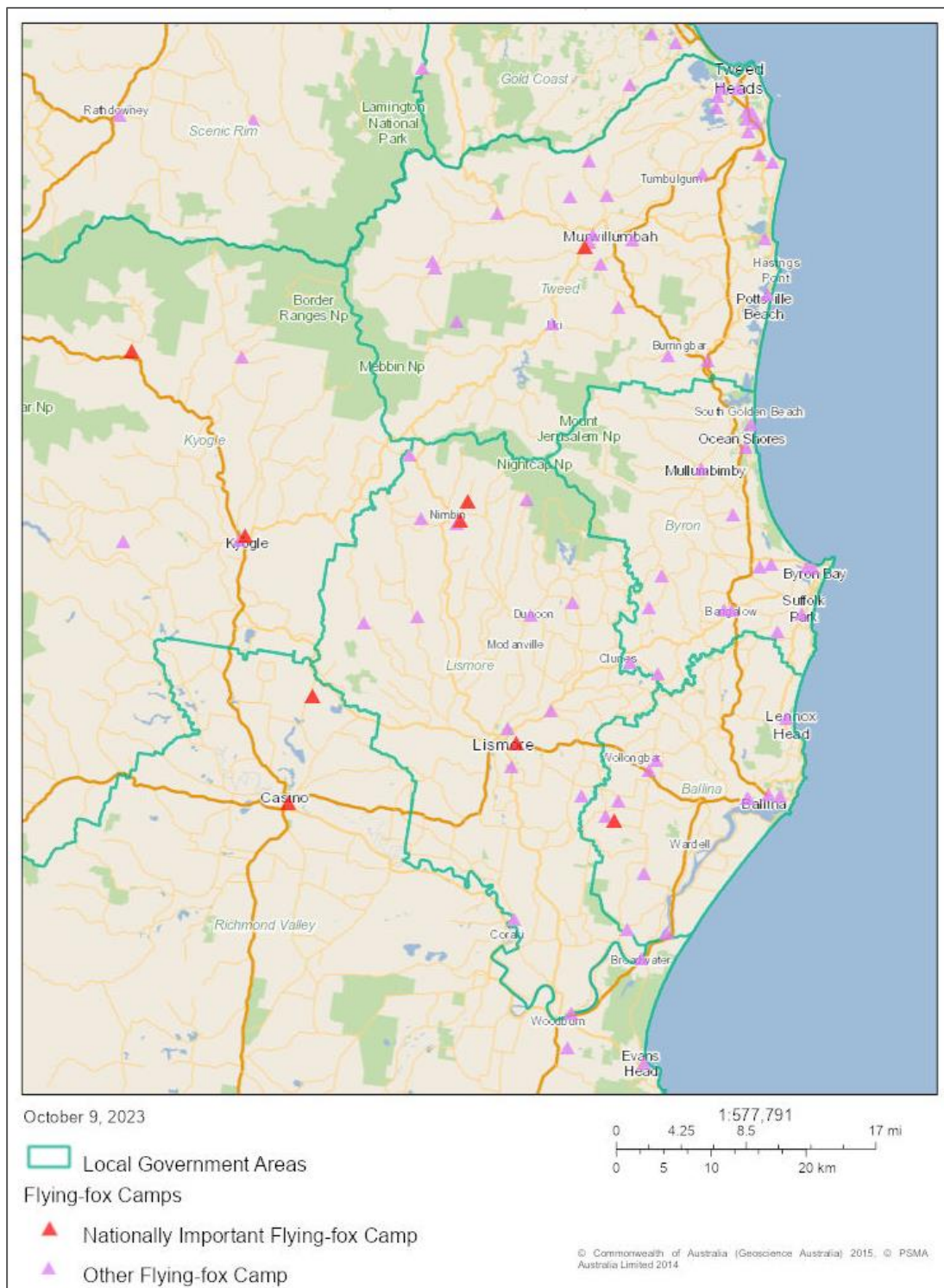
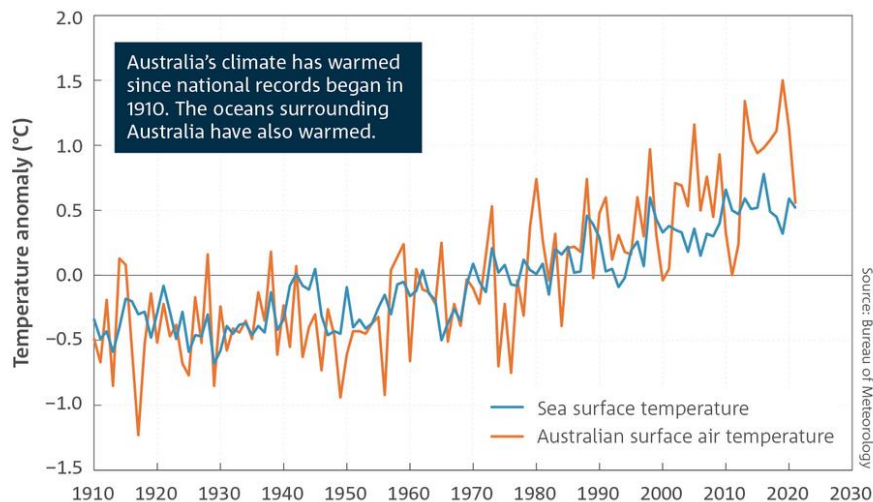


Figure 4 National flying-fox Monitoring program regional flying-fox camp locations

## 2.4. Potential Impacts and Responses from a Changing Climate

As temperatures warm, the atmosphere has a greater capacity to store water vapour. With each degree Celsius of warming, this connection alone may raise the atmosphere's moisture capacity by 7% (BoM & CSIRO 2022). The 2022 State of the Climate report from the Bureau of Meteorology (BoM) states that the warming trend in Australia is  $1.47 \pm 0.24^\circ\text{C}$  since national records began in 1910 (Figure 5).



**Figure 5** Anomalies in annual mean sea surface temperature and temperature over land, in the Australian region. Anomalies are the departures from the 1961-90 standard averaging period. (Source: BoM)

The additional heating of the land and the sea surface increase rates of evaporation. Elevated atmospheric moisture levels may potentially supply more energy to some mechanisms responsible for producing intense precipitation episodes, hence intensifying heavy rainfall events brought on by global warming. The increased probability of heavy rainfall events owing to global warming may balance a predicted decrease in overall average rainfall totals.

Some of the more overt impacts of a changing climate are -

- Intensification of storms, particularly damaging rainfall and hail events cause direct mortality and impact habitat.
- Flooding events and their aftermath that introduce weed propagules, especially vines, which can be brought into camp areas and hamper roosting.
- Extended and more intense droughts reduce flowering and fruiting in native forests causing periods of food shortage with substantially reduced reproduction and increased mortality in adults
- Increased incidence of high severity bushfires impact food availability by reducing reproductively mature trees and interrupting flowering patterns in the vegetation that survives.
- More frequent and damaging heat stress events cause direct mortality, particularly in juveniles and BFF (see **Table 12** for management options).

Climate change will affect flowering and fruiting regimes, according to research conducted by Hudson et al.'s (2010), which indicated that temperature and rainfall have complicated effects on the timing and intensity of eucalypt flowering. The findings of Butt et al. (2015) indicated that the subtropics are experiencing altered blossoming and fruiting events due to temperature and rainfall extremes caused by climate change, diminishing the availability of resources for species that depends on them. Eby et al. (2022) found the periods of highly reduced flowering that result in food shortages for flying foxes are linked to drought and periods of strong El Nino events.

### 2.4.1. Heat Stress Events

Heat stress events can impact camps to different extents based on abiotic factors such as temperature, wind, and humidity. The BFF tends to be the most susceptible, with mortality commencing as temperatures climb above 38°C. The GHFF, while also suffering heat stress, have been found to begin dying after a temperature of 42°C is reached (Welbergen et al., 2008). Management options for dealing with heat stress events are detailed in **Appendix 1**.

Biotic factors, such as the amount and quality of understory, and the health and ability of the canopy to provide shade, also affect survivability during heatwaves. Any works involving weed removal needs to be balanced by planting appropriate canopy and understorey species.

Council's role in flying-fox heat stress events is to monitor the flying-fox roosts, and establish site control during mitigation, rescue and clean-up efforts on Council controlled land. In addition, Council will communicate with the community and provide data and relevant information to other stakeholders such as State Government agencies. Council has elected to take this role during a heat stress event to support wildlife care organizations, develop greater insights to the flying-fox roosts, and to provide prompt and accurate information and service to the community. It should be acknowledged that it is not a legal requirement for local governments to be actively involved in flying-fox heat stress events.

#### **Heat Stress Actions**

Council's flying-fox coordinator

- is advised to monitor 7 - 10 day forecasts from the Bureau of Meteorology (BoM) for days between early November and late February for days with predicted temperatures of or above 38 degrees.
- need to keep an up-to-date contact list for support agencies with care support abilities.
- ensure vaccinated carers are identifiable with a feature such as coloured armband.
- Enlist non-vaccinated workers to provide support
- Provide workers with details of appropriate personal protection equipment (PPE)
- Provide maps with designated meeting points for workers.

#### **Use of handheld water sprayer**

Handheld mist sprayer should be

- held at least 1 – 2 metres from animals.
- Workers must be vaccinated.
- Walk slowly towards animals as you spray to not alarm.
- Only effective if animals in shaded areas.
- Indirect spraying of foliage will only increase humidity.
- Keep noise disturbance to a minimum.
- Spray should be directed above the animals so they can rehydrate from falling water.
- If the animals begin to climb higher into the foliage, immediately back away and try again later.
- After rehydrating, the animals may begin to climb away from the ground into the canopy.

As temperatures increase towards 38 °C, animals will move to lower strata of the foliage. Flying-fox tend to go from panting to clustering together, then to clumping nearer the ground. At this stage, handheld water sprayers will be of benefit if used appropriately.

#### 2.4.2. Food Shortages

While relatively few animals die in camps during food shortage, new camps form. There are implications for conflict and disease risk when flying-foxes start roosting at or near their feeding trees (which are often in urban areas) and are found starving or dead in private land or public spaces outside of roosts. Increasing understanding of what occurs and how to respond have been identified as a priority (pers comm Peggy Eby).

### 2.5. Human and Animal Health

Flying-foxes, like all animals, carry pathogens that may pose human health risks. Many of these are viruses that cause only minor infections with no clinical signs in the flying-foxes, but may cause significant disease in other animals that are exposed. In Australia the most well-defined of these include Australian bat lyssavirus (ABLV), Hendra virus (HeV) and Menangle virus. Specific information on these viruses is provided in **Appendix 3**.

Outside of an occupational cohort, including wildlife carers and vets, human exposure to these viruses is rare (WHA 2023, 2020, 2016). Similarly, transmission rates and incidence of human infection are very low. In addition, HeV infection in humans requires transfer from an infected intermediate equine host, Menangle virus requires pigs as host, and direct transmission from flying-foxes to humans has not been reported. Thus, 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 judged to be low (Qld Health 2016).

Wildlife Health Australia (WHA) <https://wildlifehealthaustralia.com.au/> has a Bat Health Focus Group that meets regularly and provides Fact Sheets on ABLV, HeV, Menangle virus, general wildlife disease and bat handling issues. WHA collates recent media articles and publications into a free monthly Bat News email service <https://wildlifehealthaustralia.com.au/Resource-Centre/Bat-Health>

#### 2.5.1. Disease and Flying-fox Management

The effects of stress are linked to increased susceptibility and expression of disease in both humans (AIHW 2012) and animals including reduced immunity to disease (Henry & Stephens-Larson 1985; Aich et al. 2009). Therefore, it can be assumed that management actions that may cause stress (e.g. dispersal), particularly over a prolonged period or at times where other stressors are increased (e.g. food shortages, habitat fragmentation, etc.), are likely to increase the susceptibility and prevalence of disease within the flying-fox population, and consequently the risk of transfer to humans.

Management actions and environmental changes may increase disease risk by:

- forcing flying-foxes into closer proximity to one another, increasing the probability of disease transfer between individuals and within the population.
- causing miscarriages and/or dropped young if inappropriate methods are used during critical periods of the breeding cycle. This will increase the likelihood of direct interaction between flying-foxes and the public, and potential for disease exposure.
- adoption of inhumane methods with the potential to cause injury which would increase the likelihood of the community encountering injured/dying flying-foxes.

The potential to increase disease risk should be carefully considered as part of a full risk assessment when determining the appropriate level of management and the associated mitigation measures required.

### **2.5.2. Light Mitigation Strategies**

Retaining the natural darkness around the habitats of bat species, including flying-foxes, is the most efficient way to mitigate the impacts from artificial lighting. Maintaining dark roost locations, constructing dark pathways from roosts to foraging/watering sites, lowering light intensities, and rerouting light away from habitats are useful management strategies where lighting is present or is added. For several bat species, artificial light with longer wavelengths (red) seems to have the least negative effects (DCCEEW 2022). Minimal effect does not equate to no impact, thus mitigation strategies should be tailored to the local bat population and evaluated on a case-by-case basis.

Artificial lighting may disrupt certain bat species' roosting grounds, modify the ecology of bat feeding, and/or split up commuting routes. The ability of a threatened species such as the GHFF to endure or recover may be weakened by these effects. Artificial point sources that directly illuminate bats' habitats are the kind of light pollution that has been shown to have the greatest impacts (DCCEEW 2022).



## 2.6. Overview of Legislation Relevant to Flying-foxes

It should be noted that this Plan does not constitute a licence to undertake works. Landholders and property managers seeking to undertake works on private property will need to acquire the relevant approvals via Council and/ or DPE.

### 2.6.1. Local government

Local government is required to prepare planning schemes (including Environmental Planning Instruments and Development Control Plans) consistent with provisions under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Local Environment Plans are environmental planning instruments that are legal documents and that relate to a local government area. A development control plan provides detailed planning and design guidelines to support the planning controls in a Local Environment Plan, but they are not legal documents.

Planning schemes enable a local government authority to manage growth and change in their local government area (LGA) through land use and administrative definitions, zones, overlays, infrastructure planning provisions, assessment codes and other administrative provisions. A planning scheme identifies the kind of development requiring approval, as well as zoning all areas within the LGA based on the environmental values and development requirements of that land. Planning schemes could potentially include a flying-fox habitat and roost site overlay and may designate some habitat as flying-fox conservation areas.

Known plans held by Council or Trusts for reserves containing a flying-fox camp are listed in Error! Reference source not found..

Table 1 Local Government Policy Documents and their Relevance to the FFCMP

Documentation	Administered by	Relevance to subject camps
Byron Local Environmental Plans 1988 & 2014	Council	A variety of land zones apply to the different camps. The camps contain land that is zoned under either 'deferred matter zones' under the Byron Local Environment Plan 1988 (which will require rezoning in future) and/or current land zoning under the Byron Local Environment Plan 2014.
Development Control Plan 2014	Council	Advice and guidance on planning for land use compatibility, avoiding land use conflict and the use of buffers. The emphasis is on identifying current and potential future land use conflicts at the outset and designing to avoid them during the development process where possible.
Byron Biodiversity Conservation Strategy 2020 - 2030	Council	Matters for consideration when developing planning controls. New developments or activities that occur in close proximity to ecological attributes and/ or habitats can impose negative impacts to human health, safety or comfort values (e.g. where in close proximity to flying-fox camp). The Strategy supports appropriate buffers as required.  The accuracy and availability of mappable information held within Council note high environmental values, but indicates the need to continually update mapping including flying-fox camps, as new camps establish.

Documentation	Administered by	Relevance to subject camps
Open Spaces Asset Management Plan 2020	Council	The plan details information about infrastructure assets including actions required to provide an agreed level of service in the most cost-effective manner while outlining associated risks.
Byron Shire Council Operational Plan for Pine Avenue Sports Field Mullumbimby Crown Reserve 85663 for Public Recreation	Council	<p>The Operational Plan provides a framework for the management and development of Crown Land under Council's control. Council has responsibility for two main types of public land; Crown Land whose control is vested in Council under the <i>Crown Lands Act 1989</i> and Council owned and managed community land dedicated under the <i>Local Government Act 1993</i>.</p> <p>The land included in the Operational Plan is Crown Land identified as Crown Reserve 85663, comprising Lot 451 DP 728526, which is located in Mullumbimby, west of the township and bordered by Pine Avenue, Garden Avenue and the tributaries of Chinbible Creek, being the Yalgany and Yoga-bera Creeks.</p> <p>The land is known locally as the Pine Avenue Sports fields, and also includes the Rotary Rainforest Park.</p>
Mullumbimby Flying-fox Camp Management Actions Plan	Council	Management actions support the Mullumbimby Flying-fox Camp Management Actions Plan and comply with the flying-fox camp management policy. The flying-fox camp management policy has been considered during the preparation of the proposed management actions in this Plan and the Mullumbimby Flying-fox Camp Management Actions Plan and as such recommends level 1 then level 2 management actions.
Plan of Management for Butler Street Reserve, Byron Bay - Reserve 88993 for Public Recreation	Crown Land	Management actions support the Plan of Management for Butler Street by seeking to minimise adverse environmental impacts of the Reserve use on adjacent land uses, water bodies and areas of significant habitat. However, under the Plan of Management for Butler Street, proposals to develop a skate park, children's playground and additional 20-space car parking would need to consider the negative impacts of flying-foxes on such infrastructure e.g. smell, faecal drop and reduced general amenity.
Cumbebin Wetland Sanctuary Site Restoration and Weed Management Plan	Cumbebin Wetland Trust	Management actions support the Cumbebin Wetland Sanctuary Site Restoration and Weed Management Plan (2006) by assisting in managing the site in order to ensure that existing bushland elements are protected from excessive human induced disturbance. Focus is on bush regeneration and weed control.

### 2.6.2. State Legislation and Policy

**Flying-fox Camp Management Code of Practice 2018** under clause 2.9 of the *Biodiversity Conservation Regulation 2017*.

The object of this Code is to authorise camp management actions in flying-fox camps in NSW

subject to the requirements of this Code. The Code directly informed the DPIE Flying-fox Camp Management Plan Template 2019 upon which the management actions presented within the Byron Shire Flying-fox Management Plan 2024 - 2029 are based.

#### **Flying-fox Camp Management Policy 2015**

The [Flying-fox Camp Management Policy 2015](#) (the Policy) has been developed to empower land managers, principally local councils, to work with their communities to manage flying-fox camps effectively. It provides the framework within which the Department will make regulatory decisions. In particular, the Policy strongly encourages local councils and other land managers to prepare Camp Management Plans for sites where the local community is affected.

#### ***Biodiversity Conservation Act 2016***

The [Biodiversity Conservation Act 2016](#) (BC Act) replaced the *Threatened Species Conservation Act 1995* on 25 August 2017.

The purpose of the BC Act includes to conserve biodiversity at the bioregional and state scales. Under this Act, a person who harms or attempts to harm an animal of a threatened species, an animal that is part of a threatened ecological community, or a protected animal, is guilty of an offence.

The GHFF is listed as threatened (Vulnerable) under the BC Act.

A biodiversity conservation licence under Part 2 of the BC Act may be required if the proposed action is likely to result in one or more of the following:

- harm to an animal that is a threatened species, or part of a threatened population
- the picking of a plant that is a threatened species, or part of a threatened population or ecological community
- damage to habitat of a threatened species, population or ecological community
- damage to a declared area of outstanding biodiversity conservation value.

An assessment of impacts is required for any threatened species or their habitat, population, or ecological community that may be impacted by actions proposed in the Plan.

If the Department assesses a biodiversity conservation licence application and determines that a significant impact is unlikely, a biodiversity conservation licence will be granted (the appendix to the Policy lists standard conditions for flying-fox management approvals).

The Department regulates flying-fox camp management through two options provided to land managers:

- authorisation under the Flying-fox Camp Management Code of Practice for public land managers
- licensing for public and private land managers.

The Code of Practice provides a defence under the BC Act for public land managers, as long as camp management actions are carried out in accordance with the Code of Practice.

### ***Prevention of Cruelty to Animals Act 1979***

It may be an offence under this Act if there is evidence of unreasonable/unnecessary torment associated with management activities. Adhering to welfare and conservation measures provided in Section 10.3 will ensure compliance with this Act.

### ***Environmental Planning and Assessment Act 1979***

The objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act) are to encourage proper management, development and conservation of resources, for the purpose of the social and economic welfare of the community and a better environment. It also aims to share responsibility for environmental planning between different levels of government and promote public participation in environmental planning and assessment.

The EP&A Act is administered by the Department of Planning and Environment.

Development control plans under the Act should consider flying-fox camps so that planning, design and construction of future developments is appropriate to avoid future conflict.

Development under Part 4 of the Act does not require licensing under the BC Act.

Where public authorities such as local councils undertake development under Part 5 of the EP&A Act (known as 'development without consent' or 'activity'), assessment and licensing under the BC Act may not be required; however, a full consideration of the development's potential impacts on threatened species will be required in all cases.

Where flying-fox camps occur on private land, landowners are not eligible to apply for development under Part 5 of the EP&A Act. Private landowners should contact council to explore management options for camps that occur on private land.

### **2.6.3. Commonwealth Legislation**

#### ***Environment Protection and Biodiversity Conservation Act 1999***

The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection for the environment, specifically matters of national environmental significance (MNES). A referral to the Commonwealth Department of the Environment and Energy (DEE) is required under the EPBC Act for any action that is likely to significantly impact on an MNES.

MNES under the EPBC Act that relate to flying-foxes include:

- world heritage sites (where those sites contain flying-fox camps or foraging habitat)
- wetlands of international importance (where those wetlands contain flying-fox camps or foraging habitat)
- nationally threatened species and ecological communities.

The GHFF is listed as a vulnerable species under the EPBC Act, meaning it is an MNES. It is also considered to have a single national population. DEE has developed the [Referral](#)

[guideline for management actions in GHFF and SFF<sup>1</sup> camps](#) (DoE 2015) (the Guideline) to guide whether referral is required for actions pertaining to the GHFF.

The Guideline defines a nationally important GHFF camp as one that has either:

- contained  $\geq 10,000$  GHFF in more than one year in the last 10 years
- been occupied by more than 2,500 GHFF permanently or seasonally every year for the last 10 years.

Provided management at nationally important camps follows the mitigation standards, DEE has determined that a significant impact on the population is unlikely, and referral is not likely to be required.

Referral will be required if a significant impact to any other MNES is considered likely as a result of management actions outlined in the Plan. Self-assessable criteria are available in the [Significant Impact Guidelines 1.1](#) (DoE 2013) to assist in determining whether a significant impact is likely; otherwise consultation with DEE will be required.

### ***National Recovery Plan for the Grey-headed Flying-fox 2021***

The plan identifies nine recovery objectives and 31 actions, with the overall aim '*to improve the national population trend; identify, manage and secure key foraging and roosting habitat; improve the community's capacity to coexist with flying-foxes; and increase awareness about flying-foxes, the threats they face and the important ecosystem services they provide as seed dispersers and pollinators*'. Actions specifically relevant to flying-fox camp management include:

- *Action 2.1: Continue to maintain a database of GHFF camps.*
- *Action 2.2: Undertake work on the database to include tenure and zoning of the land and land adjoining all camps.*
- *Action 2.3: Protect and enhance roosting habitat for GHFF.*
- *Action 2.4: Develop and implement plans of management for all problematic GHFF camps.*
- *Action 4.1: Undertake community surveys to elicit community values and attitudes towards wildlife, specifically flying-foxes, and also to assess the effectiveness of public awareness-raising.*
- *Action 4.2: Develop and publish information for the community to build their capacity to coexist with GHFF.*
- *Action 4.3: Publish case studies demonstrating how effective in situ management of Flying-foxes can mitigate impacts on the local community, as well as the difficulties and costs associated with attempting dispersals.*
- *Action 4.4: Work with local governments and private landholders to identify existing Flying-fox roosting habitat, implement mitigation measures in areas of conflict and investigate opportunities for creating or rehabilitating habitat away from people, and areas unsuitable for development due to potential conflict.*
- *Action 6.1: Ensure the public is aware of the referral guideline and that it is widely available for proponents who are proposing to manage a problematic flying-fox camp.*

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<sup>1</sup> spectacled Flying-fox (*P. conspicillatus*)



In November 2016 the House of Representatives Standing Committee on the Environment and Energy conducted an inquiry into the impact of flying-foxes, including the GHFF on communities in the eastern states of Australia. The Committee tabled its report in Parliament on 27 February 2017 which included recommendations aimed to complement existing efforts to protect, conserve and recover flying-fox populations and provide support for the local councils and affected residents (DAWE 2021).

### 3. Flying-fox Management Goals and Options

Developing and enhancing a vision or aim for a flying-fox camp assists with determining the actions required to achieve that vision. For example, is the aim to ensure camp sustainability, mitigate local impacts, or to undertake ecological restoration of the site?

Realistic aims for appropriate flying-fox camp management are site specific and will vary between sites depending on conservation values and the risks (such as health and safety issues related to site access) and/or threats (such as weed species that may be impacting upon the flying-fox roost) present at individual sites (see **Roost Details Plan** for specific camp data). Flying-fox camp sites are highly modified ecosystems and when compared with works on a similar site that don't involve a flying-fox roost are likely to:

- take longer to restore
- require planning and works over a larger area, including appropriate management of buffer zones
- need greater resources
- require a greater focus on community engagement.

Based on the NSW Flying-fox Camp Management Policy 2015 (the Policy), there are three levels of actions recommended for the management of flying-fox camps which are detailed below.

#### 3.1. Level 1 Actions: routine camp management

##### Education and awareness programs

This management option involves undertaking a comprehensive and targeted flying-fox education and awareness program to provide accurate information to the local community about flying-foxes.

Such a program would include managing risk and alleviating concern about health and safety issues associated with flying-foxes, options available to reduce impacts from roosting and foraging, an up-to-date program of works being undertaken at the camp, and information about flying-fox numbers and behaviour at the camp.

Residents should also be made aware that faecal drop and noise at night can be associated with plants that provide food, independent of camp location. Staged removal of foraging species such as fruit trees and palms from residential yards, or management of fruit (e.g. bagging, pruning) will greatly assist in mitigating this issue. Approval from the local council may be required for the removal of some trees.

Collecting and providing information should always be the first response to community concerns in alleviating issues without the need to actively manage flying-foxes or their

habitat. Where it is determined that management is required, education should similarly be a key component of any approach.

The Byron Shire Council has initiated education programs including the components shown in Figure 6 Possible components of an education program

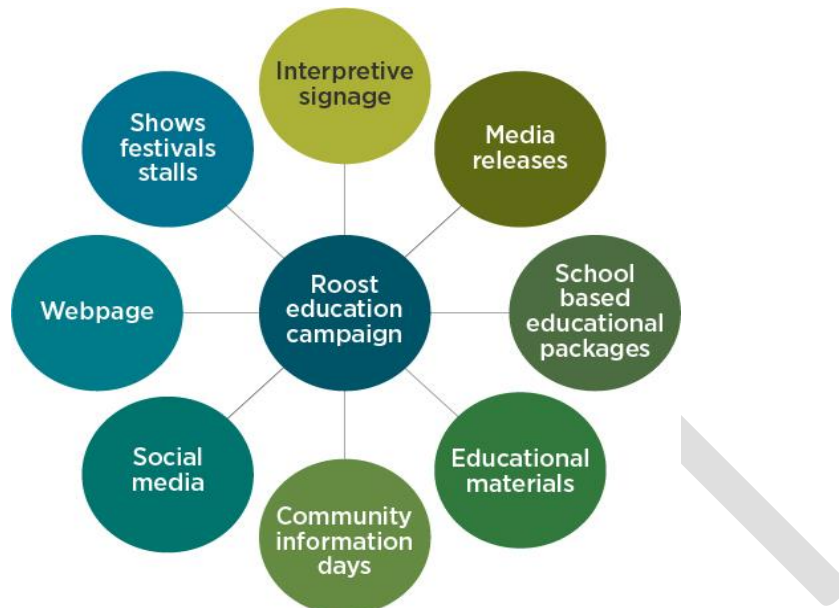


Figure 6 Possible components of an education program

Extensive education for decision-makers, the media and the broader community may be required to overcome negative attitudes towards flying-foxes.

### Facts about bats

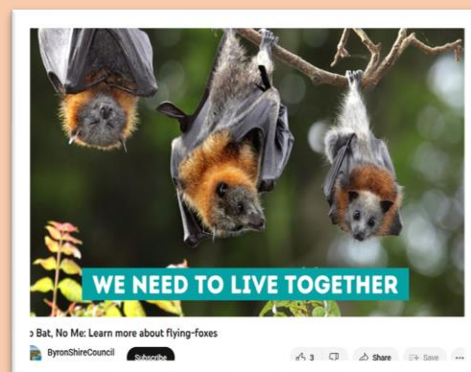
In an initiative to facilitate informing and inspiring children and teachers throughout the Shire, the BSC has invested in an informative and beautiful A3 flip-book.



Designed to support educators with a stand-up format, the book has visually appealing imagery on the pages presented to an audience, with detailed information and fun facts visible on the pages facing the presenter.

### No Bats, No Me

BSC are offering local schools a free 30-minute workshop and video to explore the secret network between Flying-foxes and koalas.



Education and engagement initiatives such as these can change perceptions while reinforcing appropriate safety for humans and bats alike.

It should be stressed that a long-term solution to the issue resides with a better understanding of flying-fox ecology and applying that understanding to careful urban planning and development. Council is currently developing an Education and Awareness Action Strategy as part of this Plan implementation.

### **Property modification**

The managers of land on which a flying-fox camp is located would promote or encourage the adoption of certain actions on properties adjacent or near to the camp to minimise impacts from roosting and foraging flying-foxes (note that approval may be required for some activities, refer to Section 3.5 for further information):

- Create visual/sound/smell barriers with fencing or hedges. To avoid attracting flying-foxes, species selected for hedging should not produce edible fruit or nectar-exuding flowers, should grow in dense formation between two and five metres (Roberts 2006) (or be maintained at less than five metres). Vegetation that produces fragrant flowers can assist in masking camp odour where this is of concern. Council's website has a foraging plant species list that can be used to attract or deter flying-foxes <https://www.byron.nsw.gov.au/Services/Environment/Native-animals-and-plants/flying-foxes/Tree-species-for-flying-foxes>.
- Manage foraging trees (i.e. plants that produce fruit/nectar-exuding flowers) within properties through pruning/covering with bags or wildlife friendly netting, early removal of fruit, or tree replacement.
- Cover vehicles, structures and clothes lines where faecal contamination is an issue, or remove washing from the line before dawn/dusk.
- Move or cover eating areas (e.g. barbecues and tables) that are close to a camp or foraging tree to avoid droppings by flying-foxes.
- Install double-glazed windows, insulation and use air-conditioners when needed to reduce noise disturbance and smell associated with a nearby camp.
- Follow horse husbandry and property management guidelines (see **Appendix 3** for details).
- Include suitable buffers and other provisions (e.g. covered car parks) in planning of new developments.
- Consider removable covers for swimming pools and ensure working filters and regular chlorine treatment.
- Appropriately manage rainwater tanks, including installing first-flush systems.
- Avoid disturbing flying-foxes during the day as this will increase camp noise.

The cost would be borne by the person or organisation who modifies the property; however, opportunities for funding assistance (e.g. environment grants) may be available for management activities that reduce the need to actively manage a camp.

### **Routine camp maintenance and operational activities**

Examples of routine camp management actions are provided in the Policy. These include:

- removal of tree limbs or whole trees that pose a genuine health and safety risk, as determined by a qualified arborist
- weed removal, including removal of terrestrial and aquatic weeds under the Commonwealth Biosecurity Act 2015, or species listed as undesirable by a council
- trimming of understorey vegetation or the planting of vegetation, particularly to achieve buffers
- minor habitat augmentation for the benefit of the roosting animals

- mowing of grass and similar grounds-keeping actions that will not create a major disturbance to roosting flying-foxes
- application of mulch or removal of leaf litter or other material on the ground.

Protocols are in place for carrying out operations which can result in excess camp noise that may disturb flying-foxes. This is mandatory for Council workers and strongly recommended for private landholders and property managers within 100 m of flying-fox roosts. See Working Nearby Flying-fox Camps (**Appendix 4**) for further details.

### **Revegetation and land management to create alternative habitat**

This management option involves revegetating and managing land to create alternative flying-fox roosting habitat through improving and extending existing low conflict camps or developing new roosting habitat in areas away from human settlement.

- Selecting new sites and attempting to attract flying-foxes to them has had limited success in the past, and ideally, habitat at known camp sites would be dedicated as a flying-fox reserve (DPIE 2019a). However, if a staged and long-term approach is used to make unsuitable current camps less attractive, while concurrently improving appropriate sites, it is a viable option (particularly for the transient and less selective LRFF). Supporting further research into flying-fox camp preferences may improve the potential to create new flying-fox habitat.
- When improving a site for an existing designated flying-fox camp, preferred habitat characteristics detailed in **Section 2** should be considered.
- Foraging trees planted amongst, and surrounding, roost trees (excluding in/near horse paddocks) may help to attract flying-foxes to the desired site. They will also assist with reducing foraging impacts in residential areas. Consideration should be given to a mix of tree species that could provide year-round food, increasing the attractiveness of the designated site.
- The presence of a water source is likely to increase the attractiveness of an alternative camp location. Supply of an artificial water source should be considered if unavailable naturally; however, this may be cost-prohibitive.
- Potential habitat mapping using camp preferences (see **Section 2 and Appendix 5**) and suitable land tenure can assist in initial alternative potential site selection. A feasibility study would then be required prior to site designation to assess the likelihood of success, any possible detriments, and determine the warranted level of resource allocated to habitat improvement.

### **Participation in research**

This management option involves participating in research to improve knowledge of flying-fox ecology to address the large gaps in our knowledge about flying-fox habits and behaviours and why they choose certain sites for roosting. Further research and knowledge sharing at local, regional and national levels will enhance our understanding and management of flying-fox camps. There is a need to increase knowledge in local camps, including important indicators such as site-specific temperature and humidity.

### **Appropriate land use planning**

Land use planning instruments should be used to ensure adequate distances are maintained between future residential developments and existing or historical flying-fox camps. While this management option will not assist in the resolution of existing land use conflict, it may prevent issues for future residents. Please refer to Council's DCP, chapter B1 (currently under review) <https://www.byron.nsw.gov.au/Services/Building-and-development/Building->

## 3.2. Level 2 Actions: in situ management

### Buffers

Buffers can be created through vegetation removal and/or the installation of permanent/semi-permanent deterrents.

Creating buffers may involve planting low-growing or spiky plants between residents or other conflict areas and the flying-fox camp. Such plantings can create a visual, auditory or olfactory buffer between the camp and residences or make areas of the camp inaccessible to humans.

Buffers greater than 300 metres are likely to be required to fully mitigate amenity impacts (SEQ Catchments 2012). The usefulness of a buffer to mitigate odour and noise impacts generally declines if the camp is within 50 metres of human habitation (SEQ Catchments 2012); however, any buffer will assist and should be as wide as the site allows.

### Buffers through vegetation removal

Vegetation removal aims to alter the area of the buffer habitat sufficiently so that it is no longer suitable as a part of the camp. The amount required to be removed varies between sites and camps, ranging from some weed removal to removal of most of the canopy vegetation.

Any vegetation removal must be done using a staged approach, with the aim of removing as little native vegetation as possible. This is of particular importance at sites with other values (e.g. ecological or amenity), and in some instances, the removal of any native vegetation will not be appropriate. Thorough site assessment will inform whether vegetation management is suitable (e.g. can impacts to other wildlife and/or the community be avoided?).

Removing vegetation can also increase visibility into the camp and noise issues for neighbouring residents, which may create further conflict.

Suitable experts (**Appendix 6**) should be consulted to assist selective vegetation trimming/removal to minimise vegetation loss and associated impacts.

The importance of under- and mid-storey vegetation in the buffer area also requires consideration. Under- and mid-storey vegetation should be retained in the buffer area of camps that are known or likely to be affected by heat stress events (see **Section 2.4.1** for further detail).

### Buffers without vegetation removal

Permanent or semi-permanent deterrents can be used to make buffer areas unattractive to flying-foxes for roosting, without the need for vegetation removal. This is often an attractive option where vegetation has high ecological or amenity value.

While many deterrents have been trialled in the past with limited success, there are some options worthy of further investigation:

Visual deterrents - Visual deterrents such as plastic bags and fluoro vests (GeoLINK 2012) in roost trees have shown to have localised benefits, with flying-foxes deterred from roosting



within 1-10 metres of the deterrents. The type and placement of visual deterrents would need to be varied regularly to avoid habituation.

Noise emitters on timers - Noise needs to be random, varied and unexpected to avoid flying-foxes habituating. As such these emitters would need to be portable, on varying timers and a diverse array of noises would be required. It is likely to require some level of additional disturbance to maintain its effectiveness, and ways to avoid disturbing flying-foxes from desirable areas would need to be identified. This is also likely to be disruptive to nearby residents.

Smell deterrents - Bagged python excrement has been hung in trees at some sites; however, its effectiveness as a deterrent remains unproven. The smell of certain deterrents may also impact nearby residents, while flying-foxes may become used to it.

Canopy-mounted water sprinklers - This method has been effective in deterring flying-foxes during dispersals, and current trials in Queensland and New South Wales are showing relative success in keeping flying-foxes out of designated buffer zones. This option can be logistically difficult (installation and water sourcing) and may be cost-prohibitive. Design and use of sprinklers needs 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 and/or lead to flying-foxes becoming habituated. The use of potable water may also be considered excessively wasteful given the limited or negligible benefits.

Note that any deterrent with a high risk of causing inadvertent dispersal may be considered a Level 3 action.

#### **Noise attenuation fencing**

Noise attenuation fencing could be installed in areas where the camp is particularly close to residents. This may also assist with odour reduction, and perspex fencing could be investigated to assist fence amenity. Although expensive to install, this option could negate the need for habitat modification, maintaining the ecological values of the site, and may be more cost-effective than ongoing management.

### **3.3. Level 3 Actions: dispersal through disturbance**

#### **Dispersal**

Living near a flying-fox roost can be challenging for some, with impacts associated with noise, odour, faecal drop, damage to vegetation, property and concern about human and other animal health. Some people have an expectation that flying-foxes can be moved or controlled. There are many challenges associated with management. Level 3 dispersal actions are extremely expensive, resource intense, very rarely successful in the long term due to flying-foxes returning year after year and often splinter a roost to multiple undesirable locations that are difficult to predict. Flying-foxes will regularly attempt to recolonise their preferred roost site when resources are available, so the outcomes of dispersal attempts are usually very short-term.

Roberts and Eby (2013) summarised dispersals between 1990 and 2013:

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 (63% of the time within 600m).
4. In 85% of cases, new camps established nearby.
5. In all cases it was not possible to predict where replacement camps would form.
6. Conflict was often not resolved.
7. In 71% of cases conflict still being reported either at the original site or within the local area years after the initial dispersal actions.
8. Repeat dispersal was always required except where extensive vegetation removal occurred.

Roberts et al. (2021) summarized the information of 48 camp dispersals in Australia.

1. In 88% of cases, replacement camps formed within 1 km and became sites of transferred conflict.
2. In 58% of the cases more than 2 or more methods of dispersal were employed (such as noise, lights and vegetation removal - the most common ones employed)
3. Average cost was AU\$ 388400
4. After extensive destruction of roost habitat, only 23% of dispersal attempts were successful in resolving conflict for communities.

Industry best-practice and Byron Shire Council do not support dispersal as a management option unless in rare and unique situations and should only be considered once Level 1 and Level 2 management methods have been implemented and impacts have not been mitigated. Authorisation under legislation is required.

There is a range of potential risks, costs and legal implications that are greatly increased with Level 3 actions. These include:

- increased risk of disease spill-over
- impact on animal welfare and flying-fox conservation
- splintering the camp into other locations that are equally or more problematic
- shifting the issue to another area
- impact on habitat value
- effects on the flying-fox population, including potential increase in disease susceptibility and associated public health risk
- impacts to nearby residents associated with ongoing dispersal attempts
- excessive initial and/or ongoing effort and financial investment required
- negative public perception and backlash
- unsuccessful management requiring multiple attempts, which may exacerbate all of the above.

#### Prior to Level 2 or 3 works

- Residents adjacent to the camp will be individually notified one week prior to on-ground works commencing. This will include information on what to do if an injured or orphaned Flying-fox is observed, a reminder not to participate in or interfere with the program, and details on how to report unusual Flying-fox behaviour/daytime sightings. Relevant contact details will be provided (e.g. Program Coordinator). Resident requests for retention of vegetation and other concerns relating to the program will be taken into consideration.
- Where the Plan is being implemented by council, information will be placed on council's website along with contact information.
- The Department will be notified at least 48 hours before works commence.
- A protocol for Flying-fox rescue, in accordance with the [NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes](#) (DPIE 2012), will be developed including contact details of rescue and rehabilitation organisations. This protocol will be made available to all relevant staff, residents and volunteers prior to the action commencing. See Appendix 8 for an example protocol.
- A licensed wildlife carer trained in Flying-fox rescue and appropriately vaccinated will be notified prior to beginning works in the event that rescue/care is required.

Attempts at dispersal of flying-fox camps, such as occurred at the Northern Rivers township of Maclean, have proven to be financially costly, with the animals repeatedly attempting to return to the camp in subsequent years. Another significant result was increased numbers of regional residents, especially in the nearby township of Illuka, experiencing negative consequences as the displaced flying-foxes established new camps in residential areas (Roberts et al., 2011). The dispersal effort resulted in distress for the animals, as well as an increase of people experiencing conflict.

For further information on level 3 management options, see **Table 12** Analysis of Management Options in **Section 5.8**.

### 3.4. Unlawful Activities

#### Culling

Culling is addressed here as it is often raised by community members as a preferred management method; however, culling is contrary to the objects of the BC Act and will not be permitted as a method to manage flying-fox camps.

### 3.5. Site-specific Analysis of Camp Management Options

All works must follow the protocols identified under Working Nearby Flying-fox Camps (**Appendix**) and consequently will happen when flying-foxes are not at the site. In any rare occasions when work needs to be conducted when flying-foxes are present in the camp, a person experienced in their behaviour must be onsite to evaluate the flying-foxes' risk of being harmed as a consequence of the works.

### **3.5.1. Vegetation Trimming / Removal**

Dead wood and hollows will be retained on site where possible as habitat.

Vegetation chipping is to be undertaken as far away from roosting flying-foxes as possible (at least 100 m).

### **3.5.2. Canopy Trimming / Removal**

#### **Prior to works**

Trees to be removed or lopped will be clearly marked (e.g. with flagging tape) prior to works commencing, to avoid unintentionally impacting trees to be retained.

Threatened flora and EECs for retention within vegetation removal buffers would be clearly marked and communicated to the clearing contractor prior to commencing works.

#### **During works**

Any tree lopping, trimming or removal is undertaken under the supervision of a suitably qualified arborist (minimum qualification of Certificate III in Horticulture (Arboriculture) who is a member of an appropriate professional body such as the National Arborists Association).

Trimming will be in accordance with relevant Australian Standards (e.g. AS4373 Pruning of Amenity Trees), and best practice techniques used to remove vegetation in a way that avoids impacting other fauna and remaining habitat.

No tree in which a flying-fox is roosting will be trimmed or removed. Works may continue in trees adjacent to roost trees only where a person experienced in flying-fox behaviour assesses that no flying-foxes are at risk of being harmed. A person experienced in flying-fox behaviour is to remain on site to monitor, when canopy trimming/removal is required within 50 m of roosting flying-foxes.

While most females are likely to be pregnant or carrying young (generally August - January) vegetation removal within 50 m of the camp will only be done in the evening after fly-out, unless otherwise advised by a flying-fox expert.

Where threatened vegetation removal is required, the land manager will prepare an Offset Strategy (see **Section 3.5.3**) to outline a program of restoration works in other locations (in addition to existing programs). The strategy will be submitted to DPE for approval at least two months prior to commencing works.

Vegetation would be directionally felled into cleared areas to prevent damage to adjacent retained vegetation.

### **3.5.3. Offsets**

Offsets to compensate for loss of habitat due to proposed buffers are required in accordance with Chapter B2 of Council's DCP. When necessary specific offsetting requirements, mitigation measures and the proposed location are outlined within the VMP prepared for each camp. It is acknowledged that offsetting insitu (i.e. at the subject flying-fox camp) is preferred.

Conditions are likely to be placed on the development consent in regards to compensatory planting and survival rates where trees are proposed to be removed. Where approval for tree removal is given, the following compensatory planting rates are likely to be applied:

**1:10 for trees of high ecological value**

For example, local indigenous trees in high conservation value vegetation and habitat, local indigenous rainforest trees, trees within a wildlife corridor, trees with habitat value for local wildlife, trees with a diameter at breast height >50 cm.

#### **1:5 for trees of medium ecological value**

For example, local indigenous trees not located in high conservation value vegetation and habitat, a wildlife corridor or which do not have habitat value for local wildlife.

#### **1:1 for trees of low ecological value**

For example, other trees not located in high conservation value vegetation and habitat, a wildlife corridor or which do not have habitat value for local wildlife.

#### **Survival rates**

These ratios apply to survival rates after two years, therefore it is recommended to plant additional trees (10-20% more) to accommodate for a survival rate of less than 100% of the planted trees.

### **3.5.4. Bush Regeneration**

All works will be carried out by suitably qualified and experienced bush regenerators, with at least one supervisor knowledgeable about flying-fox habitat requirements (and how to retain them for Level 1 and 2 actions) and trained in working under a camp (see **Table 4** for further details).

Vegetation modification, including weed removal, will not alter the conditions of the site such that it becomes unsuitable flying-fox habitat for Level 1 and 2 actions.

Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys at all times.

Weed control in the core habitat area will be undertaken using hand tools only (or in the evening after fly-out while crèching young are not present). If no Flying-fox are present, powered equipment such as brush-cutters and chainsaws may be used.

Species selected for revegetation will be consistent with the habitat on site, and in buffer areas or conflict areas should be restricted to small shrubs/understorey species to reduce the need for further roost tree management in the future.

All restoration activities must remain consistent with a Council approved VMP, **Table 1** and **Section 3.5.5** of the Plan.

### **3.5.5. Planned Management Approach**

All works must follow the Working Nearby Flying-fox Camps protocols (**Appendix 1**) and consequently will mainly happen when flying-foxes are not at the site. Management activities will require

- all personnel be appropriately experienced, trained and inducted. Induction will include each person's responsibilities under this Plan (see **Table 4** for further details).
- All personnel will be briefed prior to the action commencing each day and debriefed at the end of the day.



- Works will cease and the Department of Planning and Environment (the DPE) consulted by the Council Flying-fox Officer in accordance with the 'stop work triggers' section of the Plan (**Stop Work Triggers 3.5.7**).
- Large crews will be avoided where possible.
- The use of loud machinery and equipment that produces sudden impacts/noise will be limited. Where loud equipment (e.g. chainsaws) is required they will be started away from the camp and allowed to run for a short time to allow flying-foxes to adjust.
- Any activity likely to disturb flying-foxes so that they take flight in the daytime will be avoided during the sensitive GHFF/BFF birthing period (i.e. when females are in their final trimester or the majority are carrying pups, generally August - December) and avoided altogether during crèching (generally November/December to February).
- Where works cannot be done at night after fly-out during these periods, it is preferable they are undertaken in the late afternoon close to or at fly-out. If this is also not possible, a person experienced in flying-fox behaviour will monitor the camp for at least the first two scheduled actions (or as otherwise deemed to be required by that person) to ensure impacts are not excessive and advise on the most appropriate methods (e.g. required buffer distances, approach, etc.).
- The DPE will be contacted immediately if LRFF are present between March and October or are identified as being in their final trimester/with dependent young.
- Non-critical maintenance activities will ideally be scheduled when the camp is naturally empty.
- Works will not take place in periods of adverse weather including strong winds, sustained heavy rains, extreme heat, cold temperatures or during periods of likely population stress (e.g. food shortages).
- Works will be postponed on days predicted to exceed 35°C (or ideally 30°C), and for one day following a day that reached  $\geq 35^{\circ}\text{C}$ . If an actual heat stress event has been recorded at the camp or at nearby camps, a rest period of several weeks will be scheduled to allow affected flying-foxes to fully recover.
- Evening works may commence after fly-out. Noise generated by the works should create a first stage disturbance, with any remaining flying-foxes taking flight. Works should be paused at this stage to monitor for any remaining flying-foxes (including crèching young, although December - February should be avoided for this reason) and ensure they will not be impacted. All Level 1 and 2 works (including pack-up) will cease by 0100 to ensure flying-foxes returning early in the morning are not inadvertently dispersed.
- Any proposed variations to works detailed in the Plan must be approved, in writing, by the Department before any new works occur.
- The DPE may require changes to methods or cessation of management activities at any time.

Ensure management actions and results are recorded to inform future planning.

### Worker safety

- All personnel to wear protective clothing including long sleeves and pants; additional items such as eye protection and a hat are also recommended. People working under the camp should wash their clothes daily. Appropriate hygiene practices will be adopted such as washing hands with soap and water before eating/smoking.
- All personnel who may come into contact with Flying-foxes will be vaccinated against ABLV with current titre.
- A wash station will be available on-site during works along with an anti-viral antiseptic (e.g. Betadine) should someone be bitten or scratched.
- Details of the nearest hospital or doctor who can provide post-exposure prophylaxis will be kept on-site.

### Post-works

Reports for Level 1 actions will be provided to the Department annually. Reports for Level 2 and 3 actions will be submitted to the Department one month after commencement of works and then quarterly for the life of the Plan (up to five years) (for all Level 3 actions and in periods where works have occurred for Level 2 actions). Each report is to include:

- results of pre- and post-work population monitoring
- any information on new camps that have formed in the area
- impacts at other locations that may have resulted from management, and suggested amelioration measures
- an assessment of how the flying-foxes reacted to the works, with particular detail on the most extreme response and average response, outlining any recommendations for what aspects of the works went well and what aspects did not work well
- further management actions planned, including a schedule of works
- an assessment<sup>2</sup> of how the community responded to the works, including details on the number and nature of complaints before and after the works
- detail on any compensatory plantings undertaken or required
- expenditure (financial and in-kind costs)

#### 3.5.6. Decision making processes

A flow chart demonstrating the planned process for decision making including 'stop work triggers' is shown in **Figure 7**. As indicated in the flow chart, following approval of the Plan by DPE, implementation of management actions commences from the lowest level of management actions first.

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<sup>2</sup> A similar approach should be taken to pre-management engagement (see Section 4) to allow direct comparison, and responses should be assessed against success measures to evaluate success.

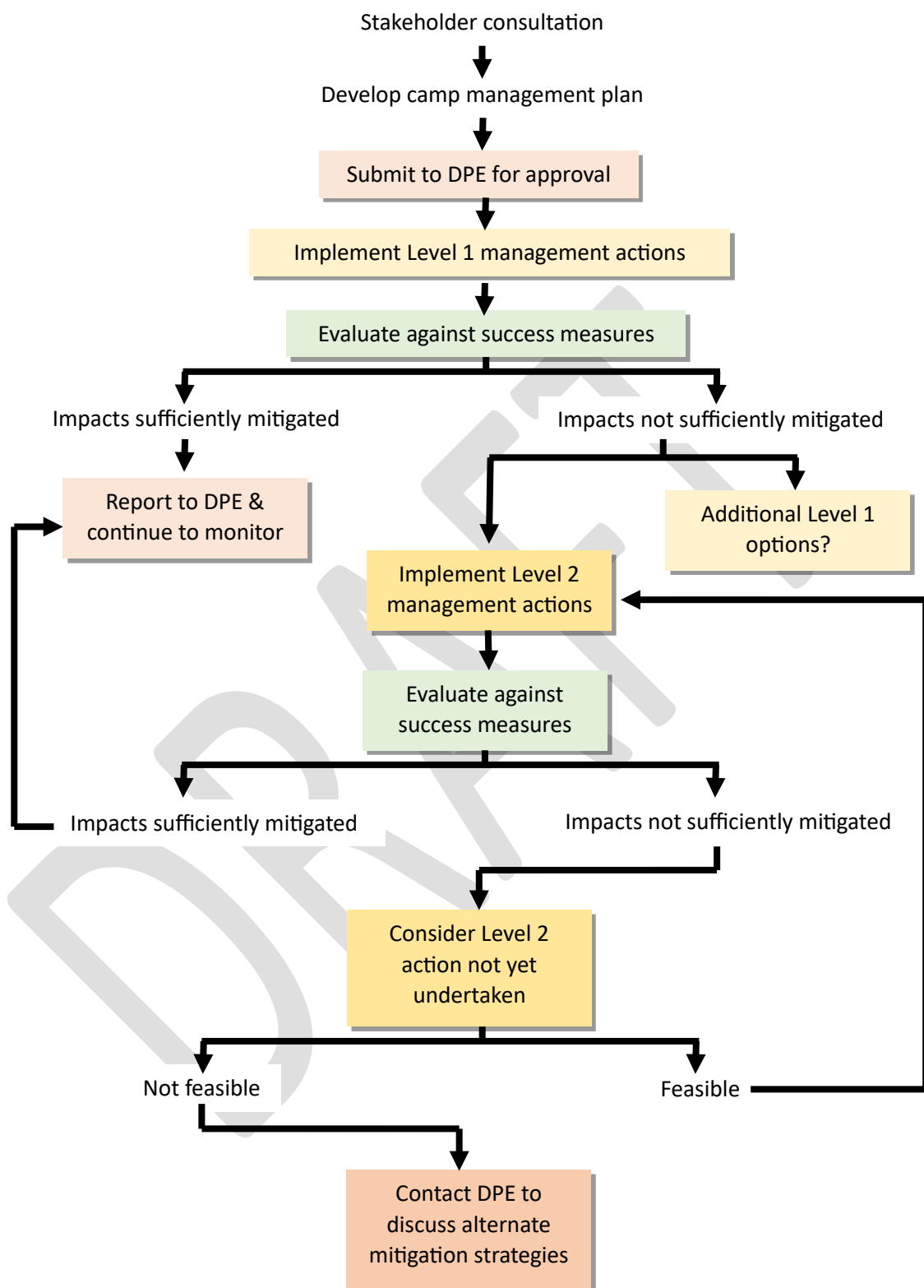


Figure 7 Flow chart demonstrating the planned process for management decision-making.

### 3.5.7. Stop Work Triggers

The management program will cease and will not recommence or progress to subsequent levels without consulting the Department if:

- any of the animal welfare triggers occur on more than two days during the program, such as unacceptable levels of stress
- there is a flying-fox injury or death
- a new camp/camps appear to be establishing
- impacts are created or exacerbated at other locations
- there appears to be potential for conservation impacts (e.g. reduction in breeding success identified through independent monitoring)
- standard measures to avoid impacts (detailed in **Section 3.5.5**) cannot be met.

Management may also be terminated at any time if:

- unintended impacts are created for the community around the camp
- allocated resources are exhausted.

Welfare triggers presented in **Table 2** are provided by the DPE (DPIE, 2019a).

**Table 2 Welfare triggers from planned actions for potential impacts during management**

Welfare trigger	Signs	Action
Unacceptable levels of stress	If any individual is observed: <ul style="list-style-type: none"> <li>• panting</li> <li>• saliva spreading</li> <li>• located on or within 2 m of the ground.</li> </ul>	Works to cease for the day.
Adverse weather	<ul style="list-style-type: none"> <li>• &gt;35°C or within two days of &gt;35°C is recorded</li> <li>• Winds of &gt;40 km/ hr</li> <li>• Sustained heavy rains.</li> </ul>	Works to cease for the day.
Fatigue	In-situ management: <ul style="list-style-type: none"> <li>• more than 30% of the camp takes flight</li> <li>• individuals are in flight for more than 5 minutes</li> <li>• Flying-foxes appear to be leaving the camp.</li> </ul>	In-situ management. Works to cease and recommence only when flying-foxes have settled*/ move to alternative locations at least 50 m from roosting animals.
Injury/ death	<ul style="list-style-type: none"> <li>• a flying-fox appears to have been injured/ killed on site (including aborted fetuses)</li> <li>• any flying-fox death is reported within 1 km of the dispersal site that appears to be related to the dispersal</li> <li>• females in final trimester</li> <li>• dependent/ crèching young present</li> <li>• loss of condition evident</li> </ul>	Works to cease immediately and DPE notified AND rescheduled OR adapted sufficiently so that significant impacts (e.g. death/ injury) are highly unlikely to occur, as confirmed by an independent expert# OR stopped indefinitely and alternative management options investigated.

\* maximum of two unsuccessful attempts to recommence work before ceasing for the day.

# A person with experience in flying-fox behaviour will monitor for welfare triggers and direct works.

## 4. Engaging Communities

### 4.1. Community and Stakeholder Engagement

There is a range of stakeholders who are directly or indirectly affected by flying-fox camps, or who are interested in their management. Attempts to reach all stakeholders were conducted by Council when undertaking consultation in developing the previous 2018-2023 Plan. Community consultation was the main focus at the time, with emphasis in promoting a robust community engagement process. In 2023 Council commenced reviewing the 2018-2023 Plan, focusing on new research, industry best practice and any new information that could support better decisions and inform our community. After extensive research, consultation with experts, discussions with relevant land managers, flying-fox officers in other LGAs and relevant State officers, it was identified that due the species traits and habits, a multi-pronged approach, incorporating elements such as education, regular maintenance and effective monitoring would bring more consistency to flying-fox management, and consequently greater benefits to the community. Focus was given to components that have incremental effects in achieving better outcomes, such as incorporating local Indigenous People Engagement.

Many stakeholders have been involved in the preparation of this Plan or will be involved in its eventual implementation. They are listed within **Table 3**.

**Table 3 Stakeholders associated with the Plan**

Stakeholder	Involvement	Comment
Business owners	Consultation during Plan preparation.	Work near a camp. Businesses in the vicinity of Middleton camp and Paddy's Creek camp have reported being negatively financially impacted by the flying-fox camp (although not quantifiably investigated by Council).
Byron Shire Council	Consultation during Plan preparation. Will also be involved during approvals process and Plan implementation.	Local government has responsibilities to the community and environment of the area for which it is responsible in accordance with the <i>Local Government Act 1993</i> .  Council is also responsible for administering local laws, plans and policies, and appropriately managing assets (including land) for which it is responsible.



Stakeholder	Involvement	Comment
Indigenous community	Invited to be involved in Plan consultation. Will continue to be consulted during Plan implementation.	<p>The five local Indigenous groups were invited to contribute to this Plan.</p> <p>There are two camps located on land covered by the Ngulingah Local Aboriginal Land Council (LALC).</p> <p>There are 12 camps located on land covered by Tweed-Byron LALC.</p> <p>There are seven camps located on land covered by Jali LALC.</p> <p>Additional cultural information provided by Tweed Indigenous rangers.</p>
Commonwealth Department of the Environment and Energy (DEE) (relevant to camps with GHFF or other matters of national environmental significance)	May be involved during approvals process and Plan implementation.	DEE is responsible for administering federal legislation relating to matters of national environmental significance, such as the GHFF and any other federally-listed values of the camp site.
Department of Industry -Lands	Consultation during Plan preparation. Will continue to be consulted during Plan implementation.	<p>Butler and Middleton camps are both located entirely on Crown land and therefore management actions require authorisation by Department of Industry -Lands.</p> <p>Middleton camp has an Aboriginal Land Claim pending which will affect management options. Mullumbimby is located partially on crown land however is managed by Byron Shire Council under an Operational Plan.</p>
Local Government NSW	Provide funding	Local Government NSW is an industry association that represents the interests of councils in NSW.
NSW Department of Planning and Environment (DPE)	Will be involved during approvals process and Plan implementation.	DPE is responsible for administering legislation relating to (among other matters) the conservation and management of native plants and animals, including threatened species and ecological communities.
Orchardists and fruit growers	All relevant stakeholders are invited to the information sessions.	Fruit growers may be impacted by flying-foxes raiding orchards.

Stakeholder	Involvement	Comment
Residents	All relevant stakeholders are invited to the information sessions.	Live near a camp. Are often negatively impacted by the issues raised above.
Schools	Amongst residents invited to be involved during consultation. May also be involved in Plan implementation.	The following schools are within 150 m of camps: <ul style="list-style-type: none"> <li>• Byron Bay Preschool</li> <li>• Sandhills Early Childhood Centre</li> <li>• Bangalow Community Child Care Centre</li> <li>• Byron Public School.</li> </ul>
Tourists and visitors to the area	May be affected by Plan implementation.	Temporary visitors to the area.
Wildlife carers and conservation organisations (such as Cumbebin Wetland Trust, Northern Rivers Wildlife Carers, WIRES, Bangalow Land and Rivercare)	Consultation during Plan preparation and expected to be involved in Plan implementation.  All relevant stakeholders are invited to the information sessions.	Wildlife carers and conservation organisations have an interest in flying-fox welfare and conservation of flying-foxes and their habitat.

## 4.2. Engagement Methods

Council has initiated engagement with all local First Nations groups, and this will be an ongoing process during the Plan implementation. Council will be offering an information session to guide all relevant stakeholders in providing feedback on this Plan. Extensive effort has been made to engage with the community regarding flying-fox camp management, during implementation of Council's 2018-2023 Flying-fox Camp Management Plan (FFCMP), including:

- understand the issues, directly and indirectly, affecting the community
- raise awareness within the community about flying-foxes
- correct misinformation and allay fears
- share information and invite feedback about management responses to date
- seek ideas and feedback about possible future management options
- invite people to join advisory and/or plan development committees
- engagement of a biodiversity projects officer to deliver the FFCMP.

The types of engagement that have been undertaken include:

- promotion of contact details of responsible officers

- telephone conversations to record issues and complaints
- face-to-face meetings and telephone calls with adjacent residents
- media (radio, television, print, social media)
- brochures and other educational material
- website pages and links (<http://www.byron.nsw.gov.au/flying-foxes>) reviewed monthly and updated accordingly (if required)
- direct contact with adjacent residents including letters, brochures and emails
- on-site signage: interpretive signage was installed in November 2016 at:
  - Beech Camp: the footpath located on the southern junction of Beech Drive and Bottlebrush Crescent
  - Middleton: on Middleton Street
  - Mullumbimby Camp: at Rotary Rainforest Park
  - Paddy's Creek Camp: the footbridge located on the east bank of Paddy's Creek
  - public meetings
- face-to-face opportunities in community centres and markets
- online surveys.

#### 4.3. Community Feedback - Management Options

To be completed after community engagement completed

## 5. Plan administration

### 5.1. Approvals

The following key steps would be undertaken to instigate implementation of the Plan:

- Obtain Biodiversity Advisory Committee endorsement.
- Obtain Byron Shire Council endorsement.
- Obtain Department of Planning and Environment (DPE) endorsement.

### 5.2. Evaluation and Review

The Plan will be reviewed by the flying-fox working group, which will include evaluation of management actions against measures shown in **Table 12**.

The following will trigger a reactive review of management actions/activities for a given camp roost:

- completion of a management activity
- progression to a higher level of management
- changes to relevant policy/ legislation
- new management techniques becoming available
- outcomes of research that may influence the Plan
- incidents associated with the camp such as flying-fox deaths or illegal actions.

If the Plan is to remain current, a full review including stakeholder consultation and expert input will be undertaken in the final year (year 5) of the Plan's life prior to being re-submitted to DPE.

### 5.3. Monitoring of the Camp

At a minimum, monitoring of each of the six subject flying-fox camps will continue to be undertaken by Council on a quarterly basis in line with the National Flying-fox Monitoring Program. Monitoring will continue for the life of the Plan and will include:

- area and size of the flying-fox camp
- detailed flying-fox counts including species and number present, presence of pregnant females or females with young
- maintaining detailed records of the management activities and their outcomes
- recording details of timing, costs and staff resources utilised
- surveying affected neighbours and the local community after implementation of proposed management actions.

A flying-fox monitoring data sheet template is available from <http://www.environment.nsw.gov.au/animals/flying-fox-monitor.htm>

### 5.4. Reporting

Progress reports may be required periodically throughout the life of the Plan, and submitted through Council's relevant committees and panels, prior to Councillors.

Any reporting obligations related to licences or certificates associated with proposed works will be adhered to as per the licence conditions.

## 5.5. Management structure and responsibilities

Implementation of the proposed management actions requires a dedicated team. All relevant contact details, their roles and responsibilities to implement the Plan are provided within

**Table 4.**Error! Reference source not found.

**Table 4 Roles and responsibilities**

Role	Name*	Required experience/ approvals	Responsibilities/ authority	Communication lines
Program Coordinator	Council staff - Biodiversity Projects Officer	Project management Human resource management Community engagement Reporting	Inform and consult with stakeholders and interested parties Community engagement Evaluate program Submit reports to DPE Ensure all landowners have provided consent prior to works	Reports to: Council & DPE Direct reports: Project Manager
Project Manager	Council staff - Biodiversity Projects Officer	Project management Team leadership and coordination Data management	Coordinate field teams and ensure all personnel are appropriately experienced and trained for their roles Induct all personnel to the program Collect and collate data Liaise with DPE Liaise with wildlife carers/veterinarians (for orphaned/ injured wildlife only)	Reports to: Program Coordinator Direct reports: Supervisor, Contractor
Supervisor	Council staff and/ or Contractor	Knowledgeable in flying-fox biology, behaviour and camp management. Recommended ABLV-vaccinated. Team training, leadership and supervision.	Pre- and post-management monitoring Surrounding camp monitoring Coordinate daily site briefings Coordinate daily activities Monitor flying-fox behaviour Determine daily works end point Participate in management activities	Reports to: Project Manager Direct reports: Team members, Observers/ support
Team member	Council staff and/ or Contractor	Recommended ABLV-vaccinated (employer to assess risk). Ideally all team knowledgeable in flying-fox biology, behaviour and camp management however not required.	Attend daily site briefings Participate in relevant management activities	Reports to: Supervisor Direct reports: Nil
Contractor e.g. arborist bush regenerator	Council staff and/ or Contractor	Relevant licences and experience in field	Conduct specified activities (e.g. tree trimming) Adhere to all directions given by Supervisor Training of lead bush regenerator (awaiting further information from Council staff)	Reports to: Project Manager Direct reports: Nil

Role	Name*	Required experience/ approvals	Responsibilities/ authority	Communication lines
Observer/ support	Council staff and/ or Contractor, wildlife carers or community individuals	Approval to access site	Provide care of injured/orphaned wildlife (under licence) if required. Monitor flying-foxes as part of National flying-fox Monitoring Program	Reports to: Supervisor Direct reports: Nil
Flying-fox expert (see Appendix 6)		Knowledge of flying-fox habitat requirements and behaviour. Ability to differentiate between breeding and non-breeding females. Ability to identify females in final trimester. Ability to estimate age of juveniles. Experienced in flying-fox population monitoring.	On-site population assessment, monitor flying-fox behaviour and ensure compliance with the Plan.	Reports to: Supervisor Direct reports: Nil

\* It is preferable that the Council staff or Contractor appointed is a dedicated flying-fox Officer appointed by Council (refer to management action 1.1 in Table 5).

## 5.6. Adaptive Management

Adaptive management is a procedure for implementing management while learning about which management actions are most effective at achieving the specified objectives. Council is committed to using adaptive management to improve on-ground management decisions for ecological, social and/ or economic outcomes. An adaptive management procedure includes all of the four elements shown in Figure 8.



Figure 8 Adaptive management procedure



Adaptive management emphasises the importance of involving stakeholders (those that control or enable management) in all four elements, encouraging active partnerships between Council, other land management authorities, scientists and local community and other stakeholders.

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## 5.7. Proposed Management Actions for Urban Camps

### Management Options

Council surveys six of the urban camps due to size and proximity to residential areas. During the development of this Plan, two additional urban camps were identified (See Part B Roost Detail Plan for location further information). During the implementation of the Plan, Council will investigate the need to include the new camps into the management actions.

Table 5 Proposed Management Actions for Byron Shire Flying-fox Urban Camps

Action ID	Management action	Priority	Timing	Management action details	Performance indicators	Cost
1.1	Maintain Flying-fox Officer	High	Years 1 to 5	Council maintain a part-time Flying-fox Officer, to organise and facilitate at least the initial stages of the Plan implementation where a high level community engagement will be required, as well as establishing a working group to seek ongoing external funds and prioritise on ground works.	<ul style="list-style-type: none"> <li>Flying-fox Officer facilitates management actions.</li> <li>Community confidence in Council's ability to management flying-fox camps increased</li> </ul>	Annual: \$55K, Life of Plan: \$287K

1.2	Education and awareness services	High	Commence: Year1 Continue: Years 1-5 Benefit: Long term	<p>Provide information to the community regarding disease risk and management, how to minimise flying-fox impacts at your home, flying-fox management actions being undertaken by Council, flying-fox ecology and legislative status. This includes:</p> <ul style="list-style-type: none"> <li>• Create a flying-fox Education Communications Plan to promote appreciation and tolerance of flying-foxes. Include in education messages the potential economic impacts if flying-fox populations declined.</li> <li>• Utilising existing flying-fox community information and awareness information published by Australasian Bat Society, DPE and DEE.</li> <li>• Collaborate with Traditional Owners to deliver education and engagement.</li> <li>• In partnership with other organisations e.g. National Parks and Wildlife Service - Discovery Ranger Program, investigate opportunities to facilitate talks in schools to staff and students regarding flying-foxes and health.</li> <li>• Continue updating Council website with up-to-date program of works being undertaken at each camp. Continue to update Council's mapping and share monitoring data and map access with the community.</li> <li>• Continue providing opportunities for consultation where the community has expressed concern about a flying-fox roost.</li> <li>• Encourage positive media releases regarding works done at each camp and trends of flying-foxes in the Shire.</li> <li>• Education to be delivered via public information sessions, targeted workshops, information on Council's website, information leaflets/ fact sheets etc.</li> <li>• Providing on-going education to Council staff and decision-makers.</li> </ul>	<ul style="list-style-type: none"> <li>• Community has greater understanding of the long-term strategy for managing flying-foxes.</li> <li>• Complaints to Council regarding flying-foxes are reduced.</li> </ul>	Use budget from Flying-fox Officer (see below)
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Action ID	Management action	Priority	Timing	Management action details	Performance indicators	Cost
				<ul style="list-style-type: none"> <li>Investigate budget for annual Bat Nights and other educational events in collaboration with community groups (e.g. Bat Conservation and Rescue Queensland).</li> <li>Review roost signage.</li> <li>Provide information on products and modifications that residents can undertake to reduce flying-fox impacts (e.g. first flush water tank diverters, removing washing before dusk, relocating clothes-lines from below food trees, netting fruit trees).</li> <li>Support and encourage flying-fox research and make information readily available to the community and other land managers.</li> <li>Ensure regular monitoring of all known flying-fox roosts and continue providing data to the National Flying-fox Monitoring Program (NFFMP).</li> <li>Ensure evidence-based best practice management during severe weather response (e.g. heat stress events).</li> </ul>		
1.3	Alternative habitat creation	Medium	Commence: Year 1 Benefit: Long term	<p>Identify if there are any Council owned areas within Byron Shire that comprise preferred camp habitat characteristics and would therefore be suitable to plant out; providing alternate flying-fox roosting habitat away from conflict areas. Communication with the Brunswick Valley Landcare Community Liaison officer is recommended.</p> <p>If suitable options are identified, investigate grants and researchers interested in developing foraging and habitat suitability mapping.</p>	<ul style="list-style-type: none"> <li>Suitable areas are mapped.</li> <li>Suitable areas are ground-truthed.</li> <li>Suitable areas are planted with flying-fox roosting vegetation.</li> </ul>	Planning: \$10K Onground Works: \$30K for 1 ha

Action ID	Management action	Priority	Timing	Management action details	Performance indicators	Cost
1.4	Routine camp management	High	Implement: Years 1-5	<p>Maintain camps at 'Weeds Maintenance' level</p> <p>All relevant staff are aware of Working Nearby Flying-fox Camps protocols (<b>Appendix</b> ).</p> <p>All relevant staff are aware of flying-fox related work stop triggers (<b>Appendix 4</b>).</p>	<ul style="list-style-type: none"> <li>Bush regeneration activities have been in place in all camps.</li> <li>Original urban camps (Paddy's, Mullumbimby, Beech, Buttler and Middleton are in 'Weed Maintenance' level</li> <li>Training provided to relevant Council staff.</li> </ul>	Existing resources
1.5	Protocols and procedures to manage incidents	Medium	Implement: Years 1-5	<p>In consultation with relevant organisations Council to identify roles and responsibilities in developing an response procedure for:</p> <ul style="list-style-type: none"> <li>New and/ or emerging camps with an influx of flying-foxes.</li> <li>Investigate the purchase of equipment to monitor humidity and temperature at camps.</li> <li>Review Heat stress strategy and investigate any change of behaviour due to adverse weather events e.g. bushfire threat, flood or storm, leading to flying-foxes changing their behaviour and/ or dying. Council are familiar with and use <a href="http://www.animalecologylab.org/ff-heat-stress-forecaster.html">http://www.animalecologylab.org/ff-heat-stress-forecaster.html</a>.</li> <li>Scheduled and/or unanticipated response to infrastructure maintenance associated near to or within a flying-fox camp. The procedure would outline possible issues, and how Council would address them e.g. out of hours, who to contact internally and externally to help respond.</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes remain low.</li> <li>Council are prepared for heat stress and emergency events.</li> <li>Council has established procedures to better monitor humidity and temperature at all urban camps</li> <li>Reduced numbers of flying-fox deaths reported during heat stress events.</li> <li>Heat stress events are reported to <a href="http://www.animalecologylab.org/heat-stress-data-form.html">http://www.animalecologylab.org/heat-stress-data-form.html</a></li> </ul>	Existing resources

Action ID	Management action	Priority	Timing	Management action details	Performance indicators	Cost
1.6	Appropriate land-use planning	High	Years 1-5 Benefit: Long term	<ul style="list-style-type: none"> <li>Ensure adequate distances are maintained between future residential developments and existing or historical flying-fox camps.</li> <li>Ensure mapping leading to DCP protocols are updated.</li> <li>Investigate the possibility of including flying-fox habitat on Section 149 certificates (Section 10.7 certificates).</li> <li>Investigate if minor residential additions aimed at providing protection from potential nuisance from faecal drop/ noise etc from flying-foxes (e.g. car ports, sound proofing, covered outdoor areas etc) can be processed under the Exempt and Complying Provisions of Council's DCP.</li> </ul>	<ul style="list-style-type: none"> <li>Conflicts are minimised through appropriate use of the site and awareness of new owners/ occupiers that a flying-fox camp is present nearby.</li> <li>Appropriate developments are located near future flying-fox camps.</li> </ul>	Existing resources
1.7	Service subsidies for property cleaning equipment	Low	Year 3	<p>Council to investigate the purchase and management off a high-pressure cleaner to be provided/ rented to affected residents to clean driveways/ verandas etc affected by faecal drop.</p> <p>Investigate opportunities to exempt residents affected by flying-fox faecal drop from water restrictions to allow cleaning of essential pathways and structures.</p>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> <li>Pressure cleaner available.</li> </ul>	Life of Plan: \$500
1.8	Improved access for flying-fox surveys	Medium	Years 1-5	Seek written approvals from private landholders to access their property for the purpose of flying-fox surveys.	<ul style="list-style-type: none"> <li>Approval from landholders obtained - ongoing.</li> </ul>	Nil
1.9	Update mapping	Medium	Year 2	<p>Update Council's internal Geocortex mapping to reflect maximum extent of known flying-fox camps.</p> <p>Council to map potential versus available flying-fox habitat across the shire.</p>	<ul style="list-style-type: none"> <li>Council's mapping is up to date - ongoing.</li> </ul>	Existing resources



Action ID	Management action	Priority	Timing	Management action details	Performance indicators	Cost
1.10	Investigate the necessity for Integrated Vegetation Management Plan (VMP) of new urban camps	High	Year 1	<p>Investigate additional Council approved integrated VMPs as required at new camps eg. Mullumbimby Showgrounds and Byron Creek in Bangalow. The VMP would encompass site specific bush regeneration or habitat creation actions, as well as the management of vegetation removal sites with the objective of minimising adverse vegetative or habitat impacts. For example, where riparian Camphor Laurel removal is required, the VMP would include weed management and planting with appropriate species to minimise degradation of other values of the site such as bank stability and water quality.</p> <p>All Council approved VMPs must consider community group or Trust plans e.g. Brunswick Valley Landcare, State government plans (if applicable).</p>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> <li>Original sites are kept at a 'Maintenance' level.</li> <li>New camps have weed incursion reduced.</li> <li>Other ecological values of sites are maintained.</li> </ul>	Life of Plan: \$5K covering all camps
1.11	Evaluate the continuation of the Flying Fox Project Reference Group	Medium	Year 1	Investigate if there is a requirement for the ongoing commitment of the Flying-fox Project Reference Group.	<ul style="list-style-type: none"> <li>Working group consulted in decision making.</li> </ul>	Existing resources
1.12	Develop compliance process	Medium	Year 1	In consultation with DPE, Council to develop a process for responding to unlawful activities and the triggers for reporting matters to DPE and make such a process publically available via Council's website.	<ul style="list-style-type: none"> <li>Process adopted by Council.</li> <li>Process available on Council's website.</li> </ul>	Existing resources
1.13	Participation in research projects	Medium	Years 1-5	Collaborate with researchers in producing accurate local data.	<ul style="list-style-type: none"> <li>Increase relevant data collection in camps</li> <li>Investigate installation of monitoring equipment for humidity and temperature within camps susceptible to heat stress.</li> </ul>	Existing resources

Action ID	Management action	Priority	Timing	Management action details	Performance indicators	Cost
1.14	Plan review	Medium	Year 5	Council will develop a procedure (a series of actions or steps taken) in order to review the Plan's actions, consultation requirements and level of approval requirements.	<ul style="list-style-type: none"> <li>Procedure for review adopted by Council.</li> </ul>	Existing resources

### 5.7.1. Beech Camp

Residential development directly bounds the Beech flying-fox camp to the south, west and north (see **Roost Detail Plan** for mapping and further details). The camp is at maintenance level, and management actions listed in **Table 6** apply specifically to Beech flying-fox camp and are in addition to those listed in **Table 5**. In addition to the community consultation findings, other key considerations when identifying site specific management actions at this site include:

- The camp supports relatively low numbers of flying-foxes and occupation is not consistent.
- The vegetation at the site is mapped as high environmental value.
- There are limited opportunities to 'nudge' the camp away from receivers due to the camp being surrounded by residential development.
- Residential housing is the main sensitive receiver surrounding the site.

The following tasks also apply to all proposed management actions:

- Actions need to adhere to relevant licence requirements.
- When an approval/ licence is required, conditions of the approval/ licence must be met prior to commencement of works.
- Consultation must be undertaken with Jali LALC prior to commencement.

Table 6 Proposed management for Beech Flying-fox camp.

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
Level 1 actions							

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
1.1	Maintain buffers	Noise Faecal drop	High	As required	<ul style="list-style-type: none"> <li>Monitor and control weed infestations at the site. The site currently has low levels of weeds, and maintaining or further removing weeds would help conserve the amenity of the site.</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> </ul>	Existing resources and Flying-fox Officer
1.2	Bush regeneration	All	Low	Implement : Quarterly Benefit: Long term	<ul style="list-style-type: none"> <li>Monitor and control weed infestations at the site. The site currently has low levels of weeds, and maintaining or further removing weeds would help conserve the amenity of the site.</li> <li>4 x 25hrs = 100hrs per annum</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> <li>Weed incursion is reduced.</li> </ul>	Annual: \$5.5K Life of Plan: \$22K
1.3	Update educational signage	All	Medium	As required	<ul style="list-style-type: none"> <li>Monitor and update existing signage as required</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.4	Engage school students	All	Low	As required	<ul style="list-style-type: none"> <li>Engage with nearby primary school to educate students. Work with staff to develop protocol for monitoring school grounds.</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.5	Continue engagement with nearby residents	All	Medium	Ongoing	<ul style="list-style-type: none"> <li>Promote positive information and clarification of any issues</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> <li>Complaints to Council regarding flying-foxes are reduced</li> </ul>	Existing resources and Flying-fox Officer

### 5.7.2. Butler Camp

Residential development is located in close proximity to the Butler flying-fox camp to the south, east and north along with localised commercial businesses (see **Roost Detail Plan** for mapping and further details). The camp is at maintenance level, and management actions listed in **Table 6** apply specifically to Butler flying-fox camp and are in addition to those listed in **Table 5**. In addition to the community consultation findings, other key considerations when identifying site specific management actions at this site include:

- The camp has not had flying-foxes present for much of the past five years, however there has been small numbers once more observed in 2023.
- The vegetation at the site is mapped as high environmental value.
- Existing buffers and separation between the camp footprint and sensitive receivers is in place.

The following tasks also apply to all proposed management actions:

- Actions need to adhere to relevant licence requirements.
- When an approval/ licence is required, conditions of the approval/ licence must be met prior to commencement of works.
- Consultation must be undertaken with Tweed-Byron LALC and Reserve Trust prior to commencement.

Table 7 Proposed management for Butler flying-fox camp.

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
<b>Level 1 actions</b>							
1.1	Bush regeneration	All	Low	Quarterly	<ul style="list-style-type: none"> <li>• Monitor and control weed infestations at the site. The site currently has low levels of weeds, and maintaining or further removing weeds would help conserve the amenity of the site.</li> <li>• 4 x 40hrs = 160hrs per annum</li> </ul>	<ul style="list-style-type: none"> <li>• Complaints to Council regarding flying-foxes are reduced.</li> <li>• Weed incursion is reduced.</li> </ul>	Annual: \$8.8K Life of Plan: \$35.2K
1.2	Update educational signage	All	Medium	As required	<ul style="list-style-type: none"> <li>• Monitor and update existing signage as required</li> </ul>	<ul style="list-style-type: none"> <li>• Positive reactions from residents</li> </ul>	Existing resources and flying-fox Officer

### 5.7.3. Middleton Camp

Commercial development is located in close proximity to the Middleton flying-fox camp to the south, west and north. Residential housing occurs to the south and east. These proposed management actions attempt to address impacts from flying-foxes experienced by these sensitive receivers (see **Roost Detail Plan** for mapping and further details). Due to the degradation of roost trees, the bush regen figures presented below are a guide only, with further actions envisaged during the life of this plan. The camp management actions listed in **Table 8** apply specifically to Middleton flying-fox camp and are in addition to those listed in **Table 5**. In addition to the community consultation findings, other key considerations when identifying site specific management actions at this site include:

- Existing buffers and separation between the camp footprint and sensitive receivers are in place.
- Commercial businesses are the key sensitive receivers.

The following tasks also apply to all proposed management actions:

- Actions need to adhere to relevant licence requirements.
- When an approval/ licence is required, conditions of the approval/ licence must be met prior to commencement of works.
- Consultation must be undertaken with Tweed-Byron LALC and Reserve Trust prior to commencement.

Table 8 Proposed management for Middleton flying-fox camp.

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
<b>Level 1 actions</b>							
1.1	Bush regeneration	All	Low	Quarterly	<ul style="list-style-type: none"> <li>Monitor and control weed infestations at the site. The site currently has low levels of weeds, and maintaining or further removing weeds would help conserve the amenity of the site.</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> <li>Weed incursion is reduced.</li> </ul>	Annual: \$5.5K Life of Plan: \$22K
1.2	Maintain buffers	All	Low	As required	<ul style="list-style-type: none"> <li>Investigate options for ongoing maintenance of existing buffer along the                             <ul style="list-style-type: none"> <li>Northern side of the camp to the courthouse</li> <li>Southern side of the camp including the public road corridor to private property</li> <li>Eastern side of the camp to rear of dwellings on Tennyson Street.</li> </ul> </li> <li>This will maintain a minimum 5 m separation between the courthouse to the north; and 20 m separation to the south and east between dwellings/ businesses and vegetation at the camp.</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> </ul>	To be reviewed based on pending buffer analysis by bush regen team
1.3	Update educational signage	All	Low	As required	<ul style="list-style-type: none"> <li>Monitor and update existing signage as required</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.4	Engage school students	All	Low	As required	<ul style="list-style-type: none"> <li>Engage with Sandhills Childcare to educate students. Work with staff to develop protocol for monitoring childcare grounds.</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.5	Tourist engagement	All	Low	If required	<ul style="list-style-type: none"> <li>Investigate possible tourist opportunities for engagement and education</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from tourism operators</li> </ul>	Existing resources and Flying-fox Officer
1.6	Continue engagement with nearby residents	All	Medium	Ongoing	<ul style="list-style-type: none"> <li>Promote positive information and clarification of any issues</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> <li>Complaints to Council regarding flying-foxes are reduced</li> </ul>	Existing resources and Flying-fox Officer
<b>Level 2 actions</b>							

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
2.1	Buffer increase	All	Low	If required	<ul style="list-style-type: none"> <li>Investigate the potential to increase existent buffers</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents and business operators</li> </ul>	Existing resources and Flying-fox Officer
2.2	Artificial roosts	All	Low	If required	<ul style="list-style-type: none"> <li>Investigate the potential to provide artificial roosts</li> </ul>	<ul style="list-style-type: none"> <li>Better roosting options for flying-fox</li> </ul>	Existing resources and Flying-fox Officer

#### 5.7.4. Mullumbimby Camp

Residential development is located in close proximity to the Mullumbimby flying-fox camp. These proposed management actions attempt to address impacts from flying-foxes experienced by these sensitive receivers (see **Roost Detail Plan** for mapping and further details). Approximately 70% of the BSC-managed land is at maintenance level, and primary works still occurring on the remaining 30%. In recent years the camp has shifted upstream from Federation Bridge towards the south, with a new section (possibly a new urban camp) forming along the main arm of the Brunswick River behind the Mullumbimby Showgrounds. Further monitoring will be required to establish if this is a new camp or the shifting of the original camp. The camp management actions listed in **Table 9** apply specifically to Mullumbimby flying-fox camp and are in addition to those listed in **Table 5**. In addition to the community consultation findings, other key considerations when identifying site specific management actions at this site include:

- Land tenure (i.e. much of the camp in proximity to sensitive receivers is located outside of Council land)
- Management actions need to be sensitive to the riparian environment at the site, which includes threatened species habitat and EECs.
- Due to the urban context of the camp, there is a risk of shifting the flying-fox/human conflict towards other sensitive receivers (particularly in the short-term) if works are not implemented appropriately. This includes highly sensitive sites such as schools.
- Residential housing is the main sensitive receiver surrounding the site.

The following tasks also apply to all proposed management actions:

- Actions need to adhere to relevant licence requirements.
- When an approval/ licence is required, conditions of the approval/ licence must be met prior to commencement of works.
- Consultation must be undertaken with Tweed-Byron LALC and Reserve Trust prior to commencement.



Table 9 Proposed management for Mullumbimby flying-fox camp.

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
<b>Level 1 actions</b>							
1.1	Bush regeneration	All	Low	Quarterly	<ul style="list-style-type: none"> <li>Monitor and control weed infestations at the site. The site currently has medium levels of weeds, and maintaining or further removing weeds would help conserve the amenity of the site.</li> <li>4 x 90hrs = 360hrs per annum</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> <li>Weed incursion is reduced.</li> </ul>	Annual: \$19.8K Life of Plan: \$79.2k
1.2	Maintain buffers	All	Low	As required	<ul style="list-style-type: none"> <li>Maintain current buffers from residences and commercial premises</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> </ul>	Existing resources
1.3	Update educational signage	All	Low	As required	<ul style="list-style-type: none"> <li>Monitor and update existing signage as required</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.4	Engage school students	All	Low	As required	<ul style="list-style-type: none"> <li>Engage with local schools to educate students.</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.5	Engage Mullum Showgrounds	All	Low	As required	<ul style="list-style-type: none"> <li>Engage with Mullum Showgrounds management and provide educational package.</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.6	Tourist engagement	All	Low	If required	<ul style="list-style-type: none"> <li>Investigate possible tourist opportunities for engagement and education</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from tourism operators</li> </ul>	Existing resources and Flying-fox Officer
1.7	Continue engagement with nearby residents	All	Medium	Ongoing	<ul style="list-style-type: none"> <li>Promote positive information and clarification of any issues</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> <li>Complaints to Council regarding flying-foxes are reduced</li> </ul>	Existing resources and Flying-fox Officer

#### 5.7.5. Paddy's Creek Camp

Residential development is located in close proximity to the Paddy's Creek flying-fox camp to the east and west. There are mature Camphor trees and Alexander palms throughout the majority of the site. The remainder of the site is at maintenance level. These proposed management actions attempt to address impacts from flying-foxes experienced by these sensitive receivers (see **Roost Detail Plan** for mapping and further

details). The camp management actions listed in **Table 10** apply specifically to Paddy's Creek flying-fox camp and are in addition to those listed in **Table 5**. In addition to the community consultation findings, other key considerations when identifying site specific management actions at this site include:

- Steep riparian corridor.
- Management actions need to be sensitive to the riparian environment at the site, which includes threatened species habitat and EECs.
- Due to the urban context of the camp, there is a risk of shifting the flying-fox/human conflict towards other sensitive receivers (particularly in the short-term) if works are not implemented appropriately. This includes highly sensitive receivers such as the Bangalow Community Child Care Centre.
- Residential housing is the main sensitive receiver surrounding the site.

The following tasks also apply to all proposed management actions:

- Actions need to adhere to relevant licence requirements.
- When an approval/ licence is required, conditions of the approval/ licence must be met prior to commencement of works.
- Consultation must be undertaken with Ngulingah LALC prior to commencement.

**Table 10 Proposed management for Paddy's Creek flying-fox camp.**

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
<b>Level 1 actions</b>							
1.1	Bush regeneration	All	Low	Quarterly	<ul style="list-style-type: none"> <li>• Monitor and control weed infestations at the site. The site currently has low levels of weeds, and maintaining or further removing weeds would help conserve the amenity of the site.</li> <li>• 4 x 50hrs = 200hrs per annum</li> </ul>	<ul style="list-style-type: none"> <li>• Complaints to Council regarding flying-foxes are reduced.</li> <li>• Weed incursion is reduced.</li> </ul>	Annual: \$11K Life of Plan: \$55K
1.2	Maintain buffers	All	Low	As required	<ul style="list-style-type: none"> <li>• Maintain current buffers from residences and commercial premises</li> </ul>	<ul style="list-style-type: none"> <li>• Complaints to Council regarding flying-foxes are reduced.</li> </ul>	Existing resources
1.3	Update educational signage	All	Medium	As required	<ul style="list-style-type: none"> <li>• Monitor and update existing signage as required</li> </ul>	<ul style="list-style-type: none"> <li>• Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
1.4	Engage school students	All	Low	As required	<ul style="list-style-type: none"> <li>Engage with Bangalow Community Child Care Centre to educate students. Work with staff to develop protocol for monitoring childcare grounds.</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.5	Continue engagement with nearby residents	All	Medium	Ongoing	<ul style="list-style-type: none"> <li>Promote positive information and clarification of any issues</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> <li>Complaints to Council regarding flying-foxes are reduced</li> </ul>	Existing resources and Flying-fox Officer

#### 5.7.6. Byron Creek Bangalow Camp

Residential development, sports field and showgrounds are located in close proximity to the Byron Creek flying-fox camp. The BSC Regen Team have provided proposed works for managing the site. These proposed management actions attempt to address impacts from flying-foxes experienced by these sensitive receivers (see **Roost Detail Plan** for mapping and further details). The camp management actions listed in **Table 11** apply specifically to Byron Creek flying-fox camp and are in addition to those listed in **Table 5**. In addition to the community consultation findings, other key considerations when identifying site specific management actions at this site include:

- Management actions need to be sensitive to the riparian environment at the site, which includes threatened species habitat and EECs.
- Due to the urban context of the camp, there is a risk of shifting the flying-fox/human conflict towards other sensitive receivers (particularly in the short-term) if works are not implemented appropriately. This includes highly sensitive receivers such as the Bangalow Showgrounds.

The following tasks also apply to all proposed management actions:

- Actions need to adhere to relevant licence requirements.
- When an approval/ licence is required, conditions of the approval/ licence must be met prior to commencement of works.
- Consultation must be undertaken with Ngulingah LALC prior to commencement.

Table 11 Proposed management for Byron Creek Bangalow flying-fox camp.

Action ID	Management action	Target issue	Priority	Timing	Management action details	Performance indicators	Cost
<b>Level 1 actions</b>							
1.1	Bush regeneration	All	Low	Quarterly	<ul style="list-style-type: none"> <li>Monitor and control weed infestations at the site. The site currently has low levels of weeds, and maintaining or further removing weeds would help conserve the amenity of the site.</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> <li>Weed incursion is reduced.</li> </ul>	Annual: \$11K Life of Plan: \$55K
1.2	Maintain buffers	All	Low	As required	<ul style="list-style-type: none"> <li>Maintain current buffers from residences and commercial premises</li> </ul>	<ul style="list-style-type: none"> <li>Complaints to Council regarding flying-foxes are reduced.</li> </ul>	Existing resources
1.3	Investigate need for educational signage	All	Medium	As required	<ul style="list-style-type: none"> <li>Consult with Landcare and Showgrounds management to understand the need for educational sign</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer
1.4	Engage nearby residents and Landcare groups	All	Low	As required	<ul style="list-style-type: none"> <li>Engage with nearby residents and provide educational advice and information on flying-fox behaviour and ecology.</li> </ul>	<ul style="list-style-type: none"> <li>Positive reactions from residents</li> </ul>	Existing resources and Flying-fox Officer

## 5.8. Analysis of Management Options

Table 12 Analysis of Management Options

Management option	Relevant impacts	Cost	Advantages	Disadvantages
<b>Level 1 actions</b>				

Management option	Relevant impacts	Cost	Advantages	Disadvantages
Information and awareness programs	Perceived health risks Noise Smell Faecal drop	\$	Low cost, promotes conservation of FFs, contributes to attitude change which may reduce general need for camp intervention, increasing awareness and providing options for landholders to reduce impacts can be an effective long-term solution, can be undertaken quickly, will not impact on ecological or amenity value of the site.	Information and advice itself will not mitigate all issues and may be seen as not doing enough.
Property modification	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	\$\$	Property modification is one of the most effective ways to reduce amenity impacts of a camp without dispersal (and associated risks), relatively low cost, promotes conservation of FFs, can be undertaken quickly, will not impact on the site, may add value to the property.	May be cost-prohibitive for private landholders, unlikely to fully mitigate amenity issues in outdoor areas.
Fully-fund/ subsidise property modification	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	\$\$\$	Potential advantages as per property modification, but also overcomes issue of cost for private landholders.	Costs to the land manager will vary depending on the criteria set for the subsidy including proximity to site, term of subsidy, and level of subsidy. Potential for community conflict when developing the criteria and may lead to expectations for similar subsidies for other issues.
Service subsidies including rate rebates	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	\$\$\$	May encourage tolerance of living near a camp, promotes conservation of FFs, can be undertaken quickly, will not impact on the site, and would reduce the need for property modification.	May be costly across multiple properties and would incur ongoing costs, may set unrealistic community expectations for other community issues, effort required to determine who would receive subsidies.
Routine camp management	Health/ wellbeing	\$	Will allow property maintenance, likely to improve habitat, could improve public perception of the site, will ensure safety risks of a public site can be managed. Weed removal has the potential to reduce roost availability and reduce numbers of roosting FFs. To avoid this, weed removal should be staged and alternative roost habitat planted, otherwise activities may constitute a Level 3 action.	Will not generally mitigate amenity impacts for nearby landholders.

Management option	Relevant impacts	Cost	Advantages	Disadvantages
Alternative habitat creation	All	\$\$- \$\$\$	If successful in attracting FFs away from high conflict areas, dedicated habitat in low conflict areas will mitigate all impacts, promotes FF conservation. Rehabilitation of degraded habitat that is likely to be suitable for FF use could be a more practical and faster approach than habitat creation.	Generally costly, long-term approach so cannot be undertaken quickly; previous attempts to attract FFs to a new site have not been known to succeed.
Provision of artificial roosting habitat	All	\$\$-\$	If successful in attracting FFs away from high conflict areas, artificial roosting habitat in low conflict areas will assist in mitigating all impacts, generally low cost, can be undertaken quickly, and promotes FF conservation.	Would need to be combined with other measures (e.g. buffers/alternative habitat creation) to mitigate impacts, previous attempts have had limited success.
Protocols to manage incidents	Health/ wellbeing	\$	Low cost, will reduce actual risk of negative human/pet-FF interactions, promotes conservation of FFs, can be undertaken quickly, will not impact the site.	Will not generally mitigate amenity impacts.
Research	All	\$	Supporting research to improve understanding may contribute to more effectively mitigating all impacts, promotes FF conservation.	Generally, cannot be undertaken quickly, management trials may require further cost input.
Appropriate land-use planning	All	\$	Likely to reduce future conflict, promotes FF conservation. Identification of degraded sites that may be suitable for long-term rehabilitation for FFs could facilitate offset strategies should clearing be required under Level 2 actions.	Will not generally mitigate current impacts, land-use restrictions may impact the landholder.
Property acquisition	All for specific property owners Nil for broader community	\$\$\$	Will reduce future conflict with the owners of acquired property.	Owners may not want to move, only improves amenity for those who fit criteria for acquisition, very expensive.
Do nothing	Nil	Nil	No resource expenditure.	Will not mitigate impacts and unlikely to be considered acceptable by the community.
<b>Level 2 actions</b>				
Buffers through vegetation removal	Noise Smell Health/wellbeing Property devaluation Lost rental return	\$\$-\$	Will reduce impacts, promotes FF conservation, can be undertaken quickly, and limited maintenance costs.	Will impact the site, will not generally eliminate impacts, vegetation removal may not be favoured by the community.



Management option	Relevant impacts	Cost	Advantages	Disadvantages
Buffers without vegetation removal	Noise Smell Health/wellbeing Damage to vegetation Property devaluation Lost rental return	\$\$	Successful creation of a buffer will reduce impacts, promotes FF conservation, can be undertaken quickly, options without vegetation removal may be preferred by the community.	May impact the site, buffers will not generally eliminate impacts, maintenance costs may be significant, often logistically difficult, limited trials so likely effectiveness unknown.
Noise attenuation fencing	Noise Smell Health/wellbeing Property devaluation Lost rental return	\$\$	Will eliminate/significantly reduce noise impacts, will reduce other impacts, limited maintenance costs.	Costly, likely to impact visual amenity of the site, will not eliminate all impacts, may impact other wildlife at the site.
<b>Level 3 actions</b>				
Nudging	All	\$\$- \$\$\$	If nudging is successful this may mitigate all impacts.	Costly, FFs will continue attempting to recolonise the area unless combined with habitat modification/ deterrents.
Passive dispersal through vegetation management	All at that site but not generally appropriate for amenity impacts only	\$\$- \$\$\$	If successful can mitigate all impacts at that site, compared with active dispersal: less stress on FFs, less ongoing cost, less restrictive in timing with ability for evening vegetation removal.	Costly, will impact site, risk of removing habitat before outcome known, potential to splinter the camp creating problems at other locations (although less than active dispersal), potential welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk (see <b>Section 2.5.1</b> ), potential to impact on aircraft safety. Parson et al (2008) concluded the majority of flying-foes fly at elevations of approximately 15m, with a few records of flights of up to 1,500m
Passive dispersal through water management	All at that site but not generally appropriate for amenity impacts only	\$\$- \$\$\$	Potential advantages as per with passive dispersal through vegetation removal, however likelihood of success unknown.	Potential disadvantages as per passive dispersal through vegetation removal, however likelihood of success unknown.

Management option	Relevant impacts	Cost	Advantages	Disadvantages
Early dispersal before a camp is established at a new location	All at that site	\$\$- \$\$\$	Potential advantages as per other dispersal methods, but more likely to be successful than dispersal of a historic camp.	Potential disadvantages as per other dispersal methods, but possibly less costly and slightly lower risk than dispersing a historic camp. Potential to increase pressure on FFs that may have relocated from another dispersed camp, which may exacerbate impacts on these individuals.

## 5.9. Funding Commitment

Approximate costs have been included within the specific management action table within **Table 12**. Cost sharing between stakeholders will be investigated during the pre-management consultation and consent period. Council will be seeking a commitment by landholders to maintain private property. Specific management actions for the urban camps within the Byron Shire are presented in the **Roost Detail Plan**.

Council will seek to take advantage of flying-fox grants as and when they become available.

Councillors are aware that funding commitment is required long term beyond the five-year life of this Plan.

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## Appendix 1

### Heat Stress Event Management

#### Volunteers

##### Dress Code and Equipment for Volunteers

- Long pants
- Long sleeved shirt
- Closed in shoes
- Mask
- Arm protectors
- Gloves
- Hat

Volunteers will also be required to bring the following

- Drinking water (minimum 4 litres)
- Sunscreen
- Insect repellent
- Band aids
- Two tea towels: During the afternoon, these tea towels can be wet and worn around the neck or under the hat.

Coordinators will provide lists for any additional equipment that may be required.

#### Care Responders' Occupational Health & Safety Requirements

- Only vaccinated persons with an appropriate current titre will be permitted to enter the colony.
- Volunteers must not enter the colony until they have contacted the Site Coordinator and completed the sign on/out sheet.
- All volunteers working in the colony must work in pairs.
- Volunteers must not deviate from instructions without consulting the Site Coordinator.
- Do not climb trees.
- Use marked trails where possible.
- Beware of snakes and spiders.
- All bites & scratches to be washed immediately & registered with appointed person.
- Sign out when you leave. This allows the Site Coordinator to know you have not had an accident, become lost or hurt somewhere in the colony.

Flying-fox heat-stress data form can be found at <https://www.animalecologylab.org/heat-stress-data-form.html>

Management actions will be undertaken following guidance of State officers and wildlife animal behaviour specialists. The information contained within **Table 13** is guidance only and will need to be adapted according to site specific indicators.

Table 13 Flying-fox behavioural guide in heat stress events

Category	Behaviour	Response
1 Normal behaviour	Normal	None
2 Minor stress	Wing fanning	Observe
3 Moderate stress	Shade seeking	Observe
	Clustering	Observe / prepare for possible response
4 Major stress	Clumping / licking	Observe / prepare for possible response
	Salivating	Do not disturb - These animals are trying to cope within the last of their tolerance limits - imposing additional stress may cause death at this point.
	Panting	
5 Critical stress Low humidity	Falling from trees	Direct spray three times with 15-minute intervals. Retrieve to treat only if vet or euthanasia carer is on-site, leave in-situ if not.
5 Critical stress High humidity	Falling from trees	<p>Assess if there is the ability to wet flying foxes safely and directly in the camp. (Spraying without directly wetting flying-foxes will only increase humidity surrounding the flying-foxes, removing their last protective mechanism to reduce their body temperature). Ineffective spraying of flying-foxes in high humidity events can be catastrophic.</p> <ul style="list-style-type: none"> <li>• Direct spray once and observe for evaporation/drying of fur.</li> <li>• If evaporation is occurring, spray 2 more times.</li> <li>• If evaporation is <b>not occurring</b> cease spraying.</li> <li>• Retrieve to treat only if a vet or licenced euthanasia carer is on-site, leave animals in-situ if not.</li> </ul>
6 Deceased	Deceased	<ul style="list-style-type: none"> <li>• Leave deceased flying-foxes, if possible, for several days if a lactating female is dead. Pups are known to come down to rest with deceased mother several days after death, making live pup retrieval easier.</li> <li>• Collect deceased animals and complete datasheet.</li> <li>• Dispose of as per Council guidelines.</li> </ul>

- adapted from <https://www.qld.gov.au/environment/plants-animals/animals/living-with/bats/flying-foxes/about-flying-foxes/flying-fox-mass-dying-events-and-heat-stress-events>

Table 14 Water spraying procedures

### **Spraying procedures**

If most animals at the roost are exhibiting Category 4 (Major stress behaviour) of clumping low down in trees, panting, salivating, and licking their wrists:

- Assess the tolerance of the Flying-foxes to a quiet approach.
- If mass lifting occurs or Flying-foxes are showing signs of elevated distress, then the animals are not tolerant to approach. **Cease actions** and continue to monitor behaviours.
- If tolerant, attempt to spray Flying-foxes directly using water in easily transportable, low noise spray mechanisms such as a backpack spray.
  1. Start gently with the stream as a good spray using large droplets at low force.
  2. Gradually increase the intensity of the spraying so that each animal becomes saturated with water.
  3. Monitor the response.
  4. **Immediately cease spraying** if any Flying-foxes are starting to lift off or become more distressed.
  5. Move on to observe the next area and come back and observe the previously sprayed Flying-foxes after 15 minutes.
  6. If the animals are drying off between sprays, continue with another spray, if not, **cease spraying** as humidity may be impeding evaporative cooling.
  7. After three attempts at spraying, and if resources allow, remove animals that are not responding for triage (i.e., those that are not climbing back into the mid-storey near to the ground).
  8. Do not immediately remove orphans that are roosting in trees as mothers will often come back for babies once the situation has settled - it will become apparent over the next 24 to 48 hours if pups and juveniles are truly orphaned.
  9. Ideally all animals brought in for triage should be seen at a wildlife veterinary facility, as they will all have some form of systemic damage due to heat stroke which can only be addressed adequately and humanely with intensive veterinary treatment.

- adapted from <https://www.qld.gov.au/environment/plants-animals/animals/living-with/bats/flying-foxes/about-flying-foxes/flying-fox-mass-dying-events-and-heat-stress-events>

Table 15 Communication plan for a heat stress event

Stage	Trigger	Stakeholders (internal/external)			General Public		
		Communication Type	Key Messages	Responsible Stakeholder/ Department	Communication Type	Key Messages	Responsible Stakeholder/ Department
<b>Notification</b>	High temperature forecast	Email (internal stakeholders)	Possibility of flying-fox (FF) heat stress event occurring Key contacts for Environmental Services	Biodiversity Officer and Operations Team	Social media	General information about heat stress and wildlife including flying-foxes (FF). To report sick or injured FF on your property, contact a local wildlife care organisation or RSPCA on 1300 ANIMAL (1300 264 625).	Corporate Communications
<b>Phase 1 - Monitoring</b>	When Council Officers are deployed to site	Email (internal stakeholders)	Advising what camps are currently being monitored	Communications Coordinator	Social media and customer requests and enquiries	Do not approach or touch heat stressed FF. Heat stressed FF can be identified by groups clumping low to the ground or low on tree trunks. These FF should only be approached by trained and vaccinated wildlife carers.	Customer services - call centre
						To report sick or injured FF on your property, contact a local wildlife care organisation or RSPCA on 1300 ANIMAL (1300 264 625).	Environmental Services - Environment Operations Team
		Email (external stakeholders)	Advise WIRES and Northern Rivers Wildlife Carers what camps are currently being monitored	Biodiversity Officer		For further information on FF and human health, contact Public Health Unit on 1300 066 055 or visit the NSW Health website <a href="http://www.health.nsw.gov.au">www.health.nsw.gov.au</a>	NSW Health
<b>Phase 2 - Rescue and Mitigation</b>	When wildlife carers implement mitigation measures	Email (internal stakeholders)	Advising what camps rescue and mitigation is occurring and likelihood of clean-up required.	Biodiversity Officer and Operations Team	Social media and customer requests and enquiries	Do not approach or touch heat stressed FF. Heat stressed FF can be identified by groups clumping low to the ground or low on tree trunks. These FF should only	Customer Services - call centre

Stage	Trigger	Stakeholders (internal/external)			General Public		
		Communication Type	Key Messages	Responsible Stakeholder/ Department	Communication Type	Key Messages	Responsible Stakeholder/ Department
		Various (external stakeholders)	Liaise and collaborate with media units and communications departments of lead agencies such as DPE, NSW Health and RSPCA where and when appropriate.	Communications Coordinator and Communications Team		be approached by trained and vaccinated wildlife carers. Avoid direct contact with deceased FF. Deceased FF may still have live young attached to them. Do not touch live animals - contact a local wildlife care organisation or RSPCA on 1300 ANIMAL (1300 264 625).	Communications Coordinator  Biodiversity Officer
		Phone the Department of Environment and Science	Advising what camps rescue and mitigation is occurring and likelihood of clean-up required	Biodiversity Officer			
Phase 3 - Clean-up	Once clean-up measures are undertaken	Various (external stakeholders)	Liaise and collaborate with media units and communications departments of lead agencies such as DPE, NSW Health and RSPCA where and when appropriate.	Communications Team	Media release, social media, customer requests and enquiries	If there are deceased FF on your property, dispose of them by wearing gloves and/or long handle shovel or tongs to place into an appropriate bag (e.g. heavy-duty plastic bag or hessian bag). Subject to availability, Council may be able to supply bags to residents where large numbers of deceased FF occur.	Customer Services - call centre
				Communications Coordinator		Council will deploy rubbish bins for storing deceased animals and dispose of them at waste facilities.	Communications Coordinator
Phase 4 - Debrief	Conclusion of the event, noting it may take a few days for	Various (external stakeholders)	Liaise and collaborate with media units and communications departments of lead agencies such	Biodiversity Officer, Communications Team and Operations Team	Not applicable	Not applicable	Not applicable



Stage	Trigger	Stakeholders (internal/external)			General Public		
		Communication Type	Key Messages	Responsible Stakeholder/ Department	Communication Type	Key Messages	Responsible Stakeholder/ Department
	event to end		as DPE, NSW Health and RSPCA where and when appropriate.				
		Email (internal stakeholders)	Summary of event	Communications Coordinator			

## Appendix 2

### Flying-fox Rescue Protocol

#### Reference documents

OEH 2012, [NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes](#), Office of Environment and Heritage, Sydney.

OEH 2011b, [NSW Code of Practice for Injured, Sick and Orphaned Protected Fauna](#), Office of Environment and Heritage, Sydney.

#### Purpose

These work instructions are intended for Australian bat lyssavirus (ABLV)-vaccinated fauna spotter catchers (FSCs) or wildlife rescue personnel on site during activities to monitor, capture or provide first aid treatment for sick or injured flying-foxes that may require human intervention for their survival. Flying-fox rescue must only be attempted by personnel trained and experienced in flying-fox rescue and handling.

This work instruction provides rescuers with information regarding capture and first aid until a flying-fox is in the specialist care of a veterinarian or person qualified in wildlife rehabilitation.

#### Requirements

FSC and wildlife rescue personnel involved in flying-fox rescue must:

- be trained and experienced in rescue and handling
- be vaccinated against ABLV (titre levels checked at least once every two years)
- be aware of the hazards and risks of coming into contact with all bats
- utilise appropriate PPE and equipment for capture, transport and treatment of flying-foxes
- undertake a risk assessment before carrying out a rescue - do not endanger yourself or others during a rescue
- have the contact details for a local veterinarian or bat carer who will accept the sick or injured flying-fox.

#### Human first aid

All bats in Australia should be viewed as potentially infected with ABLV. If bitten or scratched by a bat, immediately wash the wound with soap and water (do not scrub) and continue for at least five minutes, followed by application of an antiseptic with anti-viral action (e.g. Betadine), and immediate medical attention (post-exposure vaccinations may be required). Similarly medical attention should be immediately sought if exposed to an animal's saliva or excreta through the eyes, nose or mouth.

#### Equipment

- lidded plastic carry basket or 'pet-pack' with bedding (juveniles) / transport container with hanging perch, tall enough for bat to hang without hitting its head (in accordance with Section 5.1 of the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012))
- warm water bottle/ cold brick
- wraps/ towels
- teats for small bottle
- extension pole or broom

- bat first aid kit - juice drink/glucose powder, syringes, cloths for wounds, Betadine/saline, dummy for baby bats. FFs only to be offered liquids under advice from a licensed wildlife carer.

### Work instructions - Case assessment

Observe, assess and then determine if/what intervention is required using the decision tree in the NSW Code of Practice for Injured (Figure 9), Sick and Orphaned Protected Fauna (OEH 2011), included below.

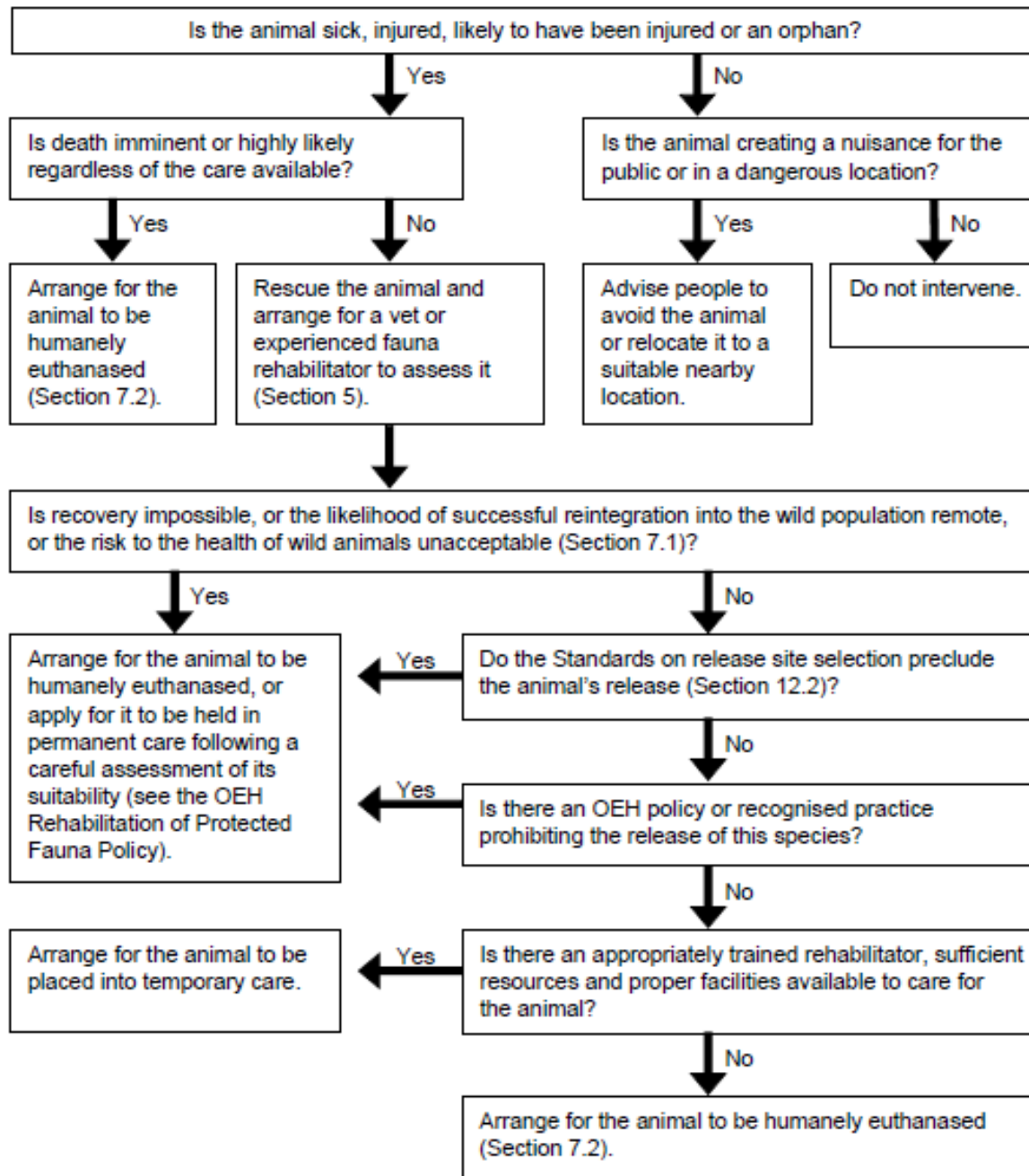


Figure 9 A DPE (formally OEH) decision tree for the care of protected fauna

Personnel should approach stressed flying-foxes cautiously. If flying-foxes panic or fly this will waste energy; retreat and continue to monitor behaviour.

- Dehydration: Eyes dull or depressed in skull, change to skin elasticity, skin stays pinched, animal cold, wing membranes dry, mouth dry.
- Heat stress: wing fanning, shade seeking, clustering/clumping, salivating, panting, roosting at the base of trees, on the ground, falling from tree.
- Obvious injury: bleeding, broken bones.

### **Rescue instructions**

As per Section 4 of the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012):

The objective is to rescue a flying-fox while minimising further stress and injury to the animal.

Before a rescue attempt, rescuers must assess the risks to the flying-fox from environmental hazards and from capture.

Rescuers must employ the correct rescue equipment for the condition and location of the flying-fox and be trained in its use.

### *Example scenarios*

- Bat low in tree:
  - quickly place towel around bat before it can move away
  - grab hold of feet, toes may curl over rescuers fingers
  - place in carry basket / transport container.
- Bat high in tree:
  - place pole wrapped in towel in front of bat
  - coax bat onto towel
  - once on towel, quickly move away from branches and lower to ground
  - once on ground, cover with towel and place into carry basket / transport container.
- A bat caught on barbed wire fence:
  - two people only - one to restrain with towel, while the other untangles
  - put towels on the wire strands under or around to avoid further entanglement
  - if the membrane has dried onto wire, syringe or spray water onto wing
  - use pliers or wire cutter if necessary.

### **Animal first aid**

Physical assessment: Keep animal wrapped and head covered, only expose one part at a time. Examine head. Unwrap one wing and extend. Wrap and extend other wing. Check legs. Examine front and back of body.

Dehydration: Offer water/juice (low acid juice only, e.g. apple/ mango) orally with syringe (under supervision/ advice from licensed wildlife carer ONLY).

Heat stress: Reduce temperature in heat exhausted bats by spraying wings with tepid water.

Hypothermia: May be seen in pups separated from mother - keep head covered and warm core body temperature slowly by placing near (not on) warm water bottle covered by towel.

Bleeding: Clean wounds with room temperature saline or diluted Betadine.

## **Transport to veterinarian/ wildlife carer**

See Section 5 of the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012) summarised below.

### *Objective*

To transport a flying-fox so as to minimise further stress and injury to the animal.

### *Standards*

- The transport container must be tall enough for the flying-fox to hang by its feet without hitting its head on the floor.
- The container must be designed, set up and secured to prevent injuries to the flying-fox. The sides of the container must prevent the flying-fox from poking its head or wings out.
- The container must be designed to prevent the flying-fox from escaping.
- The flying-fox must be allowed to hang by its feet from the top of the container or if it is unable to hang, wrapped in material (e.g. sheet or flannel) and placed in a sling so its feet are higher than its head.
- The container must be kept at a temperature which is appropriate for the age and condition of the flying-fox. A range of 25-27°C is appropriate for an adult. A temperature of 28°C is appropriate for an orphan. A cool or warm water bottle may be required.
- The container must be ventilated so air can circulate around the flying-fox.
- The container must minimise light, noise and vibrations and prevent contact with young children and pets.
- During transport, a container holding a flying-fox must have a clearly visible warning label that says 'Warning - live bat'.
- A flying-fox must not be transported in the back of an uncovered utility vehicle or a car boot that is separate from the main cabin.

### *Guidelines*

- Flying-fox transport should be the sole purpose of the trip and undertaken in the shortest possible time.
- The fauna rehabilitation group's contact details should be written on the transport container in case of an emergency.

## **Wildlife carers and hospitals in the Northern Rivers**

### **WIRES**

All WIRES flying-fox rescuers have been vaccinated and these rescues will be attended ASAP by their rescue team. Call WIRES Rescue Line for rescue assistance with any flying-foxes or microbats.

#### **Contact**

- Phone 1300 094 737 or (02) 6628 1898

### **Byron Bay Wildlife Hospital**

Byron Bay Wildlife Hospital provides professional veterinary services for injured, diseased, orphaned and displaced native Australian animals. Services are provided free of charge to achieve positive welfare outcomes for wildlife.

#### **Contact**

- Phone 1300 WILDLIFE (1300 945 354) or 0437 818 883  
- Email [info@byronbaywildlifehospital.org](mailto:info@byronbaywildlifehospital.org)

### **Northern Rivers Wildlife Carers**

Northern Rivers Wildlife Carers Inc. is a not-for-profit network of trained volunteers that is licensed to rescue and rehabilitate sick, injured or orphaned wildlife for release back into the wild. If you find any injured or orphaned wildlife, please call the Northern Rivers Wildlife Carers.

#### **Contact**

- Phone (02) 6628 1866

### **Northern Rivers Wildlife Hospital at Wollongbar**

The Northern Rivers Wildlife Hospital (NRWH) facility accommodates short-term rehabilitation of sick and injured animals and will scale to accommodate long-term rehabilitation of certain species to reduce the workload of existing local carers.

In addition to providing veterinary care to assist the network of wildlife carers and providing wildlife with the expert veterinarian services they need, NRWH will play a significant role in community preparedness and resilience by becoming a local disease surveillance site as part of the national Sentinel Clinic Wildlife Disease Surveillance program.

#### **Contact**

- Email [info@nrwh.com.au](mailto:info@nrwh.com.au)

## Appendix 3

### Potential Health Risks

Flying-fox camps in public places, such as parks, school grounds and residential areas can sometimes raise concerns for community members about possible health risks. Human infections with viruses borne by flying-foxes are very rare.

Wildlife disease surveillance in Australia is coordinated by Wildlife Health Australia (WHA). WHA hosts a Bat Focus Group and provides comprehensive, up-to-date information on bat borne diseases of concern to the public in online Fact Sheets. These include Australian Bat Lyssavirus (WHA 2023), Hendra Virus (WHA 2021), Menangle Virus (WHA 2016) and Coronaviruses (WHA 2020).

### Australian bat lyssavirus

Australian Bat Lyssavirus (ABLV) is a rabies-like virus that may be found in all flying-fox species on mainland Australia. It has also been found in an insectivorous microbat and it is assumed it may be carried by any bat species. The probability of human infection with ABLV is very low with less than 1% of the flying-fox population being affected (DPI 2017) and transmission requiring direct contact with an infected animal that is secreting the virus. In Australia, three people have died from ABLV infection since the virus was identified in 1996 (NSW Health 2015).

Domestic animals are also at risk if exposed to ABLV. In 2013, ABLV infections were identified in two horses (Shinwari et al. 2014). There have been no confirmed cases of ABLV in dogs in Australia; however, transmission is possible (McCall et al. 2005) and consultation with a veterinarian should be sought if exposure is suspected.

Transmission of the virus from bats to humans is through a bite or scratch but may have potential to be transferred if bat saliva directly contacts the eyes, nose, mouth or broken skin. ABLV is unlikely to survive in the environment for more than a few hours, especially in dry environments that are exposed to sunlight (NSW Health 2015).

Transmission of closely related viruses suggests that contact or exposure to bat faeces, urine or blood does not pose a risk of exposure to ABLV, nor does living, playing or walking near bat roosting areas (NSW Health 2015).

The incubation period in humans is assumed similar to rabies and variable between two weeks and several years. Similarly, the disease in humans presents essentially the same clinical picture as classic rabies.

Once clinical signs have developed the infection is invariably fatal; however, infection can easily be prevented by avoiding direct contact with bats (i.e. handling).

Pre-exposure vaccination provides reliable protection from the disease for people who are likely to have direct contact with bats, and it is generally a mandatory workplace health and safety requirement that all persons working with bats receive pre-exposure vaccination and have their level of protection regularly assessed. Like classic rabies, ABLV infection in humans also appears to be effectively treated using post-exposure vaccination and so any person who suspects they have been exposed should seek immediate medical treatment. Post-exposure vaccination is usually ineffective once clinical manifestations of the disease have commenced.

If a person is bitten or scratched by a bat they should:

- wash the wound with soap and water for at least five minutes (**do not scrub**)
- contact their doctor immediately to arrange for post-exposure vaccinations.



If bat saliva contacts the eyes, nose, mouth or an open wound, flush thoroughly with water and seek immediate medical advice.

## Hendra virus (Peggy Eby to update)

Flying-foxes are the natural host for Hendra virus, which can be transmitted from flying-foxes to horses. Infected horses sometimes amplify the virus and can then transmit it to other horses, humans and on two occasions, dogs (DPI 2018). There is no evidence that the virus can be passed directly from flying-foxes to humans or to dogs (Halim et al. 2015). Clinical studies have shown cats, pigs, ferrets and guinea pigs can carry the infection (DPI 2018).

Although antibodies to the virus have been detected in flying-fox populations across Australia, and viral shedding has been recorded periodically in various regional areas, the likelihood of horses becoming infected is low and consequently, human infection is rare. Horses are thought to contract the disease after ingesting forage or water contaminated with urine from an infected flying-fox (CDC 2014).

Humans may contract the disease after close contact with an infected horse. Hendra virus infection in humans presents as a serious and often fatal respiratory and/or neurological disease and there is currently no effective post-exposure treatment or vaccine available for people. The mortality rate in horses is greater than 70% (DPI 2018). Since 1994, more than 100 horses have died (Degeling et al. 2018) and four of the seven infections in humans were fatal (Goldspink et al. 2015).

Previous studies have shown that infections of horses have been associated with foraging flying-foxes rather than camp locations. Therefore, risks are considered similar at any location within the range of flying-fox species and all horse owners should be vigilant. Vaccination of horses can protect horses and subsequently humans from infection (DPI 2018), as can appropriate horse husbandry (e.g. covering food and water troughs, fencing flying-fox foraging trees in paddocks, etc.).

Although all human cases of Hendra virus to date have been contracted from infected horses and direct transmission from bats to humans has not yet been reported, particular care should be taken by select occupational groups that could be uniquely exposed. For example, persons who may be exposed to high levels of Hendra virus via aerosol of heavily contaminated substrate should consider additional personal protective equipment (PPE), e.g. respiratory filters, and potentially dampening down dry dusty substrate.

## Menangle virus

Menangle virus (also known as bat paramyxovirus no. 2) was first isolated from stillborn piglets from a NSW piggery in 1997. Little is known about the epidemiology of this virus, except that it has been recorded in flying-foxes, pigs and humans (Field 2002; Kirkland 2017). The virus caused reproductive failure in pigs and severe febrile (flu-like) illness in two piggery workers employed at the same Menangle piggery where the virus was recorded (Field 2002). The virus is thought to have been transmitted to the pigs from flying-foxes via an oral-faecal matter route (Kirkland 2017). Flying-foxes had been recorded flying over the pig yards prior to the occurrence of disease symptoms. The two infected piggery workers made a full recovery, and this has been the only case of Menangle virus recorded in Australia.

## General health considerations

Flying-foxes, like all animals, carry bacteria and other microorganisms in their guts, some of which are potentially pathogenic to other species. Direct contact with faecal material should be avoided and general hygiene measures taken to reduce the low risk of gastrointestinal and other diseases.

Contamination of water supplies by any animal excreta (birds, amphibians and mammals such as flying-foxes) poses a health risk to humans. Household tanks should be designed to minimise

potential contamination, such as using first-flush diverters to divert contaminants before they enter water tanks. Trimming vegetation overhanging the catchment area (e.g. the roof of a house) will also reduce wildlife activity and associated potential contamination. Tanks should also be appropriately maintained and flushed, and catchment areas regularly cleaned to remove potential contaminants.

Public water supplies are regularly monitored for harmful microorganisms and are filtered and disinfected before being distributed. Management plans for community supplies should consider whether any large congregation of animals, including flying-foxes, occurs near the supply or catchment area. Where they do occur, increased frequency of monitoring should be considered to ensure early detection and management of contaminants.

## Appendix 4

### Working nearby Flying-fox Camps: Summary Sheet

Flying-foxes, megabats or fruit-bats are essential to ensure Byron Shire's healthy vegetation. Like all native Australian wildlife they are protected. Threatened GHFF also have extra levels of protection. To ensure safety and consistency, when working near flying-fox camps, Byron Shire Council follows strict procedures based on Department of the Environment Energy and Water (DCCEEW) and Department of Planning and Environment's (DPE) guidelines that are adapted and published as Byron Shire Flying Fox Camp Management Plan.

Under the Biodiversity Conservation Act 2016, low to moderate risk activities can be carried out in accordance with an enforceable code of practice. Council can be held accountable for any action that causes harm to the population or adversely impacts on the life cycle of flying-foxes, especially the breeding and rearing of young. Below are guidelines for working in and around camps.

1. Prior to works or to any changes to the previously agreed work, a notice must be sent to the flying-fox officer through: [biodiversity@byron.nsw.gov.au](mailto:biodiversity@byron.nsw.gov.au)
2. Works should preferably happen when flying-foxes are not in that camp. In Byron Shire the best window for action occurs from April till August outside the main mating and crèche periods.
3. If works are in the vicinity of roosting flying-foxes or may be seen to affect their roosting, personnel involved in the works will be briefed by the site supervisor prior to the action commencing each day and debriefed at the end of the day. If any of these procedures are not clear to the site supervisor, it's his/her responsibility to contact the BSC biodiversity team for clarification.
4. Avoid large crews at work sites.
5. The use of loud machinery and equipment that produces sudden impacts/ noise should/must be limited. Where loud equipment (e.g. chainsaws, generators) is required, they should be started away from the camp and allowed to run for a short time to allow flying-foxes to adjust.
6. Activities that may disturb flying-foxes at any time during the year should begin as far from the camp as possible, working towards the camp gradually to allow flying-foxes to get used to the noise.
7. Any activity likely to cause flying-foxes to take flight should be avoided during the day during the sensitive GHFF/ BFF birthing period of August - December (i.e. when females are in final trimester or the majority are carrying pups) and avoided altogether during crèche (generally November/December to February) (**Figure 10**). Where works cannot be done at night after fly-out, they should be undertaken in the late afternoon close to or at fly-out. If this is not possible, a person experienced in flying-fox behaviour must monitor the camp for at least the first two scheduled actions (or as otherwise deemed to be required by that person) to ensure impacts are not excessive and advise on the most appropriate methods (e.g. required buffer distances, approach, etc.).
8. Works must be postponed in days predicted to exceed 35°C (or ideally 30°C), and for one day following a day that reached ≥35°C. If an actual heat stress event has been recorded at the camp or at nearby camps, a rest period of several weeks must be scheduled to allow affected flying-foxes to fully recover.
9. Works will not take place in periods of adverse weather including strong winds, sustained heavy rains, in very cold temperatures or during periods of likely population stress (e.g. food shortages). Wildlife carers can be consulted to determine whether the population appears to be under stress. Contact Byron flying-fox officer for clarification.

10. Camp management actions carried out within a flying-fox camp must only be carried out where at least 20% of suitable roost vegetation within the camp has been designated as a rest area in which no action is carried out.

11. Camp management actions involving removal of tree limbs or whole trees are not authorised when flying-foxes are in or within 30 metres of the tree.

12. Evening works within flying-fox camps may commence after fly-out. Noise generated by the works should create a first stage disturbance, to encourage any remaining flying-foxes taking flight. Works should be paused at this stage to monitor for any remaining flying-foxes (including crèching young, although December - February should be avoided for this reason) and ensure they will not be impacted.

13. Works around the camps must be outlined in the Byron Shire Flying-fox Camp Management Plan. Any variation to the works detailed in the Plan must be approved, in writing, by DPE before any new works occur.

14. Respect Stop Triggers:

Welfare trigger	Signs	Action
Unacceptable levels of stress	If any individual is observed: <ul style="list-style-type: none"> <li>• panting</li> <li>• saliva spreading</li> <li>• located on or within 2 m of the ground.</li> </ul>	Works to cease for the day.
Adverse weather	<ul style="list-style-type: none"> <li>• &gt;35°C or within two days of &gt;35°C is recorded</li> <li>• Winds of &gt;40 km/ hr</li> <li>• Sustained heavy rains.</li> </ul>	Works to cease for the day.
Fatigue	In-situ management: <ul style="list-style-type: none"> <li>• more than 30% of the camp takes flight</li> <li>• individuals are in flight for more than 5 minutes</li> <li>• Flying-foxes appear to be leaving the camp.</li> </ul>	In-situ management. Works to cease and recommence only when flying-foxes have settled*/ move to alternative locations at least 50 m from roosting animals.
Injury/ death	<ul style="list-style-type: none"> <li>• a flying-fox appears to have been injured/ killed on site (including aborted foetuses)</li> <li>• any flying-fox death is reported within 1 km of the dispersal site that appears to be related to the dispersal</li> <li>• females in final trimester</li> <li>• dependent/ crèching young present</li> <li>• loss of condition evident</li> </ul>	Works to cease immediately and DPE notified AND rescheduled OR adapted sufficiently so that significant impacts (e.g. death/ injury) are highly unlikely to occur, as confirmed by an independent expert# OR stopped indefinitely and alternative management options investigated.

\* maximum of two unsuccessful attempts to recommence work before ceasing for the day.

# A person with experience in flying-fox behaviour will monitor for welfare triggers and direct works.

Flying-foxes can transmit diseases. Although less than 1% of animals are thought to carry diseases, if you see an injured flying-fox, do not touch it. Only people vaccinated for rabies should handle flying-foxes. Call a wildlife rescue team:

1. Northern Rivers WIRES 1300 094 737 or 02 6628 1898.
2. Northern Rivers Wildlife Carers 02 6628 1866.

If your team requires more information, please contact: [biodiversity@byron.nsw.gov.au](mailto:biodiversity@byron.nsw.gov.au)

Timing of works near occupied camps needs to be sensitive to reproductive activities.

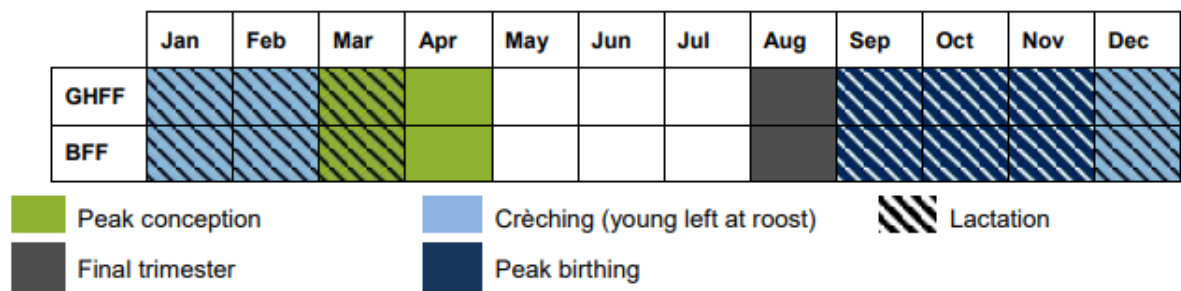


Figure 10 Indicative GHFF and BFF annual reproductive cycle

## Appendix 5

### Habitat critical to the survival of GHFF

Less than 15% of the GHFF potentially appropriate habitat in New South Wales is found in conservation reserves, and only 5% of roost locations are covered by any kind of conservation status (Murphy et al. 2008). One specific danger to the species is the removal of winter fodder. Winter flowering food plants are rare, and those that do appear to be confined to coastal lowlands in southern Queensland and northern New South Wales (Eby et al., 1999, Eby and Lunney 2002, Eby and Law 2008).

There is evidence that the spring forage in remaining habitat is insufficient to provide GHFF with consistent food at crucial times in their reproductive cycle. The species frequently experiences food shortages in winter and spring as evidenced by recurrent food shortages during these seasons (DAWE 2021). The recovery plan's activities aim to expand on the research conducted by Eby and Law (2008) by locating, confirming, charting, and safeguarding habitat that is essential to the GHFF's survival.

The majority of myrtaceous plants in the diet of GHFF flower within a defined season but are not annually reliable and the location of productive foraging habitat from these plants varies (Law et al. 2000, Eby and Lunney 2002, Birt 2005b). In most months it is difficult to predict which locations will be productive as foraging habitat for the species (DAWE 2021).

Important winter and spring vegetation communities are those that contain *Eucalyptus tereticornis*, *E. albens*, *E. crebra*, *E. fibrosa*, *E. melliodora*, *E. paniculata*, *E. pilularis*, *E. robusta*, *E. seeana*, *E. sideroxylon*, *E. siderophloia*, *Banksia integrifolia*, *Castanospermum australe*, *Corymbia citriodora*, *C. eximia*, *C. maculata*, *Grevillea robusta*, *Melaleuca quinquenervia* or *Syncarpia glomulifera* (Eby and Law 2008; Eby 2016; Eby et al., 2019).

Recovery objective 1 of the **National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus* (2021)** is

- Identify, protect and increase native foraging habitat that is critical to the survival of the GHFF.

As such, the development of habitat mapping encompassing foraging and habitat suitability through collaborations with researchers would provide an additional planning tool for Council staff, bush regenerators and biodiversity officers.

## Appendix 6

### Expert Assessment Requirements

The Plan identifies where expert input is required. The following are the minimum required skills and experience which must be demonstrated by each expert.

#### Flying-fox expert

##### Essential

- Knowledge of flying-fox habitat requirements.
- Knowledge and experience in flying-fox camp management.
- Knowledge of flying-fox behaviour, including ability to identify signs of flying-fox stress.
- Ability to differentiate between breeding and non-breeding females.
- Ability to identify females in final trimester.
- Ability to estimate age of juveniles.
- Experienced in flying-fox population monitoring including static and fly-out counts, demographics and visual health assessments.

##### Desirable

- It is strongly recommended that the expert is independent of the Plan owner to ensure transparency and objectivity. The Department may be able to help with finding flying-fox experts.
- ABLV-vaccinated (N.B. This is often an essential requirement during management implementation as detailed within the template).
- Trained in flying-fox rescue (N.B. This is often an essential requirement during management implementation as detailed within the template).
- Local knowledge and experience.

#### Ecologist

##### Essential

- At least five years demonstrated experience in ecological surveys, including identifying fauna and flora to species level, fauna habitat and ecological communities.
- The ability to identify flora and fauna, including ground-truthing of vegetation mapping.
- Formal training in ecology or similar, specifically flora and fauna identification.

##### Desirable

- Tertiary qualification in ecology or similar.
- Local knowledge and experience.
- Accredited Biodiversity Assessment Method assessor under the Biodiversity Conservation Act 2016.
- Practising member of the Ecological Consultants Association of NSW.

Depending on the site, for example, when vegetation management is proposed for an endangered ecological community or an area with a high likelihood of containing other threatened flora and fauna species, a specialist in that field (e.g. specialist botanist) may be required.



