Image: EAP_2778

MACQUARIE FIELDS (BINGARA RESERVE) GREY-HEADED FLYING-FOX CAMP MANAGEMENT PLAN

Revised July 2021

Acknowledgement of Country

We acknowledge the Traditional Custodians of the land, the Dharawal people and their unique and spiritual connections to the land. We also respectfully acknowledge Elders past, present and emerging, for the role they continue to play in guiding future generations.
We acknowledge Aboriginal and Torres Strait Islander peoples who reside in our local government area and the traditional custodial Nations.

Executive summary

The grey-headed flying-fox (*Pteropus poliocephalus*) is listed as a threatened species under the New South Wales *Biodiversity Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Council is currently responsible for two grey-headed flying-fox camps within the Campbelltown Local Government Area including a 'nationally important' camp at Bingara Reserve Macquarie Fields.

Council first become aware of the grey-headed flying-fox camp in Bingara Reserve in May 2010. The camp is located in close proximity to local residents and this has caused concern amongst the local community. Local residents have made a number of complaints to Council and local elected representatives about the Bingara grey-headed flying-fox camp. These complaints have primarily been associated with odour and noise issues, faecal drop and health concerns.

The Bingara Reserve Grey-headed Flying-fox Management Plan has been developed in consultation with the local community and other key stakeholders to guide the appropriate management of the camp. The Plan outlines issues of concern to the local community and identifies feasible management actions that will be undertaken to reduce impacts on the local community whilst managing the grey-headed flying-fox camp in situ.

Identified management actions for the Bingara Reserve grey-headed flying-fox camp seek to improve residential amenity, avoid potential health problems and to engage and educate the local community. The identified management actions are:

- likely to be effective in targeting the areas that are most significantly impacted by noise, odour and faecal drop
- relatively low cost
- relatively low risk to the community and to flying-foxes
- simple and quick to implement because they do not require further detailed studies or approvals
- supported by most of the community based on the wide range of feedback received.

Adopt:

- education and awareness programs
- property modification
- routine camp management
- alternative habitat creation
- protocols to manage heat stress
- research
- appropriate land-use planning.

Investigate further:

- residential assistance program
- provision of artificial roosting habitat
- installation of buffers including vegetative and a canopy mounted sprinkler system
- interventions to reduce impacts of HSEs such as misting sprinklers/fans.

And disregard for Campbelltown camp:

- noise attenuation fencing
- service subsidies
- property acquisition
- active dispersal
- do nothing.

Experience at other camps has shown that attempts to disperse flying-foxes have been largely unsuccessful, expensive and often move the problem or splinter the camp into multiple locations making issues more widespread. As such, relocation of the Bingara Reserve grey-headed flying-fox camp has not been identified as a feasible option.

The Plan will be implemented over a five-year period. Certain factors may trigger an earlier review of the Plan in order to enable other management options to be considered. An adaptive, flexible approach to management has been adopted and will be informed by ongoing monitoring of the camp and the effectiveness of implemented management actions.

Changes to the Camp Management Plan template and legislation triggered a review of the Plan in November 2019, with amendments relating to the legislation and recent stakeholder engagement included in this revision.

The Plan has been prepared in accordance with the Department of Planning, Infrastructure and Environment's Flying-fox Camp Management Policy 2015. DPIE approval including the issuing of relevant licences will be required in order to implement some of the identified management actions.

Acknowledgements

The first edition of the Plan was prepared by Ecosure Pty Ltd and Campbelltown City Council in 2017. The Plan was prepared with financial assistance from the Department of Planning, Industry and Environment (formerly Office of Environment and Heritage) Flying-fox Grant Program administered by Local Government New South Wales.

This revised Plan was updated by Ecosure Pty Ltd (2020) and Campbelltown City Council, specifically Council staff from City Delivery, City Growth and Economy, and City Development.

We gratefully acknowledge everyone who participated in community consultation, with all comments considered in the development of the Plan and incorporated where possible.

We thank Dr John Martin from the Royal Botanic Gardens and Domain Trust and Beth Noel from Sutherland Council for the provision of flying-fox count data.

We also acknowledge input by the NSW Department of Planning, Industry and Environment in developing the template on which this Camp Management Plan was based. Dr Peggy Eby also provided advice which was included in the template.

Acronyms and abbreviations

ABLV	Australian bat lyssavirus
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BFF	Black flying-fox (*Pteropus alecto*)
the camp	Bingara Reserve grey-headed flying-fox camp
CE	Critically endangered
Council	Campbelltown City Council
DEE	Department of the Environment and Energy (Commonwealth)
DPI	Department of Primary Industries (NSW)
DPIE	Department of Planning, Industry and Environment (NSW)
E	Endangered
EEC	Endangered ecological community
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GHFF	Grey-headed flying-fox (*Pteropus poliocephalus*)
the Guideline	Referral guideline for management actions in grey-headed and spectacled flying-fox camps 2015 (Commonwealth)
HeV	Hendra virus
HSE	Heat stress event
LEP	Local Environmental Plan
LGA	Local Government Area
LGNSW	Local Government of New South Wales
LRFF	Little red flying-fox (*Pteropus scapulatus*)
MNES	Matters of national environmental significance
NFFMP	National flying-fox monitoring program
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NPWS	National Parks and Wildlife Service (NSW)
the Plan	this Camp Management Plan
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
the Policy	Flying-fox Camp Management Policy 2015 (NSW)
the Reserve	Bingara Reserve
SEPPs	State Environmental Planning Policies
SIS	Species impact statement
TEC	Threatened ecological community
V	Vulnerable

Contents

List of figures

List of tables

1 Introduction

The Bingara Reserve Grey-headed Flying-fox Camp Management Plan (the Plan) will provide Campbelltown City Council (Council) with a framework to manage issues associated with the camp and balance the protection of flying-foxes with the future land uses.

Three species of flying-foxes occur in New South Wales (NSW):

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

Bingara Reserve grey-headed flying-fox camp (the camp) to date has only been occupied by GHFF. All three species of flying-foxes, and their habitats, are protected under NSW legislation. The GHFF is also listed as Vulnerable under Commonwealth legislation, affording it additional protection. Details of relevant legislation and policy related to flying-foxes is provided in Appendix 2. Flying-fox ecology and species profiles are provided in Appendix 3.

1.1 Flying-foxes in urban areas

Flying-foxes are highly nomadic, moving across their range between a network of camps. Camps may be permanently occupied, seasonal, temporary or sporadic, and numbers can fluctuate significantly on a daily/seasonal basis. According to available records the Bingara camp has been occupied periodically since 2010 (Campbelltown City Council 2016, NFFMP 2019).

Flying-foxes may travel up to 100 km a night in search of food resources (nectar, pollen and fruit), and their occurrence within the region is tightly linked to flowering and fruiting of foraging trees. Typically, the abundance of resources within a 20–50 km radius of a camp site will be a key determinant of the size of a camp (SEQ Catchments 2012). However, understanding the availability of foraging resources is difficult because flowering and fruiting are not reliable every year and vary between locations (SEQ Catchments 2012). This highlights the need for a multi-faceted approach to management that is continually adapted as situations change or further research improves our understanding of flying-foxes and their management.

Living near a flying-fox camp can be challenging for communities, with impacts associated with noise, odour, faecal drop, damage to vegetation and concern about potential health risks (Appendix 4). There are also challenges associated with management. State approval is required under legislation to manage a camp, and actions which may affect the GHFF must also adhere to federal policy. Attempts to relocate flying-foxes are extremely costly, and often splinter a camp to multiple undesirable locations that are difficult to predict. Flying-foxes will also regularly attempt to recolonise their preferred camp site when resources are available, and it is not appropriate or possible to remove all of the flowering and fruiting trees that attract them to the region.

Flying-foxes appear to be roosting and foraging in urban areas more frequently. During a study of national flying-fox camp occupation, almost three quarters of the 310 active GHFF camps (72%) were located in urban areas, 22% on agricultural land and only 4% in protected areas (Timmiss 2017). Furthermore, the number of camps increased with increasing human population densities (up to ~4000 people per km^2) (Timmiss 2017).

There are many possible drivers for this urbanising trend, as summarised by Tait et al. (2014):

- loss of native habitat and urban expansion
- opportunities presented by year-round food availability from native and exotic species found in expanding urban areas
- disturbance events such as drought, fires, cyclones
- human disturbance or culling at non-urban camps or 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.

These drivers mean that flying-foxes are likely to continuing occupying the camp into the future. Favourable habitat and food resources within the local government area (LGA) mean that camps may also establish in new locations. Optimal 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).

1.2 Plan Objectives

The Plan has been prepared in accordance with the NSW Flying-fox Camp Management Policy (2015) framework, administered by the Department of Planning, Industry and Environment (DPIE), to facilitate appropriate and timely responses to manage community impacts from flying-fox camps.

The objectives of the Plan are to:

- minimise impacts to the community, while conserving flying-foxes and their habitat
- improve community understanding and appreciation of flying-foxes, including their critical ecological role
- ensure flying-fox welfare is a priority during all works (i.e. avoid impacts to flying-foxes during operational works around Campbelltown camp)
- enable long-term conservation of flying-foxes in appropriate locations

- ensure camp management does not contribute to loss of biodiversity or increase threats to threatened species/communities
- provide a framework for a variety of land uses and operational works around the camp, whilst ensuring its protection and flying-fox welfare
- clearly define roles and responsibilities
- clearly outline the camp management actions that have been approved and will be utilised at the camp
- implement an adaptive management approach to camp management based on evidence collected
- facilitate licence approval (where required) for actions at the camp
- augment and align with other relevant land use and community planning documentation (i.e. Development Control Plans and Local Environment Plans).

2 Context

2.1 Camp description

The camp is located along a section of the original alignment of Bunbury Curran Creek in Bingara Reserve, Macquarie Fields. The camp is located in close proximity to residential properties (within one metre of property boundaries in some areas and overhanging private properties during peak influxes) and is bordered by Saywell Road to the north, Bingara Road and Curran Avenue to the east, Milton Park to the south and Myee Road to the west (Figure 1).

Vegetation occupied by the camp although currently degraded, consists of the endangered ecological community (EEC) River-flat Eucalypt Forest. Within this community the GHFF has been observed roosting in a number of species including Black She-Oak (*Allocasuarina littoralis*), River Oak (*Casuarina cunninghamiana*), Red Gum (*Eucalyptus camaldulensis*), Cabbage Gum (*Eucalyptus amplifolia*) as well as the environmental weed Broad-leaved Privet. For further information on ecological values of the camp refer to Section 2.4.

Bingara Reserve (the Reserve) is approximately 1.4 ha in size. On average the camp generally occupies 0.35 ha, with approximately 6.6 ha of continuous habitat remaining predominately within the adjoining Milton Park (Council 2017). During maximum occupancy the camp occupied approximately 1.38 ha and spills over into sections of Milton Park with less than 5 ha of continuous habitat remaining. However, it is important to note that it is unlikely that all areas of continuous habitat will be suitable as roosting sites for the GHFF due to extensive weed cover in some areas of the canopy and a lack of a complex structure in other areas.

Figure 1 Maximum camp extent based on previous distribution data

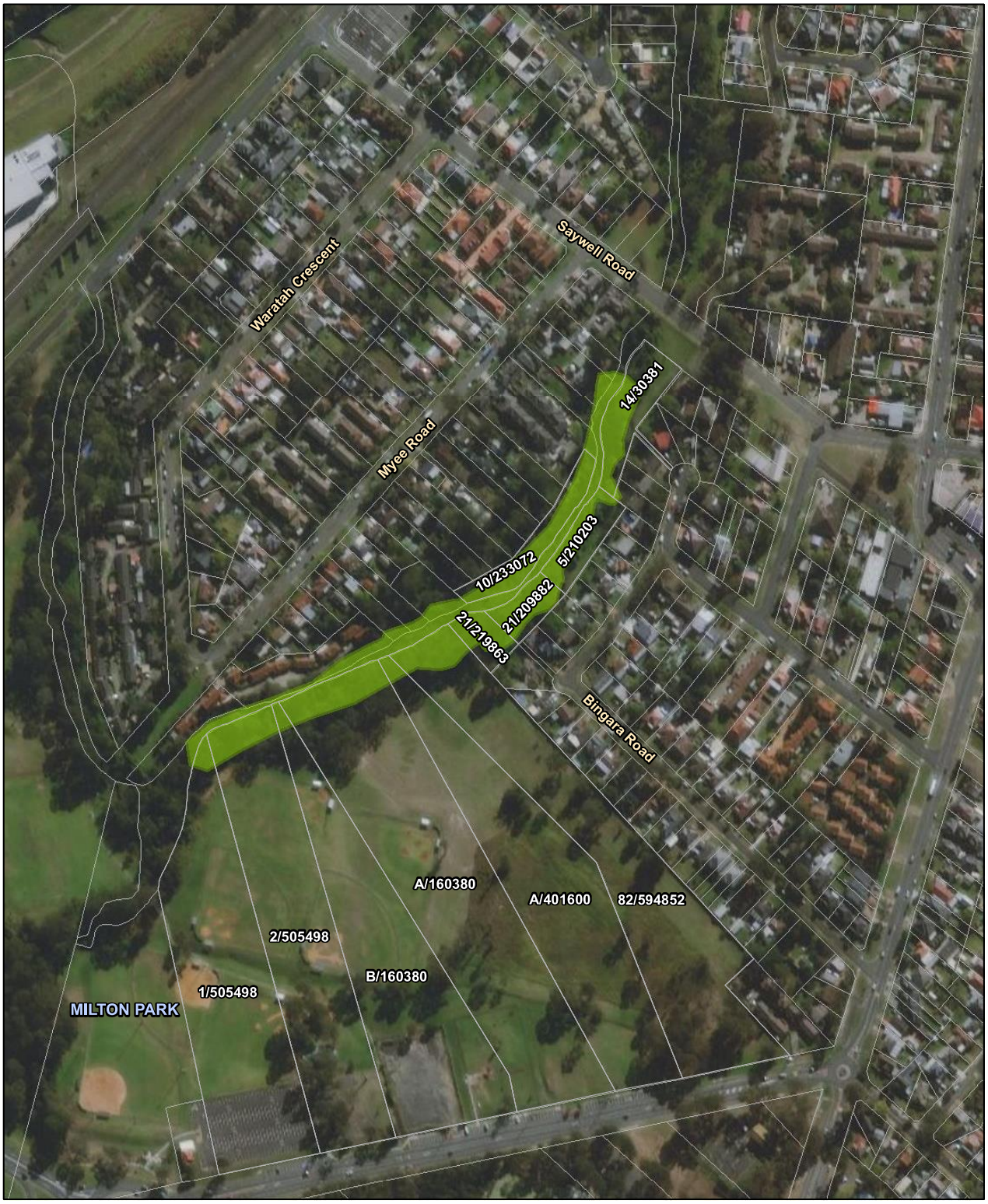


Figure 1: Maximum known camp extent

Campbelltown City Council

Grey-headed Flying-fox Monitoring Program

Maximum camp extent based on previous distribution data

Property boundary

ecosure

Job number: PR4271
Revision: 0
Author: KF
Date: 7/16/2020

0 25 50 100
Metres

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

PR4271_MP1_MaxCampExtent_BingaraReserve
A4

2.2 History of the camp

Council first became aware of the GHFF camp in May 2010 however, anecdotal evidence from local residents indicates that GHFFs first started to use the Reserve as a camp site in 2007.

The camp has been monitored on a regular basis since August 2010 by the Royal Botanic Gardens and Domains Trust on a monthly basis from 2010 until 2016 in conjunction with the Sydney Royal Botanic Gardens flying-fox relocation program. More recently it has been monitored on a monthly basis by Sutherland Shire Council in conjunction with the Kareela Camp Flying-fox dispersal. Campbelltown City Council has also commenced monthly counts at the camp.

The camp is generally occupied on a permanent basis and at the time of writing had only been empty on three separate monitoring occasions since 19 August 2010[1]. The camp is used as maternity site by the GHFF and is recognised as a nationally important camp by the Commonwealth Department of Environment and Energy.

Like all flying-fox camps the number of flying-foxes occupying the camp fluctuates in accordance with food availability. The maximum total number of GHFF ever recorded at the camp was approximately 17,000 individuals in August 2015. The count data for the camp is summarised in Figure 2.

[1] Based on count data from August 2010-May 2017.

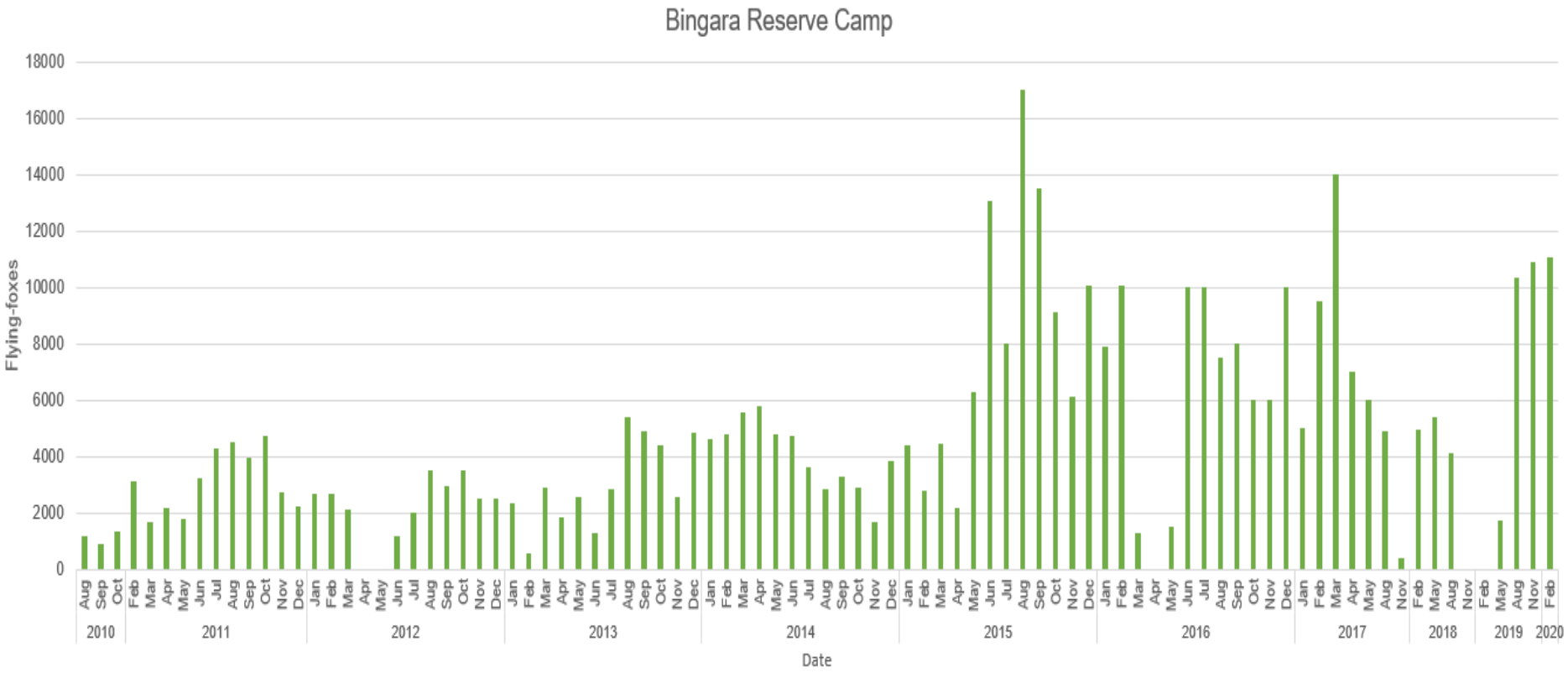


Figure 2 Number of GHFF recorded at Bingara Reserve August 2010 – November 2019 (Source: NFFMP 2019, Council 2010-20)

2.3 Land tenure

The camp is located on land owned by Council which is currently zoned RE1 Public Recreation. As the owner of land occupied by the camp, Council has legal responsibilities for its management. Surrounding land use is predominately residential, or in the case of Milton Park for public recreation purposes.

The camp lies within the Macquarie Fields Precinct of the NSW Government's Glenfield to Macarthur Urban Renewal Corridor Strategy. This strategy proposes to increase building densities around railway precincts including Macquarie Fields.

2.4 Reported issues related to the camp

The following list is a collation of issues related to the camp that have been reported by the community. The list has been compiled from information collected via a range of reporting and consultation methods. Further discussion about community engagement efforts and outcomes is provided in Section 4 .

Reported issues include:

- faecal drop on outdoor areas, exterior walls of houses, fences, vegetable patches, cars, swimming pools and clothing on washing lines, and estimated resources (time, cost) associated with cleaning faecal matter
- noise as flying-foxes depart or return to the camp
- noise from the camp during the day; noise is a particular problem when flying-foxes have been disturbed (e.g. as a result of lawn mowing, motorbike riders or when members of the community deliberately harass the camp)
- smell, especially after rain or during summer
- fear of disease/heath concerns in humans and pets (including a domestic dog being reportedly allergic to flying-fox excrement); see Appendix 4 for information about common health concerns
- reduced general amenity
- damage to vegetation
- property devaluation
- health and wellbeing impacts (a sense of helplessness)
- perceived impacts on other fauna species (e.g. diversity of birds and other fauna groups)
- fruit poaching (residential and commercial)
- inability to invite friends and family over for social functions due to amenity impacts
- flying-foxes overhanging pathways/residential properties (to date only on rare occasions during influxes of GHFF to the area)

- vegetation damage in the Reserve and in residential yards (e.g. stripping)
- flying-foxes being entangled in barbed wire fencing nearby.

Issues have been raised with regards to firework celebrations for community events such as Ingleburn Alive and their impacts on GHFF. As a result, Council no longer hosts fireworks at this location. Other general concerns include a lack of access to the Reserve, rubbish in the Reserve, vegetation from the Reserve encroaching on private property, an increase in actual/perceived pests (rats/snakes) and potential water quality impacts.

Council has received complaints in relation to the camp year-round with the highest frequency in August 2015 coinciding with the maximum recorded occupancy of the camp (approximately 17,000 GHFF). The majority of complaints have been received from residents living within 100 m of the camp.

Excluding complaints raised as part of the community consultation process, a total of 14 complaints have been received from nine complainants since April 2011. This represents 12% of the total number of households within 100 m of the camp. A further 10 residents reported high impacts during targeted community consultation during the development of the Plan (refer to Section 4.2 for further information).

The community consultation process also identified a number of people in the surrounding area (including some residents living within 100 m of the camp) who enjoy the camp and would prefer it is not managed or managed in situ only. Reported positive feedback stemmed from people who:

- recognised the need for people and wildlife to live together
- recognised the need to conserve flying-foxes as an important native species
- appreciated the critical landscape-scale services flying-foxes provide through seed dispersal and pollination
- enjoyed watching flying-foxes at the camp including fly-outs
- felt the camp does not negatively impact on their lifestyle
- valued the opportunity the camp provides for them and their family to get close to nature.

2.5 Other ecological values of the camp

The ecological values of the camp site and adjoining area was assessed in order to:

- gain an understanding of the ecology of the area supporting the GHFF camp
- to help identify feasible and appropriate management actions which would be permissible at the site with consideration to all ecological values
- identify and assess impacts on other biodiversity (threatened and non-threatened) that may occur as a result of camp management options.

The ecological values assessment included:

- Literature review of relevant documents, databases and reports. This included vegetation community mapping data (NSW Bionet) and relevant biodiversity databases (i.e. NSW BioNet and the EPBC Act Protected Matters Search Tool for flora and fauna records.
- Assessment of vegetation at the Bingara GHFF camp and contiguous habitat to the south-west, including adjacent to Henderson Road but excluding the stream branch to the north-east. Site assessment included:
    - fauna habitat assessment, particularly for threatened fauna species that may occur at the site, based on the literature review. The fauna habitat assessment included (but was not limited to) identification of landscape features such as dry slopes and wet areas, features that could provide habitat including dead wood and dead trees, identification of hollow bearing trees, searches for distinctive scats, scratches on trees, identification of nests, and assessment of the creek and its environs
    - confirmation of the vegetation communities on site, including the presence of Threatened Ecological Communities (TEC)
    - targeted survey for listed flora species
    - incidental fauna observations
    - flora and fauna species list (including weeds).

2.5.1 Site assessment methods

2.5.1.1 Fauna

Fauna habitat searches and opportunistic fauna sightings were recorded within the site using the below methodology:

- opportunistic fauna sightings were recorded throughout the day
- targeted assessments for threatened fauna and associated fauna habitat were undertaken with a particular focus on those species identified as being 'likely' or 'possible' to occur on site. The presence of any hollow bearing trees was also investigated
- bird survey over a half hour period from 7:30 am to 8:00 am and then opportunistically for the remainder of the day.

Based on the overall NSW Bionet returns for the surrounding area it was determined that there were five threatened fauna species which may use the site (Table 2,

Figure 3). Of these species, none were recorded on the site. A list of fauna species observed on the site from the targeted habitat assessment survey and opportunistic sightings is provided in Table 1.

Twenty-eight species of bird were observed on the site representing mostly common species found in urban environments. These included rainbow lorikeet (*Trichoglossus haematodus),* red-browed finch (*Neochmia temporalis*) and Australian magpie (*Cracticus tibicen*). No threatened bird species were recorded.

There is a distinct lack of ground dead wood or hollow-bearing trees across the entire site. This poor quality habitat in the lower and mid-storey has created a reduced prey base for a range of insectivorous and nectivorous birds and may partly explain the low diversity of avian species at the site.

Sampling of fallen timber and undergrowth for reptiles revealed only two common skinks; the dark-flecked garden skink (*Lampropholis delicata*) and pale-flecked garden skink (*Lampropholis guichenoti*). The site survey was undertaken in the middle of winter on a relatively cold day. Additional targeted surveys during the warmer periods of the year may reveal a range of other reptiles as they become more active.

There was very little evidence of mammal activity other than domestic dogs utilising the park area. Further survey work may reveal a range of other urban species such as the common brush-tailed possum (*Trichosurus vulpecula*) and common ringtail possum (*Pseudocheirus peregrinus*).

A 10 km EPBC Act protected matters search was undertaken which returned 49 species listed as threatened under the EPBC Act including 16 migratory species (Appendix 5).

Table 1 All fauna species recorded during site assessment

Class Name	Family Name	Scientific	Common Name	NSW Status	Exotic (*)
Aves	Anatidae	*Anas superciliosa*	Pacific Black Duck	P	
		Chenonetta jubata	Australian Wood Duck	P	
	Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	P	
	Charadriidae	*Vanellus miles*	Masked Lapwing	P	
	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	P	
		Eolophus roseicapillus	Galah	P	
	Psittacidae	*Alisterus scapularis*	Australian King-Parrot	P	
		Platycercus eximius	Eastern Rosella	P	
		Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	P	
		Trichoglossus haematodus	Rainbow Lorikeet	P	
	Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P	
		Chalcites lucidus	Shining Bronze-Cuckoo	P	

Class Name	Family Name	Scientific	Common Name	NSW Status	Exotic (*)
	Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra	P	
	Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird	P	
	Maluridae	*Malurus cyaneus*	Superb Fairy-wren	P	
	Meliphagidae	*Manorina melanocephala*	Noisy Miner	P	
		Manorina melanophrys	Bell Miner	P	
	Artamidae	*Cracticus tibicen*	Australian Magpie	P	
		Strepera graculina	Pied Currawong	P	
	Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	P	
	Corvidae	*Corvus coronoides*	Australian Raven	P	
	Monarchidae	*Grallina cyanoleuca*	Magpie-lark	P	
	Hirundinidae	*Hirundo neoxena*	Welcome Swallow	P	
		Petrochelidon ariel	Fairy Martin	P	
	Estrildidae	*Neochmia temporalis*	Red-browed Finch	P	
	Columbidae	*Streptopelia chinensis*	Spotted Turtle-Dove		*
	Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered Bulbul		*
	Sturnidae	*Sturnus tristis*	Common Myna		*
Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	
	Canidae	*Canis lupus familiaris*	Dog		*
Reptilia	Scincidae	*Lampropholis delicata*	Dark-flecked Garden Sunskink	P	
		Lampropholis guichenoti	Pale-flecked Garden Sunskink	P	

As the NSW BioNet search returns actual records of threatened species (while the EPBC Act Protected Matters Search returns all species possibly occurring), only the BioNet records have been included in Table 2 and discussed in relation to their likelihood of occurrence.

Table 2 Threatened species and ecological communities that may occur at the site.

Species name	Common name	Status TSC Act	Likelihood of occurring
Fauna			
Meridolum corneovirens	Cumberland Plain Land Snail	E1	Possible Most of the Bingara Reserve is highly modified with few logs and debris available to provide suitable habitat
Litoria aurea	Green and Golden Bell Frog	E1	Possible The stream flowing through Bingara Reserve

Species name	Common name	Status TSC Act	Likelihood of occurring
			may provide some suitable habitat but contains few bulrushes and spikerushes, its preferred microhabitat
Burhinus grallarius	Bush Stone-curlew	E1	Possible Bingara Reserve and surrounding grassy areas provides suitable habitat for this species.
Lathamus discolor	Swift Parrot	E1	Possible Flowering red gums and cabbage gums may provide a seasonal source of nectar.
Epthianura albifrons	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2	Possible The species is usually found in saltmarsh or wetland areas, habitat which is not available at the subject site although there is the possibility of observing vagrants or outliers.
Flora			
Persoonia nutans	Nodding Geebung	E1	Possible Although the has a disjunct distribution, the species is confined to aeolian and alluvial deposits similar to the subject site. Southern populations also occupy tertiary alluvium, but extend onto shale sandstone transition communities.
Pimelea spicata	Spiked Rice-flower	E1	Unlikely The species occurs on well-structured clay soils.
Acacia bynoeana	Bynoe's Wattle	E1	Unlikely Occurs in heath or dry sclerophyll forest on sandy soild, habitat which is not available at the subject site.
Syzygium paniculatum	Magenta Lilly Pilly	E1	Unlikely Occurs in lowland or littoral rainforest a habitat type not present at the subject site.
Leucopogon fletcheri subsp. fletcheri		E1	Unlikely Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat or gently sloping terrain along ridges and spurs.
Pultenaea pedunculata	Matted Bush-pea	E1	Unlikely The species has a very restricted distribution and generally occurs on loamy soils in dry gullies.
Pterostylis saxicola	Sydney Plains Greenhood	E1	Unlikely Most commonly found in small pockets of shallow soil in depressions on sandstone rock shelves. This habitat type is not available at the subject site.
Persoonia hirsuta	Hairy Geebung	E1	Unlikely Found on sandy soils derived from sandstone in dry sclerophyll open forest, woodland and heath on sandstone.
Gyrostemon		E1	Unlikely

Species name	Common name	Status TSC Act	Likelihood of occurring
thesioides			The species has a highly restricted distribution found more to the west of the subject site.
Marsdenia viridiflora subsp. viridiflora	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E2	Possible Possibly some suitable habitat available in the lower cooler banks of the creek, although the extent of vine weeds across the site is likely to have outcompeted this species if it was ever present.
Hibbertia fumana		E4A	Possible Despite only being know from a few locations, the species is known to occur on alluvials rich in sands and laterite.
Threatened ecological communities			
River flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		Endangered Ecological Community (NSW)	Present The dominance of Eucalyptus tereticornis and Eucalyptus amplifolia on an alluvial floodplain, along with other constituent flora, confirms the presence of the River flat eucalypt forest TEC

Figure 3 NSW Bionet threatened species records

Figure 3: Species records 2010-2020

Campbelltown City Council

Grey Headed Flying-fox Monitoring Program

Maximum camp extent based on previous distribution data

1 km buffer

Note: records are based on NSW Bionet records; some records may pre-date development and have not been verified by Council

ecosure

Job number: PR4271
Revision: 0
Author: KF
Date: 7/16/2020

0 75 150 300
Metres

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

PR4271_MPX_SpeciesRecords_Bingara
A4

2.5.1.2 Flora

A flora assessment of the Reserve was undertaken on the 25 July 2017, focusing primarily on the north-east sections of the Reserve (the camp extent). The assessment involved using "random meander" (Cropper 1993) transects and targeted sampling zones. Mapped vegetation communities were ground-truthed and dominant species within each vegetation patch were assessed and compared to NSW Plant Community Types (NSW Bionet). Targeted searches for threatened flora species within each vegetation community were undertaken based on local knowledge and returns from the 5 km NSW Bionet search and 10 km EPBC Act Protected Matters search.

A total of 56 flora species were recorded. Of these, 27 were native species while the remaining 29 were exotic species (Table 3). Dominant native species across the site include forest red gum (*Eucalyptus tereticornis*), cabbage gum (*Eucalyptus amplifolia*) and broad-leaved apple (*Angophora subvelutina*).

Vegetation is mapped as River flat eucalypt forest and is a NSW Threatened Ecological Community (TEC) dominated by red gum (*Eucalyptus tereticornis*) and cabbage gum (*Eucalyptus amplifolia*). This was ground-truthed during the site assessment and was found to be consistent with this vegetation type.

A list of threatened species known to occur within 5 km of the site is provided in Table 2, including the likelihood of each occurring on site. Of the eleven species that returned a Bionet result, only four were considered possible as occurring on site given the community type and alluvial soil substrate. Targeted searches failed to locate any of these threatened flora species. A 10 km EPBC Act protected matters search returned eight threatened ecological communities (TECs) as potentially occurring on site (Figure 4).

Table 3 All flora species recorded during site assessment

Family Name	Scientific Name	Common Name	Exotic (*)
Acanthaceae	*Brunoniella australis*	Blue Trumpet	
Apiaceae	*Foeniculum vulgare*	Fennel	*
Apocynaceae	*Araujia sericifera*	Moth Vine	*
Arecaceae	*Phoenix canariensis*	Canary Island Date Palm	*
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	*
	Asparagus asparagoides	Bridal Creeper	*
Asteraceae	*Ageratina adenophora*	Crofton Weed	*
	Bidens pilosa	Cobbler's Pegs	*
	Cirsium vulgare	Spear Thistle	*
	Conyza sumatrensis	Tall fleabane	*
	Delairea odorata	Cape Ivy	*

Family Name	Scientific Name	Common Name	Exotic (*)
	Senecio madagascariensis	Fireweed	*
Basellaceae	*Anredera cordifolia*	Madeira Vine	*
Brassicaceae	*Rapistrum rugosum*	Turnip Weed	*
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	*
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak	
	Casuarina cunninghamiana subsp. cunninghamiana	River Oak	
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew	*
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Convolvulaceae	*Ipomoea indica*	Morning Glory	*
Fabaceae	*Senna pendula var. glabrata*		*
	Glycine clandestina	Twining glycine	
	Glycine microphylla	Small-leaf Glycine	
	Acacia buxifolia	Box-leaved Wattle	
	Acacia decurrens	Black Wattle	
	Acacia linifolia	White Wattle	
	Acacia parramattensis	Parramatta Wattle	
Gentianaceae	*Centaurium erythraea*	Common Centaury	*
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	*
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	
	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	
Loranthaceae	*Amyema gaudichaudii*		
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	
	Geitonoplesium cymosum	Scrambling Lily	
Myrsinaceae	*Lysimachia arvensis*	Scarlet Pimpernel	*
Myrtaceae	*Angophora subvelutina*	Broad-leaved Apple	
	Eucalyptus amplifolia	Cabbage Gum	
	Eucalyptus crebra	Narrow-leaved Ironbark	
	Eucalyptus tereticornis	Forest Red Gum	
Poaceae	*Arundo donax*	Giant Reed	*
	Entolasia stricta	Wiry Panic	

Family Name	Scientific Name	Common Name	Exotic (*)
	Eragrostis brownii	Brown's Lovegrass	
	Eragrostis brownii	Brown's Lovegrass	
	Eragrostis curvula	African Lovegrass	*
	Imperata cylindrica	Blady Grass	
	Microlaena stipoides	Weeping Grass	
	Paspalum dilatatum	Paspalum	*
	Pennisetum clandestinum	Kikuyu Grass	*
	Phragmites australis	Common Reed	
	Setaria parviflora		*
	Sporobolus africanus	Parramatta Grass	*
Sapindaceae	*Cardiospermum grandiflorum*	Balloon Vine	*
	Dodonaea viscosa subsp. cuneata	Wedge-leaf Hop-bush	
Solanaceae	*Cestrum parqui*	Green Cestrum	*

The flying-fox camp is located in a dense stand of large-leaved privet (*Ligustrum lucidum*) which are the dominant roost tree, particularly on the lower banks of the stream. The higher banks, particularly on the southern side of the creek have large clumps of giant reed (*Arundo donax*). This reed has effectively created a monoculture in these areas of the site, having out-competed all other flora species. These weeds have established following prior clearing of the creek banks but have also outcompeted regrowth native vegetation. There are some eucalypts at the periphery of the camp.

Figure 4 Threatened ecological communities

Figure 4: Threatened ecological communities

Campbelltown City Council

Grey Headed Flying-fox Monitoring Program

Maximum camp extent based on previous distribution data

Threatened ecological community

Cumberland Plain Woodland

River Flat Eucalypt Forest

ecosure

Job number: PR4271
Revision: 0
Author: KF
Date: 7/17/2020

0 25 50 100
Metres

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

PR4271_MPX_VegetationMapping_Bingara
A4

3 Management response to date

Prior to commencing the development of the Plan Council's management response primarily focussed on educating impacted residents and the community about the legislative framework associated with flying-fox management and the important ecological role of the GHFF. To assist with this process information about flying-foxes including an educational brochure was placed on Council's website. Council also discussed concerns associated with noise, odour, faecal drop and human/animal health directly with complainants both during on site meetings and over the phone.

4 Community engagement

Early and effective community engagement and education has benefits for both communities and land managers. These benefits include increasing community understanding and awareness of flying-foxes, their critical ecological role and factors that need to be considered in developing a management approach. Engaging with the community is equally important to ensure land managers understand impacts associated with a camp to effectively manage community concerns.

Council sought to identify and consult with all stakeholders with an interest in the camp prior to and during the development of the plan. Identified key stakeholders are outlined in Section 4.1 below and the engagement methods that were utilised are detailed in Section 4.2.

4.1 Stakeholders

There are a range of stakeholders who are directly or indirectly affected by the flying-fox camp, or who are interested in its management. Stakeholders include those shown in Table 4.

Table 4 Stakeholders in the camp and Plan

Stakeholder	Interest/reported impacts
Residents	Many residents immediately adjacent to the camp are impacted by noise, smell, faecal drop, fruit poaching and fear of disease. Conversely a number of residents immediately adjacent to the camp reported that they are not affected. Many did not respond to invitations to provide feedback, suggesting neutral views or low level impacts.
Business owners	There are no businesses immediately adjacent to the Bingara Reserve. There are a number of businesses on Saywell Rd and Parliament Rd that may be affected, primarily by faecal drop.
Traditional Custodians	The Dharawal People are the traditional custodians who cared for the land now known as the Macarthur Region. This includes the land on the Woronora Plateau where Macquarie Fields and Bingara Reserve are located. Aboriginal people have a strong connection to place that encompasses landforms, waterways, flora and fauna and have a deep understanding of the ecologic interrelationships between all of these. In addition flying foxes specifically have a notable significance in both Dharawal and broader Aboriginal history, including foraging and camp sites.
Schools	The closest school is more than 500 m from the Bingara Reserve GHFF camp and is not expected to be impacted.
Airports	Airport managers have a responsibility to reduce the risk of wildlife–aircraft strike. The closest airfield is Bankstown Airport, more than 12 km to the north-east. The Bingara GHFF camp is unlikely to have an effect on the aircraft strike risk at this distance.
Equine facilities and vets	All equine facility managers and vets within the range of any flying-fox species (i.e. most of coastal Australia ranging to inland areas in the eastern states) should be aware of Hendra virus risk and appropriate mitigation measures.

Stakeholder	Interest/reported impacts
Orchardists and fruit growers	Fruit growers may be impacted by flying-foxes raiding orchards. There is one known commercial orchardist remaining within Campbelltown City Council local government area. This business has incurred significant costs due to fruit poaching and attempts to mitigate this impact including resource intensive deterrents. Approximately $1M of netting has been installed on this property over time to exclude flying-foxes (and birds) (1:1 personal contribution: NSW state government under the NSW Netting Subsidy Program). Ongoing costs on this property include $40,000 per annum in netting repairs (expected to increase as nets age). These costs to mitigate flying-fox damage are prohibiting further planting on remaining property.
Local government	Local government has responsibilities to the community and environment of the area for which it is responsible in accordance with the *Local Government Act 1993*. Council is also responsible for administering local laws, plans and policies, and appropriately managing assets (including land) for which it is responsible. The land occupied by the camp is owned by Council. Council therefore has responsibility over the land and its management.
Local Government NSW (LGNSW)	LGNSW is an industry association that represents the interests of councils in NSW. LGNSW administered funds, including assistance to develop the Bingara Reserve GHFF Camp Management Plan, under the NSW Flying-fox Grants Program.
DPIE	DPIE 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. Flying-fox camp management in NSW must align with the DPIE Flying-fox Policy 2015 (see Section 5), and DPIE has a regulatory role to ensure compliance with relevant legislation. DPIE made funding available to assist local government with flying-fox management (the NSW Flying-fox Grants Program, administered by LGNSW).
Commonwealth Department of the Environment and Energy (DEE)	DEE is responsible for administering federal legislation relating to matters of national environmental significance (MNES), such as the grey-headed flying-fox and any other Commonwealth-listed values of the camp site. Any management action likely to impact a MNES may require referral to the DEE.
Royal Botanic Garden and Domain Trust (RBGDT)	The Sydney Botanic Gardens GHFF camp was dispersed in June 2012, and Royal Botanical Garden and Domain Trust ecologists continue to monitor the Bingara Reserve GHFF camp as part of that dispersal program.
Sutherland Shire Council	Kareela camp in Sutherland Shire Council local government area was first dispersed in 2015. While flying-foxes have since returned to the Kareela camp site, staff from Sutherland Shire Council continue to monitor the Bingara Reserve GHFF camp as part of a regional monitoring program.
Wildlife carers and conservation organisations	Wildlife carers care for flying-foxes in the Campbelltown LGA and monitor colonies during HSEs. Wildlife carers (e.g. WIRES) and conservation organisations have an interest in flying-fox welfare and conservation of flying-foxes and their habitat.
Researchers/universities/CSIRO	Researchers have an interest in flying-fox behaviour, biology and conservation.

4.2 Community engagement phase 1 – management options feedback

Prior to development of the Plan, Council staff and elected members engaged with the community through face-to-face meetings and phone calls in response to concerns about the camp, and to educate the community about flying-foxes. As a result of this initial consultation, Council developed the draft Plan to assist addressing community concerns.

Extensive effort has been made to engage with the community during development of the Plan to:

- gain an appreciation of the impacts of the camp (both direct and indirect) on the community
- educate the community about flying-foxes, their ecological importance, conservation status, health concerns and possible management options
- understand the issues directly and indirectly affecting the community
- seek ideas and feedback about possible future management options
- gauge community feedback on the outcomes they hope management will achieve.

Engagement undertaken by Council during initial Plan development in 2016 included:

- provision of information on Plan development and engagement opportunities on Council's website, along with general information on the GHFF on Council's website
- promotion of the Plan's development and online survey through Council's Facebook page and in the Council Public Notice Section of local newspapers (The Chronicle and Macarthur Advertiser)
- mail out to all residences within 300 m of the Bingara Reserve GHFF camp (477 residences) with information on Plan development, community feedback opportunities including invitation to complete the online survey, Council contact details, and GHFF brochure
- door knock of all residences within 100 m of the camp (87 residences plus 14 additional letters to owners of leased properties), including an invitation to a resident workshop. A second letter was left for residents who were not at home, including Council contact details, details of the workshop and other community engagement opportunities
- workshop for residents within 100 m of the camp to discuss management options for the camp (two times available - 6.30pm-8pm Wednesday 26th July or 5pm-6.30pm Thursday 27th July)
- hand delivered letters to businesses and organisations within 500 m (27 businesses on Saywell Road and Parliament Road) offering a workshop or face-to-face/telephone meeting
- mail out to other identified stakeholders offering a workshop or face-to-face/telephone meeting including the Tharawal Aboriginal Land Council, Cubbitch Barta Native Title Claimants, a local orchardist, Bankstown and Camden Airports, the Wedderburn Sport

Aircraft Club, equine centres, local wildlife carers, nearby sporting clubs and the Ingleburn Chamber of Commerce

- an online survey using the Flying-fox Engage platform available via Council's Have Your Say web page from 19th July to 9th August 2017.

Additional promotional activities driven by the community included a number of media releases regarding the Plan's development and online survey run in local newspapers, and promotion on the local radio station C91.3

The number of responses received in the community engagement phase during development of the draft Plan are shown in Table 5. Reported issues and interests in the Bingara GHFF camp collated through all engagement methods are listed in Section 4.3. Suggested management options suggested during consultation are listed below.

Table 5 Responses received during community and stakeholder consultation

Target stakeholder	Mechanism	Response rate (see Section 2.3 and Appendix 6 for feedback)
Residents within 100 m of the camp	Face-to-face during door knocking	27 residents provided feedback during door knocking.
	Follow up phone call in response to letter during door knocking	Follow up call received from one resident not home during door knocking.
	Resident workshop session	Six residents from four properties attended a workshop
Residents 100-300 m of the camp	Mail out with Council contact details	No direct contact received.
Businesses within 500 m of the camp	Offer of face-to-face meeting/phone call	No requests received.
General community (entire local government area)	Online survey via the Flying-fox Engage platform	43 valid submissions received.
Other relevant stakeholders	Offer of face-to-face meeting/phone call	WIRES Commercial stone fruit grower approximately 16 km from the Bingara GHFF camp Scenic NSW Equine Centre approximately 4km from Bingara GHFF camp (represented by Elton Consulting)

Specific management options suggested by the community during consultation included:

- disperse the camp
- reduced property rates
- gurney hire, delivery and drop of gurneys for cleaning, or preferably council cleaning of outdoor areas free of charge (with residents able to make their own booking)
- clothesline covers

- pool covers for residents with pools
- planting buffers
- property modifications: in order to reduce impacts on adjoining residents it was suggested that council should organise property modifications, so residents do not have to go out of their way to arrange. the possibility of putting out a council contract to have the windows of multiple properties glazed at the same time was discussed at a workshop
- option for council to purchase affected properties
- council to cover vet costs in the event the dog is found with a dead bat
- car covers, shade sails or car ports to protect cars from faecal drop. it was raised that existing building setbacks may not allow for appropriately sized carports, and potential council development concessions were discussed
- filters for air-conditioning units to prevent odour from camp being drawn in through units
- electricity subsidies
- provision of a list of trees native to the area not likely to attract roosting or foraging flying-foxes
- provision of greenhouses/fruit bags/netting to reduce fruit and vegetable loss due to faecal drop or foraging flying-foxes.

4.3 Stakeholder engagement phase 2

Additional internal and external engagement was undertaken in November 2019 for both Bingara and Campbelltown flying-fox camps and included:

- promotion of contact details of responsible officers
- telephone conversations to record issues and complaints
- face-to-face meetings and telephone calls with adjacent residents
- online survey
- council workshop
- community workshop.

The community survey and both workshops were advertised via social media and council marketing.

4.3.1 Online survey results

An online survey was open for five weeks between 28 October and 2 December 2019. 59 submissions were received online and 1 in writing. The full survey results are provided in Appendix 6.

In relation to flying-fox issues of concern for residents (question 15), excrement received the highest number of votes (17.5%) followed by damage to vegetation (13.33%) with fear of disease concern on 12.5%. 29.17% of respondents had no concerns relating to flying-foxes.

The overall feedback from the community favoured flying-fox camp management measures that:

- protect the welfare (question 12) of the flying-foxes (72.8% very or extremely important)
- consider the ecological value (question 13) and amenity of the vegetation and trees in which the flying-foxes roost (79.6% very or extremely important)
- proposed higher density development does not move the camp away from the site to other areas near residents or businesses (question 14) (71.1% very or extremely important).

In relation to future planning of new development adjoining flying-fox camps (question 17), the following were the top three actions voted to help people coexist with flying-fox camps:

- use appropriate buffer distances between the camp and residential dwellings or offices (26.4%)
- ensure designs for future buildings or properties reduce impacts of flying foxes (22.9%)
- market the flying fox camp and associated open space as an asset to future residents (18.9%).

4.3.2 External workshop results

A two hour external workshop was held at Macquarie Fields Leisure Centre on Wednesday 20 November 2019 from 6:30pm – 8:30pm. The workshop discussion was focussed on Bingara Camp due to its size and proximity to residents. 23 people attended to share their concerns and empathy for those living adjacent to Bingara Reserve camp.

Participants were invited to share their experiences then were asked to select from available management options, tools and techniques which they believe could assist or provide some relief from flying-fox impacts.

Some of the impacts cited by residents included:

- *Flying-foxes are getting closer and closer, they are in trees they've never been in before, they have moved further south down the creek*
- *Vegetation is being stripped*
- *Smell and faecal drop on property, driveways and cars is the main issue*
- *Health of residents is at stake*
- *Amenity has been reduced significantly over the last few years*
- *Can't have solar panels, veggie patch, water tanks*
- *Air conditioning on all summer*

- *Noise at 4:30am*
- *Cleanliness of creek, discharge, creek smells*
- *Creek needs regular cleaning, cut bush and grass, make it presentable, not like a dumping zone.*

The poor condition of the creek was reiterated by residents with regard to overgrown weeds, rubbish such as trolleys in the creek, and the presence of perceived pests such as rats or snakes.

One community member presented a petition with 184 signatures from residents living in Bingara Road, Myee Road, Bunbury Road, Waratah Crescent, Alexander Crescent and Curran Avenue in order to draw Council's attention to the magnitude of the residents' problem and frustration. Ongoing engagement by Council staff with one aroused community member has resulted in a tempering of his complaints and voluntarily moderating a demand from full dispersal to a reduction of flying-fox numbers due to his increased understanding for the complexity of managing the camps.

Some of the preferred management options and solutions (in no particular order) cited by workshop participants included:

- *high pressure water cleaners*
- *build a wall in front of the creek*
- *double glaze windows and doors*
- *cover for clothes line*
- *subsidise water bills*
- *shade sails for vegie patch*
- *water tank to clean bat faeces off driveway, car and house*
- *remove some trees that are near our property*
- *prioritise vegetation removal along the creek, 20m buffer, replace with low growing shrubs*
- *prioritise disturbance as often as possible to move them*
- *clean up the creek of weeds and pests*
- *Council to pay for monthly high pressure water cleaning of property.*

4.3.3 Internal workshop results

Nine Council staff from six departments attended the flying-fox meeting to discuss management implications for both Campbelltown and Bingara Reserve camps. The workshop revealed potential competing internal interests for the council owned site in Campbelltown concerning proposed future land uses.

Campbelltown camp lies within the Campbelltown Precinct of the Glenfield to Macarthur Urban Renewal Corridor Strategy. This strategy proposes to increase housing densities around Campbelltown train station.

Council's objective to protect flying-foxes and their habitat is not intended to interfere with future growth of the city, however protocols and management will need to be developed to strike a balance between competing stakeholder interests.

Council staff sought advice from flying-fox experts regarding what needs to happen during planning and development to avoid impacts to flying-foxes and humans, specifically:

- how the flying-foxes utilise the space – camp footprint, flight paths, solar access, microclimate
- increasing residential densities around the railway station
- site maintenance including flooding, drain management, bushfire management
- recommended development controls such as height restrictions or set back requirements
- ways to avoid future heat stress events (HSE).

5 Camp management options analysis

The Flying-fox Camp Management Policy outlines a hierarchical approach to management, where low impact management options (Level 1; adaptive management, and Level 2; habitat modification) should be implemented before more invasive measures are considered (Level 3; active management). In accordance with the Policy, some Level 1 actions can be done without the need to apply to DPIE for a licence. Level 2 and Level 3 actions will require a licence. Any action at the camp must comply with the Commonwealth Guideline (Appendix 2), and referral may be required if the action is likely to have a significant impact on this nationally important camp.

Appendix 7 provides an overview of management options commonly used across NSW and Australia which have been considered in the development of the Plan. These are categorised as Level 1, 2 or 3 in accordance with the Policy. Below is a site-specific analysis of the camp management options for Campbelltown.

Table 6 Analysis of management options (Note: definitions and descriptions of each management option are provided in Section 8)

Management option	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site	Appraisal
Level 1 options						
Education, advice and feedback programs	Fear of disease Noise Smell Faecal drop	$	Low cost, promotes FF conservation, 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.	Education and advice itself will not mitigate all issues but should be part of any management approach to complement other actions.	Council has already developed FF information and educational materials which can be used in an education program.	Adopt

Management option	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site	Appraisal
Property modification	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$-$$	Property modification is one of the most effective ways to reduce amenity impacts of a camp, provides a long-term solution, promotes FF conservation, can be undertaken quickly, will not impact on the site, and may add value to the property.	Unlikely to fully mitigate impacts in outdoor areas and may be cost-prohibitive for private landholders (however subsidies will assist).	The community is in favour of a subsidies program	Investigate Further
Property modification subsidies program	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$$	A subsidies program will likely encourage tolerance of living near the camp, promote FF conservation, can be undertaken quickly, will not impact the site and there is potential for grant funding assistance, encouraging residents to modify properties will offer a long-term solution beyond the life of the subsidies program. Many residents indicated preference for a subsidies program (services or property modification) to assist mitigating impacts associated with the camp.	Will be costly across all affected properties (although more cost-effective than invasive management, such as dispersal attempts), effort required to determine the cost scale with respect to proximity to camp and program lifespan.	The community is in favour of a subsidies program	Investigate Further
Service subsidies program	Noise Smell Faecal drop Health/wellbeing Lost rental return	$$	Likely to encourage tolerance of living near the camp, promotes FF conservation, can be undertaken quickly, will not impact on the site, would reduce the need for property modification, potential for grant funding assistance.	Will be costly across all affected properties (although more cost-effective than invasive management, such as dispersal attempts), effort required to determine the cost scale with respect to proximity to camp and program lifespan, benefits will end with the subsidies program.	Many residents indicated preference for a subsidies program (services or property modification) to assist mitigating impacts associated with the camp.	Adopt

Management option	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site	Appraisal
Odour reducing / masking plants	Noise Smell Health/wellbeing Property devaluation	$	Planting dense screens and fragrant plants to assist with odour and noise and trim tall trees to less than 5 m high and /or use wildlife friendly netting to prevent occupation by flying-foxes	May take time to provide the desired effect	A low risk and low cost initiative that targets one of the main issues for the community may assist.	Adopt
Routine maintenance of the camp site	Health/wellbeing Property devaluation	$	Will allow property maintenance, likely to improve public perception of the site, will ensure safety risks of a public site can be managed. FFs at Bingara Reserve are roosting primarily in exotic vegetation (e.g. broad leaved privet), and so it is critical that any weed management is done in a strategic way to ensure FFs are not displaced to more undesirable locations (e.g. residential yards). Given it is a Nationally Important camp, sufficient vegetation must also be retained at all times to support the camp (or a referral to the Environment Minister is required – see Appendix 2). Improved maintenance of vegetation at the boundary of the Reserve to prevent incursion to private properties was requested by some residents.	Routine maintenance will not generally mitigate FF specific amenity impacts for nearby landholders (however will improve the general amenity of the site), may increase camp disturbance and associated impacts (e.g. noise and smell).	Within the camp, any weed or bushfire management should be staged and considerate of flying-fox behaviour and habitat requirements.	Adopt
Guidelines for carrying out operations adjacent to the camp	Noise Smell Faecal drop Health/wellbeing	$	Low cost, protocols to reduce disturbance of FF will reduce associated community impacts, promotes FF conservation, can be undertaken quickly, will not impact the site. Residents reported increased impacts when the camp is disturbed, particularly by mowing. These impacts could be reduced through a mowing guideline.	Will not mitigate impacts from the camp other than those associated with disturbance.	Safety protocols should be developed as part of any induction package for future construction activities.	Ongoing

Management option	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site	Appraisal
Health and safety guidelines to manage incidents	Health/wellbeing	$	Low cost, will reduce actual risk of negative human/pet–FF interactions, promotes FF conservation, can be undertaken quickly, will not impact the site. A heat stress management protocol may help prevent FF mortality during a HSE and associated impacts on both the flying-foxes	Will not generally mitigate amenity impacts.	Council could develop standard internal procedures as part of HSE plan for engaging carers to respond to sick and injured wildlife in resident's backyards	Adopt (ongoing)
Protect and enhance potential flying-fox habitat in low conflict areas	All	$$	If successful in attracting FFs away from high conflict areas this option will mitigate all impacts, promotes FF conservation. Improving habitat at low conflict locations in the nearby area to better suit FF camp preferences may form part of a long-term plan.	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.	Flying-fox habitat mapping can be used to identify potential sites for creating alternate habitat with low conflict nearby	Adopt (ongoing)
Provision of artificial roosting habitat	All	$-$$	Artificial roosting habitat could be used to alleviate pressure on vegetation in the Reserve, and encourage FFs to roost in the centre of the Reserve away from residences.	Previous attempts have had limited success, and some artificial materials may entangle animals. Council should partner with a researcher to increase the likelihood of success and ensure welfare risks are minimised. Installation of artificial roost habitat is likely to cause disturbance to the camp and may need to be installed when the camp is unoccupied, or in the evening when FFs are away foraging (outside the birthing/rearing season).	Partner with a researcher to determine whether the provision of artificial roost space is feasible at this site to alleviate pressure on native vegetation	Investigate further
Research into flying-foxes and ways to reduce community impacts	All	$-$$	Supporting research to improve understanding may contribute to more effectively mitigating all impacts, promotes FF conservation. Key research topics that would assist at this location include: better understanding camp site selection to	Generally cannot be undertaken quickly, management trials may require further cost input.	Council staff are actively involved in attending conferences and Council has also engaged researchers and consultants to understand habitat in the LGA.	Adopt (ongoing)

Management option	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site	Appraisal
			'attract' FFs to low conflict locations altering fly-out paths to reduce faecal drop for nearby residents additional deterrents (see Appendix 7) to prevent FFs roosting in vegetation on private property or poaching fruit trial new impact mitigation options (e.g. odour neutralising system).			
Appropriate planning controls for future land use	All	$	Will help ameliorate future amenity impacts and associated conflict, promotes FF.	Will not generally mitigate current impacts, restrictions may impact the landholder. Will not assist residents living in existing dwellings.	Council will consider appropriate planning and building design for future land use around the camp, along with buffer zones within their codes in future planning scheme updates.	Adopt
Property acquisition	All for specific property owners Nil for broader community	$$$	Due to the cost involved and the significant number of properties adjacent this camp, property acquisition is not a feasible option at this location.		Not feasible to Council or the community.	Disregard
Do nothing	Nil	Nil	No resource expenditure.	Will not mitigate impacts and would not be accepted by the community.	Not acceptable to community.	Disregard
Level 2 options						
Buffers through vegetation removal	Noise Smell Health/wellbeing Property devaluation	$-$$	A small buffer consisting of weed removal could be created which would have environmental and aesthetic benefits, can be undertaken under the Code of Practice.	A small buffer will not generally eliminate impacts, care is needed to ensure bank stability.	The Bingara Reserve is a narrow corridor of Critically Endangered vegetation and so there is only scope for small buffers on either side of the camp, and habitat modification should be limited to weed removal (as	Adopt

Management option	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site	Appraisal
					detailed in Section 6).	
Buffers without vegetation removal – visual deterrents, canopy mounted sprinklers	Noise Smell Health/wellbeing Damage to vegetation Property devaluation Lost rental return	$$	A visual buffer may be created by planting species unattractive to roosting FFs, or a buffer created using deterrents, both of which would reduce impacts of the camp, promotes FF conservation, can be undertaken quickly. Canopy-mounted water sprinklers – This method has been effective in deterring flying-foxes from designated buffer zones in Queensland. Visual deterrents – Visual deterrents such as plastic bags, fluoro vests (GeoLINK 2012) and balloons (Ecosure 2016, pers. comm.) in roost trees have shown to have localised effects, with flying-foxes deterred from roosting within 1–10 m of the deterrents.	Buffers should not be placed on the western side of the camp as this may contribute to mortality during HSEs. FF may use screening vegetation (careful species selection and placement are necessary, and resources must be available for deterrents if required), unknown long-term effectiveness of deterrents with limited long-term trials.	As above, the Reserve is a narrow corridor so there is only scope for small buffers on either side of the camp (as detailed in Section 7).	Adopt
Noise attenuation fencing	Noise Smell Health/wellbeing Property devaluation Lost rental return	$$	Will eliminate/significantly reduce noise impacts and reduce other impacts. May be suitable at the north-west boundary where residences are at approximately the same height as the camp.	Costly, will not eliminate all impacts, some residents would find fencing unattractive, unsuitable for properties on the south-east boundary given blocks and residences are higher than the camp, periodic maintenance required.	Not favoured by the community.	Disregard
Level 3 options						
Actively nudging the camp to a nearby location using disturbance	All	$$-$$$	If nudging to potential alternative site is successful this may mitigate all impacts to residents currently impacted.	Costly, potential for splinter camps in undesirable locations and other similar risks to active dispersal (see below).	Due to these costs and risks, dispersal will not be considered over the life of the Plan.	Disregard

Management option	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site	Appraisal
Passive dispersal through vegetation management	All at that site if successful, however dispersal is not generally recommended for amenity impacts only (see Section 8)	$$-$$$	If successful can mitigate all impacts at that site, compared with active dispersal: less stress on FFs, less ongoing cost, less restrictive in timing with ability for evening vegetation removal.	Costly, will impact site, risk of removing habitat before outcome known, potential to splinter the camp creating problems at other locations (although less than active dispersal), potential welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk (see Appendix 4) potential to impact on aircraft safety, extensive licencing requirements (Appendix 2), potential sedimentation and erosion issues	Due to these costs and risks, dispersal will not be considered over the life of the Plan.	Disregard
Active dispersal	All at that site if successful, however dispersal is not generally recommended for amenity impacts only (see Section 8)	$$$	If successful can mitigate all impacts at that site, often stated as the preferred method for impacted community members.	May be very costly, often unsuccessful, ongoing dispersal generally required unless combined with habitat modification, potential to splinter the camp creating problems in other locations, potential for significant animal welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk, potential to impact on aircraft safety.	Due to these costs and risks, dispersal will not be considered over the life of the Plan.	Disregard

6 Planned management approach

The Macquarie Fields flying-fox colony is neighboured by residential properties on both sides of Redfern Creek with conflicts between residents at a high level. Following consideration of available management options, constraints (including legislative and ecological constraints of the camp site), and feedback received during community consultation, Council has identified a range of feasible management actions that will be progressed over the life of the Plan (Table 7).

A site-specific analysis of the camp management options (Appendix 7) was undertaken in Section 5 and determined the most appropriate actions to utilise at Bingara Reserve camp (Table 6).

It should be noted that any management actions implemented at Bingara Reserve camp could have a consequence at Campbelltown camp. The management approach includes actions to adopt, investigate further or disregard within the Plan:

These management actions have been developed to complement each other, and it is proposed that Level 2 actions such as buffers will be implemented concurrently to Level 1 actions.

The identified management actions are:

- likely to be effective in targeting the areas that are most significantly impacted by noise, odour and faecal drop
- relatively low cost
- relatively low risk to the community and to flying-foxes
- simple and quick to implement because they do not require further detailed studies or approvals
- supported by most of the community based on the wide range of feedback received.

Adopt:

- education and awareness programs
- property modification
- routine camp management
- alternative habitat creation
- protocols to manage heat stress
- research
- appropriate land-use planning.

Investigate further:

- residential assistance program
- provision of artificial roosting habitat
- installation of buffers including vegetative and a canopy mounted sprinkler system

- interventions to reduce impacts of HSEs such as misting sprinklers/fans.

And disregard for Campbelltown camp:

- noise attenuation fencing
- service subsidies
- property acquisition
- active dispersal
- do nothing.

These actions will be implemented in accordance with Stop Work Triggers (Section 6.5) and Measures to Avoid Impacts (Section 6.4).

As part of the evaluation and review process stipulated in Section 8 , changes to legislation as well as phase two engagement has triggered a review of the Plan. Table 7 provides a status of the management options (i.e. in progress, or complete or if not yet begun, the level of priority of those actions is provided – low, moderate, high). Management options for prioritisation are highlighted in Section 6.1.

In accordance with the NSW Camp Management Policy, Council will take a hierarchical approach to management, beginning with Level 1 actions and progressing to Level 2 or 3 only if required with exception to the proposal of Buffers which will be implemented concurrently to Level 1 actions.

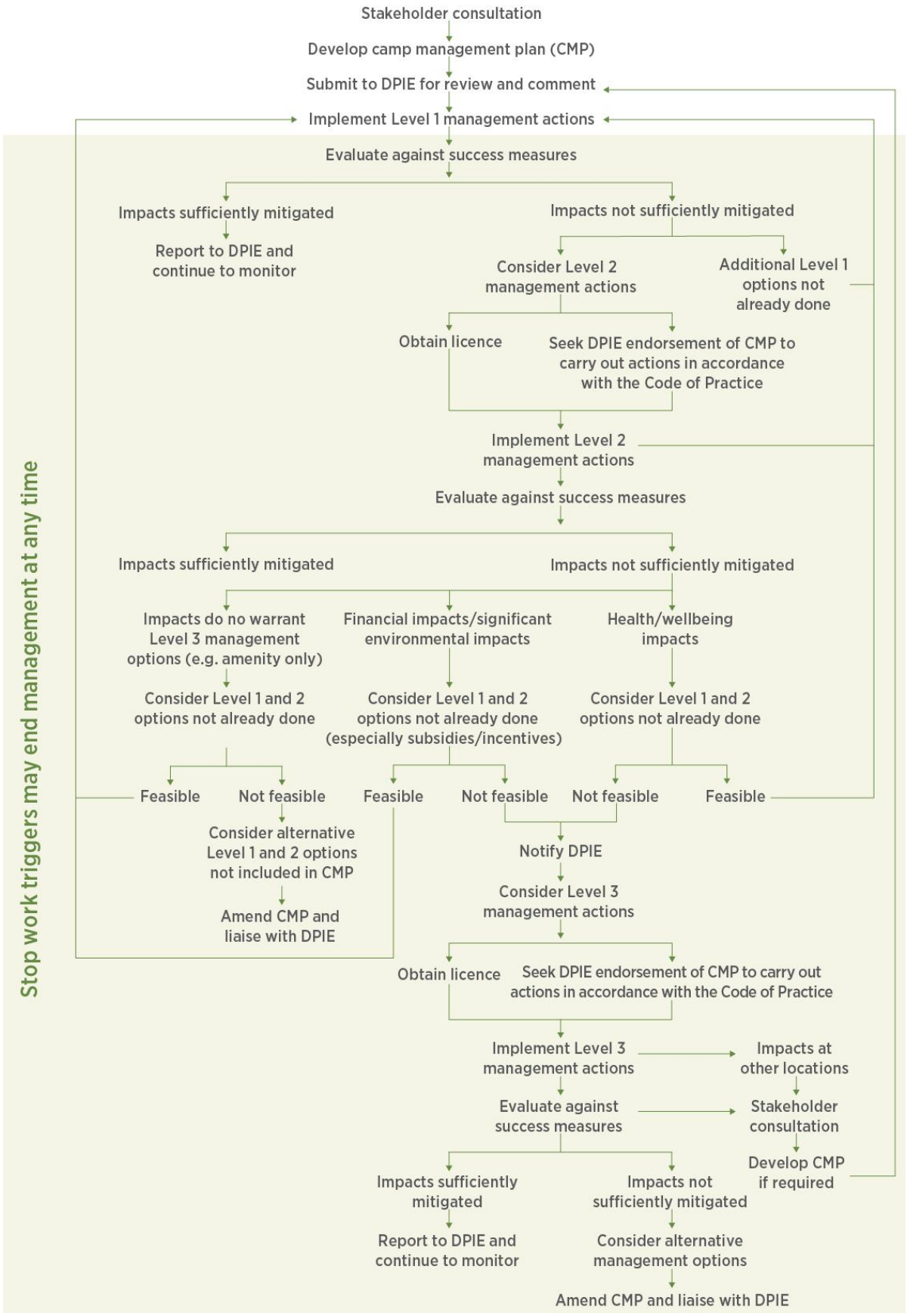


Figure 5 Flowchart that demonstrates progression through each management level

Table 7 Actions planned to be implemented by Council over the life of the Plan.

Note: *Actions are categorised as Level 1, 2 or 3 in accordance with the Camp Management Policy (OEH 2015). Those actions which require assessment by DPIE via a licence application are also identified.*

Issue	Management aim	Management theme	Management action and number	Success measure	Licence Required	Priority
Fears and misconceptions relating to flying-fox diseases, health and well-being, damage to vegetation and other issues affecting flying-fox health.	To maximise the effectiveness of management actions and understanding of flying-fox ecology To reduce flying-fox mortality	Level 1: Education and awareness program	1. Continue to engage directly with affected members of the community to ensure they are supported and have up-to-date information, including pro-active ways to reduce impacts at their properties and ways to protect flying-foxes such as wildlife friendly netting on fruit trees. https://www.wildlifefriendlyfencing.com/WFF/Netting.html	Residents kept up to date with during implementation of the Plan. Impacts of flying-foxes managed Flying-fox mortality reduced.		In progress, High
			2. Develop and maintain an annual program of community engagement (including bat events and assistance with bat counts) to support an understanding of flying-fox ecology, health and safety and management issues associated with the colony.	Program developed, bat night community events held and other relevant community programs supported.		In progress, High
			3. Ensure current flying-fox information remains readily available via Council's website and social media	Council webpage and social media kept up to date with current flying-fox information.		Complete, High
			4. Install signage at colony to build community awareness.	Signage installed at camps.		Medium
	To ensure staff and community not unnecessarily exposed to risk		5. Develop protocols for community and Council staff so everyone is aware of what to do if they encounter a dead, injured or orphaned flying-fox.	Staff and community informed with what to do if they encounter a flying-fox.		High

Issue	Management aim	Management theme	Management action and number	Success measure	Licence Required	Priority
	of ABLV or other diseases		6. Ensure voluntary vaccination is available to key Council staff.	Risk of disease or ABLV greatly reduced		
Current and future impacts such as noise, smell or faecal matter and other on nearby residents or businesses Conflict between community and flying-fox camps	To be responsive to the community's concerns and empower directly affected residents Assist residents adjacent to the Bingara Reserve camp To utilise innovative design features that allows flying-foxes and humans to coexist To ensure people can better coexist with flying-foxes	Level 1: Property Modification Level 1: Land Use Planning	7. Investigate a residential assistance program to assist with property modification, services or other incentives at the discretion of Council and on availability of grant funding. Examples of these may include covers for cars, swimming pools and outdoor areas, assistance with cleaning (e.g. free gurney hire/scheduled cleaning), planted screening on private property (see Appendix 7) noise attenuation (e.g. glazing windows), filters for air-conditioning units, tree replacement, green-houses for vegetable gardens, bat friendly bird netting, removal of cocos palms, odour management etc.	A reasonable level of amenity maintained for surrounding community Key impacts to residents or business are reduced. Residents can better coexist with flying-foxes	✓ For any large scale odour management trials	High
			8. Ensure future land uses utilise innovative design and suitable building materials for reducing noise, odour and faecal drop such as the provision of covered areas or sound mitigating measures. Developments should also consider appropriate landscaping to prevent flying-fox issues.	New developments incorporate mitigation measures to reduce impacts of flying-foxes		High
			9. Provide information about management options and interventions for residents and nearby businesses to minimise impacts of flying-foxes.	The inclusion of zoning or overlays and development requirements near flying-fox camps in the planning scheme. Residents/businesses can better coexist with flying-foxes		High
			10. Undertake GIS and onsite analysis of flying-fox habitat and identify development controls (e.g. buffer distances, camp size, seasonal spatial extent, drainage, flight paths, solar access and a persistent microclimate design requirements) for areas adjacent the camp.			
			11. Develop appropriate development controls and planning provisions for future development adjoining flying fox camps.	Reduced concerns from community.		

Issue	Management aim	Management theme	Management action and number	Success measure	Licence Required	Priority
			These provisions will seek to minimise amenity impacts through design and siting of new developments, acoustic measures, covered outdoor spaces etc, whilst also minimising the impact of proposed new development on microclimate and wellbeing of flying-foxes.			
			12. Utilise latest habitat mapping research outcomes which may inform additional impact mitigation measures, particularly the ability to 'attract' flying-foxes to low conflict locations.	Council informed with regards to options for impact mitigation		In progress (research collaboration)
			13. Consult with operational staff to develop a protocol for Council activities which may disturb the camp (e.g. mowing), informed by community observations to identify preferred timing to reduce community impacts. Such a protocol should also consider flying-fox welfare (e.g. avoiding disturbance when flightless young are likely to be present). This could also be provided to the community to outline ideal times to minimise community impacts such as lawn mowing associated with camp disturbance.	Impacts on flying-foxes from maintenance activities reduced.		Medium
			14. Consider signage, and potentially surveillance cameras if signage is insufficient, to deter people from disturbing flying-foxes (e.g. use of motor bikes or deliberate harassment) which subsequently increases noise, smell and faecal drop impacts.	Disturbance to flying-foxes is limited.		Low
		Level 1: Research	15. Partner with a researcher to determine whether the provision of artificial roost space is feasible at this site to alleviate pressure on native vegetation (and encourage flying-foxes to remain/relocate to lower conflict areas of reserve) away from residences/businesses).	Alternate roosting habitat is provided Impacts of flying-foxes is reduced.	✓ To install artificial roost habitat	Low (research collaboration)
	To provide a buffer between properties and	Level 2: Buffers	16. Investigate the creation of small buffers between residences and the flying-fox camp, ensuring that the impacts of heat stress events are not exacerbated. These could include	A buffer is created between flying-foxes and residential	✓	High

Issue	Management aim	Management theme	Management action and number	Success measure	Licence Required	Priority
	flying-fox colony		removal of weeds (under the *Flying-fox Camp Management Code of Practice 2018)*, strategic screening planting or canopy-mounted sprinklers to assist with buffering along property boundaries.	properties Impacts of lying-foxes on residents is minimised	Required for working in Threatened Ecological Communities and works that are likely to impacts flying-foxes or their habitat or for installation of canopy mounted sprinklers.	
Future land use or accumulative impacts from construction processes or multiple developments impacts upon flying-foxes current area of occupation or welfare	To minimise welfare impacts on flying-foxes from construction and development	Level 1: Environmental Assessment	17. Ensure that future development and associated construction is considerate of flying-foxes and their habitat that future development and associated construction is planned, undertaken and monitored in accordance with relevant environmental legislation.	No significant change to flying-fox numbers and colony health after works.		High
Exotic weed growth, waterway health, aesthetics, maintenance and habitat restoration	To manage flying-fox welfare, flooding and bushfire risk in camp To protect and restore the	Level 1: Routine camp management Level 1: Habitat Restoration	18. Undertake all works in accordance with legislation and monitor camp during and after routine management. Routine management includes minor weed management, tree removal or maintenance activities such as mowing or minor slashing that will not affect overall GHFF health. For routine management controls refer to Section 7.Assesment of impacts.	No significant change to flying-fox numbers and colony health after routine camp management. Routine management activities completed	✓ Required for working in Threatened Ecological Communities and for works that are likely	High
			19. Consult with expert where impacts from operational activities, routine camp management or emergency works			High

Issue	Management aim	Management theme	Management action and number	Success measure	Licence Required	Priority
	endangered ecological community in which flying-foxes roost To improve overall aesthetics of the creekline		are significant, may be unclear or unknown.	Overall aesthetics of creek line improved. All activities are undertaken to minimise impacts to flying-foxes.	to affect flying-foxes or their habitat.	
			20. In consultation with a flying-fox expert, develop a restoration plan for the site in-line with long-term objectives for the site determined through above actions in line with available budgets. Any planned restoration actions must ensure suitable flying-fox habitat remains available for the maximum number of flying-foxes that have used the site (Commonwealth requirement – see Appendix 2), minimise potential for flying-foxes to be displaced (e.g. into residential properties), and that suitable vegetation is retained for protection against extreme weather (e.g. HSEs). Protocols should also be developed to ensure personnel can work safely under the camp.	Flying-fox restoration undertaken in a cost efficient and effective manner ensuring impacts to GHFF and residents and businesses are minimised.		High
			21. Undertake restoration of flying-fox habitat in accordance with the site restoration plan.			High
			22. Consider a scheduled clean-up plan for the Reserve including scheduled rubbish collection, weed management at the periphery of the camp (providing roost habitat is not affected, which may displace flying-foxes into residential properties), and improved access to the camp periphery.	Site aesthetics and access is improved.		High
			23. Prioritise Council restoration efforts in natural areas with high value GHFF foraging habitat (identified in Eby and Law 2008) to limit reliance on urban areas and unnatural food sources (e.g. orchards).	Works prioritised towards key sites, improving flying-fox foraging habitat.		Low (research collaboration)

Issue	Management aim	Management theme	Management action and number	Success measure	Licence Required	Priority
			24. If the potential alternative site is not feasible, model habitat and land uses in the surrounds to identify other potential sites that may be improved to encourage flying-foxes to relocate on their own accord (informed by findings of ongoing research).	Other sites identified and habitat restored.		Low (research collaboration)
			25. Ensure appropriate habitat area is maintained at the site to support flying-foxes in the camp and that restoration or revegetation activities do not encourage expansion of the colony, which may affect current or future surrounding land uses.	No net loss or gain to the habitat area required to support the maximum number of flying-foxes that utilise the camp.		High
			26. All personnel working in and around camps with or without plant to be inducted into protocols outlined in Section 6'Assessment of impacts to flying-foxes'.	No significant change to flying-fox numbers and colony health after routine camp management.		High
Heat Stress Events causing illness or death to numerous flying-foxes. Clean up costs associated with not mitigating Availability of vaccinated personnel to deal with HSE	To ensure impacts of heat stress on wildlife carers and flying-foxes are minimised.	Level 1: Protocols to manage heat stress	27. Allocate resources, and develop procedures, responsibilities, and community materials for heat stress events.	Resources, procedures and community materials developed and implemented.		High, In Progress
			28. Investigate further options for technology to assist with gathering relevant data (sensors) and options to reduce heat stress including misting sprinklers and/or fans.	Heat stress items investigated and implemented where possible.	✓ Required for installation of misting sprinklers	Medium (research collaboration
			29. Assist wildlife carers where possible such as with data collection methods, equipment and physical assistance (including carcass collection) during and after heat stress events	Wildlife carers supported		High, In Progress

Issue	Management aim	Management theme	Management action and number	Success measure	Licence Required	Priority
Conflict between community and flying-fox camps	Understand and predict influxes of flying-foxes to the area Inform management decisions regarding influxes	Level 1: Research	30. Identify foraging resources within 50 km of the Bingara Reserve and likely flowering/fruiting times, including retrospective assessment of events likely to have contributed to previous influxes, to help predict future influxes.	Council is prepared for influxes of flying-foxes		Low (research collaboration)
Staff knowledge and experience	Inform staff latest knowledge and information related to flying-fox management	Level 1: Staff knowledge and capacity	31. Council staff to attend conferences or training relating to flying-fox management to ensure best practice knowledge is incorporated to flying-fox management.	Staff are up to date on latest flying-fox management information		High
Number and distribution of flying-foxes	Undertake monitoring activities	Level 1: Monitoring	32. Council staff to complete National Flying-fox Monitoring Program census and data collection on a minumum of a quarterly basis. Information should include a count, mapped camp extent, condition of individuals in the camp (e.g. presence of pregnant females and young) and flying-fox behaviour. This data can be compared against weather and other variables to identify trends.	Council and government agencies informed with up to date data		High
			33. Support establishment of a local group to research and monitor the site outside regular National Flying-fox Monitoring Program census times. Information, ideally be collected on a monthly basis,	Community engaged in monitoring process.		High
Flying-foxes coming into contact with power lines	Reduce flying-fox mortality	Level 1:	34. Collect data and investigate and consult with energy provider to bund or space power lines near the camp to prevent electrocution.	Energy providers contacted.		Low

6.1 Management options for prioritisation

After the second phase of engagement and a review of management options to date, the following actions are clear priority for Council:

Level 1:

1. Investigate a residential assistance program to assist with property modification, services or other incentives at the discretion of Council and on availability of grant funding. Examples of these may include covers for cars, swimming pools and outdoor areas, assistance with cleaning (e.g. free gurney hire/scheduled cleaning), planted screening on private property (see Appendix 7) noise attenuation (e.g. glazing windows), filters for air-conditioning units, tree replacement, green-houses for vegetable gardens, water tanks, bat friendly bird netting, removal of cocos palms, odour management etc.
2. Develop a restoration plan for the reserve that prioritises control of exotic weed growth, improving waterway and vegetation health and overall aesthetics for residents whilst not impacting flying fox habitat, particularly during heat stress events.
3. Include new planning provisions within the Campbelltown (Sustainable City) DCP through design and siting of new developments, acoustic measures, covered outdoor spaces etc.

Level 2:

1. Create small buffers between residences and the flying-fox camp as outlined in section 6.1.1 Buffers.

6.1.1 Buffers

The following small buffers will be investigated further between residences and the camp.

North-western side of the camp

Residences along Myee Road are at approximately the same height as the camp. A visual screen could be created on this side of the camp. Given the small space between the camp and residential boundaries on this side, it is important that any planted vegetation is on private property (to increase the distance between camp habitat and planted screens, and protect the integrity of the EEC), and only relatively low-growing (i.e. less than 4 m) dense shrubs unattractive to roosting flying-foxes. Species that do not attract foraging flying-foxes should also be selected to avoid increasing faecal drop impacts. A planted hedge would provide a visual screen and may also assist with noise buffering.

Such screening options may form part of a residential assistance scheme.

Canopy-mounted sprinklers may be installed on Council property to deter flying-foxes from the boundary. Cost sharing for canopy-mounted sprinklers will be investigated prior to installation (e.g. potentially dependent on residents covering operational costs).

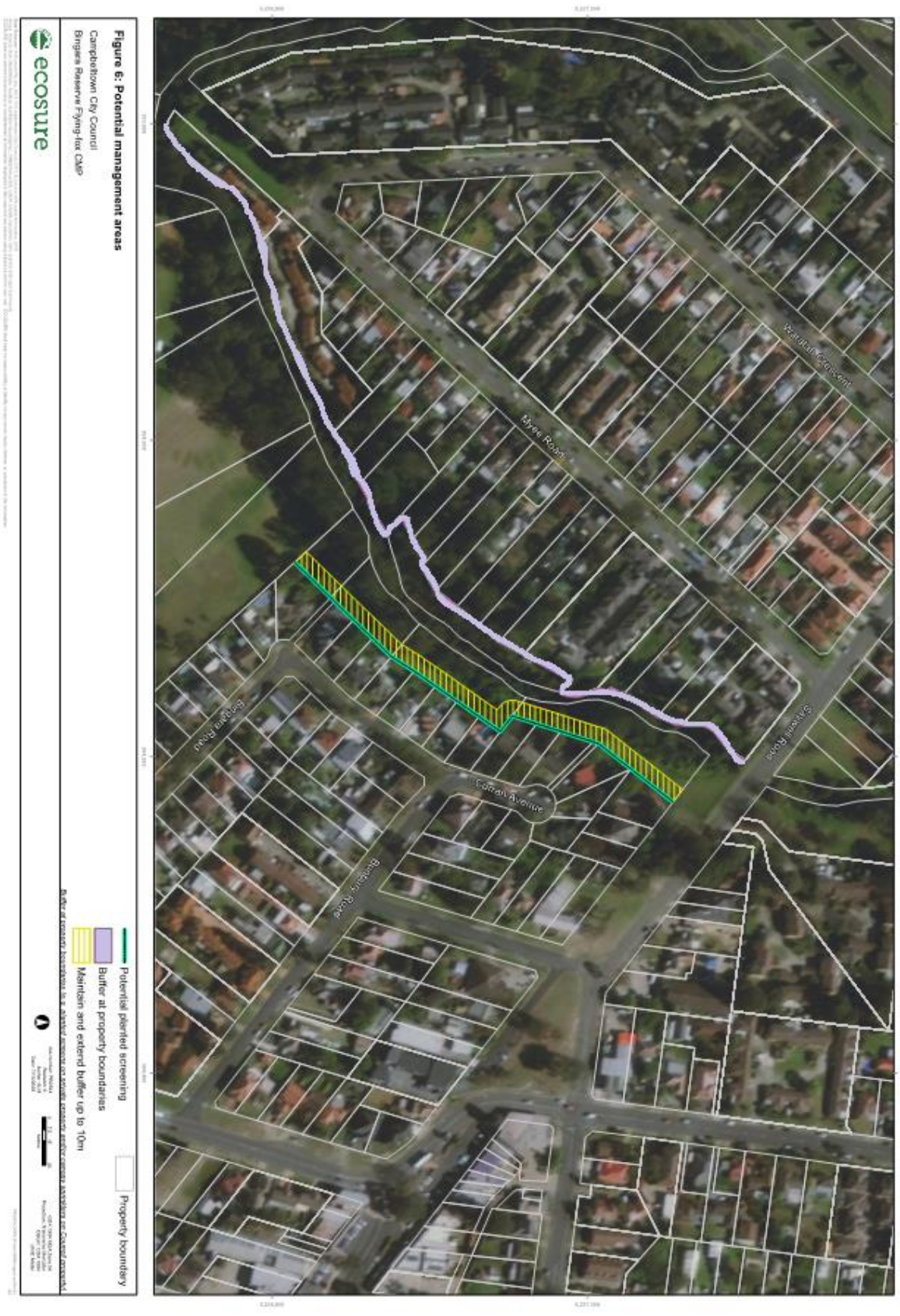
South-eastern side of the camp

The south-eastern side of the camp includes residences along Curran Ave and Bingara Rd. Residences in these areas are high set and above the camp.

Council will maintain the mown buffer between the camp and residents on this side of the camp and extend to the north and south where possible through selective weed removal at the periphery of the camp

The southern edge of the mown buffer closest to residential boundaries may also be strategically planted to provide visual screening, which may also assist noise reduction. The height of screening vegetation should be restricted as much as possible to the needs of each individual residence. For example, single-storey residences will benefit more from lower plantings than two-storey residences. Where taller vegetation is required, planting should be limited to one-two trees per boundary. Strategic placement will maximise the benefit of such plantings while minimising the potential to attract roosting flying-foxes. Residents can nominate areas with highest priority for visual screening (e.g. daytime living areas) for screening. Ideally established plants will be used to reduce time to screening height. Planting will be intermittent to ensure the canopy is not continuous (which would provide desirable roost habitat), and the cleared area maintained to avoid continuous canopy. The current buffer area will be maintained so there is no midstorey and no/limited understorey (e.g. mown). Flying-fox foraging species should be avoided to prevent increasing foraging impacts. Council will consult with residents prior to any planting in the buffer to ensure they are aware of the risk that flying-foxes may at times roost in this vegetation.

Figure 6 Potential management areas



7 Assessment of impacts

7.1 Impacts on flying-foxes

The actions outlined in the Plan do not include any Level 3 actions such as nudging the camp or dispersal. In addition, any on ground works will be undertaken in accordance with accordance with Section 7.4. This will ensure the welfare of flying-foxes during proposed minor works, and the safety of personnel working in the camp. As such, impacts on the GHFF are expected to be minimal.

As proposed actions over the life of the Plan do not aim to disperse any individuals from the site, potential habitat has not been modelled specifically for Bingara.

7.2 Flying-fox habitat to be affected

Planned vegetation buffer works (Figure 5) will remove approximately 0.12 ha of the 1.06 ha known to be used (the maximum recorded extent) (or 0.08 ha of the 0.35 ha that is regularly used as camp habitat – average camp extent. This works will focus solely on weed removal and as such will improve habitat at the site. There is sufficient habitat available in the corridor to compensate for the removal of weeds in the buffer zone.

Minor trimming of native vegetation, if required, will be done in accordance with advice from a qualified arborist to ensure the long-term health of the trees. Further details on weeds to be removed will be provided in the relevant license application.

7.3 Assessment of Impacts to other threatened species or ecological communities and other biodiversity

Sixteen threatened species and a threatened ecological community was assessed for potential occurrence at Bingara Reserve (see Section 2.4). Only one of these was recorded on site being the EEC River-flat Eucalypt Forest.

Management advocated for over the five year life of the Plan is restricted to weed removal and minor trimming of native vegetation in a restricted buffer zone to ensure it does not encroach onto private property. Such works will be undertaken by appropriately qualified bush regeneration contractors who have been trained in identifying stress in flying-foxes. These activities are not considered likely too negatively impact on this endangered ecological community or any fauna or flora on the site.

No nests or hollows were identified in the proposed buffer area during the initial ecological assessment. Should a potential breeding place be encountered during clearing it will be retained.

7.4 Standard measures to avoid impacts

The following mitigation measures will be complied with, at all times during Plan implementation.

7.4.1 All management activities

- All personnel will be appropriately experienced, trained and inducted. Induction will include each person's responsibilities under the Plan.
- All personnel will be briefed prior to the action commencing each day and debriefed at the end of the day.
- Works will cease and DPIE consulted in accordance with the 'stop work triggers' section of the Plan.
- DPIE will be contacted immediately if LRFF are present between March and October or are identified as being in their final trimester/with dependent young.
- 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.
- Activities that may disturb flying-foxes at any time during the year will begin as far from the camp as possible, working towards the camp gradually to allow flying-foxes to habituate.
- Any activity likely to disturb flying-foxes so that they take flight will be avoided during the day during the sensitive GHFF birthing period (i.e. when females are in 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.).
- Non-critical maintenance activities that do not need to be done regularly and are likely to significantly disrupt the camp will ideally be scheduled when the camp is naturally empty. Where this is not possible (e.g. at permanently occupied camps) they will be scheduled for the best period for that camp (e.g. when the camp is seasonally lower in numbers and breeding will not be interrupted, or during the non-breeding season, generally May to July).
- 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 bottlenecks). Council's Natural Area Team will be consulted prior to any works and wildlife carers will be contacted to determine whether the population appears to be under stress.

- Works will be postponed on days predicted to exceed 35°C (or ideally 30°C), and for one day following a day that reached ≥35°C. If an actual HSE 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. See the DPIE fact sheet on Responding to heat stress in flying-fox camps.
- 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. Works associated with Level 3 actions may continue provided flying-foxes are not at risk of being harmed.
- If impacts at other sites are considered, in DPIE's opinion, to be a result of management actions under the Plan, assistance will be provided by the proponent to the relevant land manager to ameliorate impacts. Details of this assistance are to be developed in consultation with DPIE.
- Any proposed variations to works detailed in the Plan will be approved, in writing, by DPIE before any new works occur.
- DPIE may require changes to methods or cessation of management activities at any time.
- Ensure management actions and results are recorded to inform future planning. See the DPIE fact sheet on Monitoring, evaluating and reporting.

Human 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 Australian bat lyssavirus 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 assessment2 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)
- Plan evaluation and review (see Section 12).

7.4.2 All Level 2 actions

Prior to 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.
- Information will be placed on Council's website along with contact information.
- DPIE will be notified at least 48 hours before works commence.
- A protocol, in accordance with the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012), for flying-fox rescue 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.
- 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.

Monitoring

- A flying-fox expert (as identified in the DPIE Camp Management Plan Template 2016) will undertake an on-site population assessment prior to, during works and after works have been completed, including:
    - number of each species

[2] A similar approach should be taken to pre-management engagement (see Section 3) to allow direct comparison, and responses should be assessed against success measures (Section 9) to evaluate success.

    - ratio of females in final trimester
    - approximate age of any pups present including whether they are attached or likely to be crèched
    - visual health assessment
    - mortalities.
- Counts will be done at least:
    - once immediately prior to works
    - daily during works
    - immediately following completion
    - one month following completion
    - 12 months following completion.

During works

- A flying-fox expert will attend the site as often as DPIE considers necessary to monitor flying-fox behaviour and ensure compliance with the Plan and the Policy. They must also be able to identify pregnant females, flightless young, individuals in poor health and be aware of climatic extremes and food stress events. This person will make an assessment of the relevant conditions and advise the supervisor/proponent whether the activity can go ahead.
- Deterrents in buffer areas will be assessed by a flying-fox expert so those that may cause inadvertent dispersal (e.g. canopy-mounted sprinklers) are not used during fly-in.
- At least one flying-fox rest day with no active management will be scheduled fortnightly, preferably weekly. Static deterrents (e.g. canopy-mounted sprinklers) may still be used on rest days.

7.4.3 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 metres).

7.4.4 Canopy vegetation trimming/removal

- 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.
- Any tree lopping, trimming or removal will be 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 Arboriculture Australia).
- 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 carrying young (generally September – 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.
- Tree removal as part of management will be offset at a ratio of at least 2:1. Where threatened vegetation removal is required, the land manager will prepare an Offset Strategy to outline a program of restoration works in other locations (in addition to existing programs). The strategy will be submitted to DPIE for approval at least two months prior to commencing works.

7.4.5 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.
- 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).
- 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.

7.4.6 Additional mitigation measures for any activity at a nationally important GHFF camp

The Bingara Reserve GHFF is a nationally important camp. As such, additional measures will apply to Level 2 actions to ensure compliance with the Federal Guideline (Appendix 2):

- The action will not occur if the camp contains females that are in the late stages of pregnancy or have dependent young that cannot fly on their own (generally August to February).
- Disturbance activities will be limited to a maximum of 2.5 hours in any 12-hour period, preferably at or before sunrise or at sunset. Disturbance activities can be defined as any activity, other than routine activities, that disturbs the camp and therefore this may apply to both Level 2 and 3 activities.

- The action will not involve the clearing of all vegetation supporting a nationally important flying-fox camp. Sufficient vegetation will be retained to support the maximum number of flying-foxes ever recorded in the camp of interest.

7.5 Stop work triggers

The on-ground implementation of actions outlined above will cease and not recommence without consulting DPIE if is thought to have resulted in:

- a breach of the animal welfare triggers on more than two days during the program, such as unacceptable levels of stress (see Table 8)
- a flying-fox injury or death
- a new camp/camps establishing
- impacts at other locations
- the inability to meet standard measures to avoid impacts (detailed in Section 7.4).

Management may also be terminated at any time if:

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

Table 8 Planned action for potential impacts during management.

A person with experience in flying-fox behaviour (as per Appendix 1) will monitor for welfare triggers and direct works in accordance with the criteria below.

Welfare trigger	Signs	Action
Unacceptable levels of stress	If any individual is observed: • panting • saliva spreading • located on or within two metres of the ground	• Works to cease for the day
Fatigue	In situ management • more than 30% of the camp takes flight • individuals are in flight for more than five minutes • flying-foxes appear to be leaving the camp	• In situ management • Works to cease and recommence only when flying-foxes have settled* / move to alternative locations at least 50 metres from roosting animals
	Dispersal • low flying • laboured flight • settling despite dispersal efforts	• Dispersal • Works to cease for the day

Welfare trigger	Signs	Action
Injury/death	• a flying-fox appears to have been injured/killed on-site (including aborted foetuses) • any flying-fox death is reported within one kilometre of the dispersal site that appears to be related to the dispersal • loss of condition evident	• Works to cease immediately and the Department notified • Rescheduled • Adapted sufficiently so that significant impacts (e.g. death/injury) are highly unlikely to occur, as confirmed by an independent expert (see Appendix 1) • Stopped indefinitely and alternative management options investigated.
Reproductive condition	• females in final trimester • dependent/crèching young present	• Works to cease immediately and the Department notified • Rescheduled • Stopped indefinitely and alternative management options investigated.

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

8 Evaluation and review

The Plan will have a scheduled review annually, primarily to evaluate management actions against measures shown in Appendix 7.

The following will trigger a reactive review of the Plan:

- a requirement to progress to a higher level of management due to prolonged changes in camp characteristics
- changes to relevant policy/legislation
- new management techniques becoming available
- outcomes of research that may influence the Plan
- incidents associated with the camp.

Results of each review will be reported to DPIE.

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

9 Plan administration

9.1 Monitoring and reporting

Monitoring of the camp will be undertaken on a quarterly basis (in accordance with NFFMP) by Council staff in order to determine the extent of the camp as well as its size and composition. This will include counts as part of the National Flying-fox Monitoring Program Census.

Monitoring of the camps management actions (and where relevant the camp's response) to these actions will be undertaken in accordance with DPIE's Monitoring, evaluating and reporting on management actions at flying-fox camps fact sheet (prepared in association with DPIE's Flying-fox Camp Management Policy) and in relation to on ground actions at the camp Section 6.5 (Stop Work Triggers), Section 7.4 Standard measures to avoid impacts and any other DPIE licence requirements.

Reporting will be undertaken in accordance with any DPIE approvals including licence approvals.

9.2 Responsibilities

Council is responsible for implementation of the Plan once it has been endorsed by DPIE, licences have been obtained where necessary and resources have been allocated for implementation. Council will seek advice from DPIE and other flying-fox experts as required during implementation.

If there is a sudden influx of flying-foxes to the camp, other councils and agencies should be consulted to determine if it is related to a dispersal. If this is the case, assistance will be sought from the council dispersing to manage any issues that arise.

9.3 Funding Commitment

Council will commit available funds on an annual basis over the life of the Plan to implement actions in Table 7. Allocation of Council funding will be dependent on resources available and annual priorities. Council will also seek opportunities for funding through relevant grant programs, and will seek contribution from other stakeholders where appropriate.

9.4 Management structure

Council is responsible for coordinating the implementation of the Plan. In addition to Council's role in Plan implementation, a flying-fox expert and a range of other contractors will also be required to guide its implementation and undertake actions as detailed in Table 9 below.

Table 9 Roles and responsibilities

Role	Position	Required experience/approvals	Responsibilities/authority	Communication lines
Program Coordinator	Coordinator Natural Areas	Project management Human resource management Community engagement Reporting Recommended ABLV-vaccinated	Inform and consult with stakeholders and interested parties Community engagement Evaluate program Submit reports to DPIE/DEE Ensure all landowners have been provided consent prior to works Supervise and where appropriate implement actions identified in the plan.	Reports to: Executive Manager Open Space Direct reports: Supervisor
Project Manager	Bushcare Officer	Project management Team leadership and coordination Data management Recommended ABLV-vaccinated Trained in the identifying signs of stress in flying-foxes	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 DPIE and DEE Liaise with wildlife carers/veterinarians (for orphaned/injured wildlife only)	Reports to: Program Coordinator Direct reports: Supervisor, Contractors
Supervisor/Flying-fox expert	Yet to be determined -	Knowledgeable in flying-fox biology, behaviour and camp management ABLV-vaccinated and trained in flying-fox rescue Team training, leadership and supervision	Pre- and post-management monitoring Surrounding camp monitoring Coordinate daily site briefings Coordinate daily activities Monitor flying-fox behaviour Rescue flying-foxes if required (and no carer/vet on site) Determine daily works end point Participate in management activities On-site population assessment and ensure compliance with the Plan.	Reports to: Project Manager Direct reports: Team members, Observers/support
Team member	Yet to be determined -	Recommended ABLV-vaccinated (employer to assess risk) Knowledgeable in flying-fox biology, behaviour and camp management	Attend daily site briefings Participate in relevant management activities Assist Supervisor with their tasks relating to monitoring flying-fox behaviour and monitoring onsite population	Reports to: Supervisor Direct reports: Nil

Role	Position	Required experience/approvals	Responsibilities/authority	Communication lines
			assessment	
Contractor Bush regeneration	Yet to be determined	Relevant Biodiversity Conservation licences and experience in field Trained in the identifying signs of stress in flying-foxes	Undertake Weed Removal in buffer areas Develop and implement Restoration Plan for camp site Adhere to all directions given by Supervisor (when implementing relevant onsite actions)	Reports to: Project Manager Direct reports: Nil
Contractors (Various) Property Modifications	Yet to be Determined	Relevant experience in area of property modification	Undertake property modifications and various other actions as required	Reports to: Project Manager/relevant resident
Observer/support	WIRES and/or Sydney Metropolitan Wildlife carers	Approval to access site Experience in Flying-fox rescue and rehabilitation Trained in identifying signs of stress in flying-foxes	Provide care of injured/orphaned wildlife (under licence) if required	Reports to: Supervisor Direct reports: Nil
Campbelltown City Council Operational Staff	Multiple	Trained in identifying signs of stress in flying-foxes	Undertake operational works as per developed guidelines Report any identified issues through to project manager	Direct reports: Nil

9.5 Work Health and Safety

Council will prepare a Risk Assessment Plan addressing all aspects of the Plans implementation and having regard to Section 8.4. Council will also ensure that any contractors engaged by Council during the Plan's development have been provided with a copy of Council's Risk Assessment Plan and have appropriate work health and safety procedures in place.

9.6 Adaptive management

The actions outlined in the Plan have been identified having regard to the characteristics of the camp, outcomes of community consultation and the best available information on flying-fox management. However, flying-fox camps and the other ecological values at Bingara Reserve are part of complex ecological systems which can behave in unpredictable ways. It is therefore essential to constantly monitor the stability of the camp and the outcomes of the Plan's management actions (as per Section 5) and be prepared to adopt and respond to changes as they occur.

The Plan therefore seeks to adopt an adaptive management approach, which provides flexibility and the ability to respond to changing circumstances as they arise. Through this process, adaptive management allows the making of incrementally better decisions about how to manage the camp.

9.7 Funding commitment

Council will commit available funds on an annual basis over the life of the Plan to implement actions in Table 7. Allocation of Council funding will be dependent on resources available and annual priorities. Council will also seek opportunities for funding through relevant grant programs, and will seek contribution from other stakeholders where appropriate.

References and further resources

Aich, P, Potter, AA and Griebel, PJ 2009, 'Modern approaches to understanding stress and disease susceptibility: A review with special emphasis on respiratory disease', *International Journal of General Medicine*, vol. 2, pp. 19–32.

AIHW 2012, *Risk factors contributing to chronic disease*, Cat no. PHE 157, Australian Institute of Health and Welfare, viewed 12 January 2016, www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737421546.

ALA 2017, Pet Dander, American Lung Association, available: https://www.lung.org/our-initiatives/healthy-air/indoor/indoor-air-pollutants/pet-dander.html

Atlas of Living Australia 2015, viewed 12 January 2016, www.ala.org.au.

Australasian Bat Society 2013, viewed 12 January 2016, ausbats.org.au/.

Australian Museum 2010, *Little Red Flying-fox*, viewed 12 January 2016, australianmuseum.net.au/little-red-flying-fox.

AVA 2015, *Hendra virus*, Australian Veterinary Association, viewed 12 January 2016, www.ava.com.au/hendra-virus.

Birt, P 2000, 'Summary information on the status of the Grey-headed (Pteropus poliocephalus) and Black (*P. alecto*) Flying-Fox in New South Wales,' Proceedings of workshop to assess the status of the grey-headed flying-fox in New South Wales. University of Sydney, Sydney, New South Wales, Australia, pp. 78-86.

Bishop T, 2015, The Management, Treatment and Physiology of Heat Stroke in Flying-foxes, presentation

CDC 2014, *Hendra virus disease (HeV): Transmission,* Centers for Disease Control and Prevention, updated 17 March 2014, viewed 12 January 2016, www.cdc.gov/vhf/hendra/transmission/index.html.

Churchill, S 2008, *Australian Bats*, Allen & Unwin, Crows Nest, NSW.

Cropper, SC 1993, *Management of Endangered Plants,* CSIRO Australia, Melbourne.

DECC 2007, *Threatened species assessment guidelines: the assessment of significance*, Department of Environment and Climate Change NSW, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf.

DECC 2008, *Best practice guidelines for the grey-headed flying-fox*, Department of Environment and Climate Change NSW, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/08540tsdsflyingfoxbpg.pdf.

DECCW 2009, *Draft National Recovery Plan for the Grey-headed Flying-fox* Pteropus poliocephalus, prepared by Dr Peggy Eby for Department of Environment, Climate Change and Water NSW, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/08214dnrpflyingfox.pdf.

DoE 2013, *Matters of National Environmental Significance: Significant Impact Guidelines 1.1*, Environment Protection and Biodiversity Conservation Act 1999, Australian Government Department of the Environment, www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf.

DoE 2014, *How can flying-foxes be managed in accordance with national environmental law*? Australian Government Department of the Environment, Canberra, viewed 12 January 2016, www.environment.gov.au/biodiversity/threatened/species/flying-fox-law.

DoE 2015, *Referral guideline for management actions in grey-headed and spectacled flying-fox camps*, Australian Government Department of the Environment, Canberra, viewed 12 January 2016, www.environment.gov.au/system/files/resources/6d4f8ebc-f6a0-49e6-a6b6-82e9c8d55768/files/referral-guideline-flying-fox-camps.pdf.

DoE 2016a, *Pteropus poliocephalus in Species Profile and Threats Database*, Australian Government Department of the Environment, Canberra, viewed 12 January 2016, www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=186.

DoE 2016b, *Monitoring Flying-fox Populations*, Australian Government Department of the Environment, Canberra, viewed 12 January, www.environment.gov.au/biodiversity/threatened/species/flying-fox-monitoring.

DPI 2013, *Australian bat lyssavirus*, June 2013 Primefact 1291 2nd edition, Department of Primary Industries, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/461873/Australian-Bat-lyssavirus.pdf.

DPI 2014, *Hendra virus*, June 2014 Primefact 970 9th edition, Department of Primary Industries, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/310492/hendra_virus_primefact_970.pdf.

DPI 2015a, *Hendra virus*, Department of Primary Industries, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/agriculture/livestock/horses/health/general/hendra-virus.

DPI 2015b, *Lyssavirus and other bat health risks*, Department of Primary Industries, Primary Industry Biosecurity, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/biosecurity/animal/humans/bat-health-risks.

DSDIP 2014, *Queensland State Planning Policy July 2014*, Department of State Development, Infrastructure and Planning, Brisbane.

Eby, P 1991, 'Seasonal movements of Grey-headed Flying-foxes, *Pteropus poliocephalus* (Chiroptera: Pteropodidae) from two maternity roosts in northern New South Wales', *Wildlife Research*, vol. 18, pp. 547–59.

Eby, P 1995, *The biology and management of flying-foxes in NSW*, Species management report number 18, Llewellyn, L. (ed.), National Parks and Wildlife Service, Hurstville.

Eby, P 2000, 'The results of four synchronous assessments of relative distribution and abundance of Grey-headed Flying-fox *Pteropus poliocephalus*', Proceedings from workshop to assess the status of the Grey-headed Flying-fox in New South Wales, pp. 66–77.

Eby, P 2006, 'Site Management Plan for the Grey-headed Flying-fox camp at the Sydney Desalination Plant Site', report to Sydney Water Corporation, Sydney.

Eby, P and Lunney, D 2002, *Managing the Grey-headed Flying–fox as a threatened species in NSW*, Royal Society of New South Wales, Darlington, NSW.

Ecosure 2011, 'Hendra Virus Risk Assessment for the Gold Coast Equine Precinct: Residual Risk Report', unpublished report to City of Gold Coast.

Edson, D, Field, H, McMichael, L, Jordan, D, Kung, N, Mayer, D and Smith, C 2015, 'Flying-fox Roost Disturbance and Hendra Virus Spillover Risk', *PLoS ONE,* vol. 10, no. 5, viewed 12 January 2016, www.ncbi.nlm.nih.gov/pmc/articles/PMC4446312/pdf/pone.0125881.pdf.

EHP 2012, *Living with Wildlife – Flying-foxes*, Department of Environment and Heritage Protection, Queensland, updated 14 May 2012, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/importance.html.

EHP 2013a, *Code of Practice – Ecologically sustainable management of flying-fox roosts*, Department of Environment and Heritage Protection, Queensland, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/roost-management.html.

EHP 2013b, *Code of Practice – Low impact activities affecting flying-fox roosts*, Department of Environment and Heritage Protection, Queensland, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/roost-management.html.

EHP 2013c, *Flying-fox roost management guideline*, Department of Environment and Heritage Protection, Queensland, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/roost-management.html.

ELW&P 2015, *Flying-foxes*, Department of Environment, Land, Water and Planning, State of Victoria.

EPA 2013, *Noise Guide for Local Government*, Environment Protection Authority, Sydney.

Fujita, MS 1991, 'Flying-fox (*Chiroptera: Pteropodidae*) pollination, seed dispersal, and economic importance: a tabular summary of current knowledge', *Resource Publication No. 2*, Bat Conservation International.

GeoLINK 2010, *Maclean Flying-fox Management Strategy*, report prepared for Clarence Valley Council on behalf of the Maclean Flying-Fox Working Group.

GeoLINK 2012, *Lorn Flying-fox management strategy*, report prepared for Maitland City Council.

Hall, L and Richards, G 2000, *Flying foxes: fruit and blossom bats of Australia*, UNSW Press, Sydney.

Henry, JP and Stephens-Larson, P 1985, 'Specific effects of stress on disease processes' in Moberg, GP (ed.), *Animal Stress*, American Physiological Society, pp.161–175.

IUCN 2015, *Little red flying-fox*, International Union for the Conservation of Nature, www.iucnredlist.org.

Ku-ring-gai Council 2013, *Ku-ring-gai Flying-fox Reserve Management Plan*, Ku-ring-gai Council, Gordon, NSW.

Markus, N 2002, 'Behaviour of the Black Flying-fox *Pteropus alecto*: 2. Territoriality and courtship', *Acta Chiropterologica*, vol. 4, no. 2, pp.153–166.

Markus, N and Blackshaw, JK 2002, 'Behaviour of the Black Flying-fox *Pteropus alecto*: 1. An ethogram of behaviour, and preliminary characterisation of mother-infant interactions', *Acta Chiropterologica*, vol. 4, no. 2, pp. 137–152.

Markus, N and Hall, L 2004, 'Foraging behaviour of the black flying-fox (*Pteropus alecto*) in the urban landscape of Brisbane, Queensland', *Wildlife Research*, vol. 31, no. 3, pp. 345-355.

McCall, BJ, Field, H, Smith, GA, Storie, GJ and Harrower, BJ 2005, 'Defining the risk of human exposure to Australian bat lyssavirus through potential non-bat animal infection', *CDI*, vol. 29, no. 2, pp. 200–203, www.health.gov.au/internet/main/publishing.nsf/content/cda-cdi2902-pdf-cnt.htm/$FILE/cdi2902k.pdf.

McConkey, KR, Prasad, S, Corlett, RT, Campos-Arceiz, A, Brodie, JF, Rogers, H and Santamaria, L 2012, 'Seed dispersal in changing landscapes', *Biological Conservation*, vol. 146, pp. 1–13, doi:10.1016/j.biocon.2011.09.018.

McGuckin, MA and Blackshaw, AW 1991, 'Seasonal changes in testicular size, plasma testosterone concentration and body weight in captive flying-foxes (*Pteropus poliocephalus* and *P. scapulatus*)', *Journal of Reproduction and Fertility*, vol. 92, pp. 339–346.

McIlwee, AP and Martin, IL 2002, 'On the intrinsic capacity for increase of Australian flying-foxes', *Australian Zoologist*, vol. 32, no. 1.

Milne, DJ and Pavey, CR 2011, 'The status and conservation of bats in the Northern Territory', in Law, B, Eby, P, Lunney, D and Lumsden, L (eds), *The Biology and Conservation of Australasian Bats*, Royal Zoological Society of NSW, Mosman, NSW, pp. 208–225.

NFFMP 2018, National Flying-fox Monitoring Program, Department of Environment and Energy, Australian Government, available: http://www.environment.gov.au/biodiversity/threatened/species/flying-fox-monitoring viewed 12 February 2018.

NSW Health 2012, *Flying foxes and health*, NSW Health, North Sydney, viewed 12 January 2016, www.health.nsw.gov.au/environment/factsheets/Pages/flying-foxes.aspx.

NSW Health 2013, *Rabies and Australian Bat Lyssavirus Infection*, NSW Health, North Sydney, viewed 12 January 2016, www.health.nsw.gov.au/Infectious/factsheets/Pages/Rabies-Australian-Bat-Lyssavirus-Infection.aspx.

OEH 2011a, *Grey-headed Flying-fox vulnerable species listing: NSW Scientific Committee final determination*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/determinations/GreyheadedFlyingFoxVulSpListing.htm.

OEH 2011b, *NSW Code of Practice for Injured, Sick and Orphaned Protected Fauna*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/wildlifelicences/110004FaunaRehab.pdf.

OEH 2012, *NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/wildlifelicences/120026flyingfoxcode.pdf.

OEH 2014, *BioBanking Assessment Methodology 2014*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf.

OEH 2015a, *Flying-foxes* (including fact sheets), Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/animals/flyingfoxes.htm.

OEH 2015b, *Flying-fox Camp Management Policy 2015*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/150070-flyingfoxcamp-policy.pdf.

OEH 2015c, *Flying-fox Camp Management Plan Template 2015*, Office of Environment & Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/150102-flyingfoxcamp-template.pdf.

OEH 2015d, *GHFF threatened species profile*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10697

OEH 2015e, *Policy and procedural guidelines for the mitigation of commercial crop damage by flying-foxes*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/wildlifelicences/140480FlyfoxPol.pdf

OEH 2018, Master Data – NSW NFFMP to Nov 2017 unpublished data.

Parry-Jones, KA and Augee, ML 1992, 'Movements of the Grey-headed Flying Foxes (*Pteropus poliocephalus*) to and from a colony site on the central coast of New South Wales', *Wildlife Research,* vol. 19, pp. 331–40.

Parry-Jones, K and Augee, M 2001 'Factors affecting the occupation of a colony site in Sydney, New South Wales by the Grey-headed Flying-fox *Pteropus poliocephalus* (Pteropodidae)', *Austral Ecology*, vol. 26, pp. 47–55.

Pierson, ED and Rainey, WE 1992, 'The biology of flying foxes of the genus Pteropus: A Review', in: Wilson, DE and GL Graham (eds), *Pacific Island Flying Foxes*: *Proceedings of an International Conservation Conference*, US Department of the Interior – Biological Report no. 90, pp. 1–17.

Qld Health 2016, *Bats and Human Health*, Queensland Health, viewed 12 January 2016, www.health.qld.gov.au/communicablediseases/hendra.asp

Ratcliffe, F 1932, 'Notes on the Fruit Bats (Pteropus spp.) of Australia', *Journal of Animal Ecology*, vol. 1, no. 1, pp. 32–57.

Roberts, B 2005, 'Habitat characteristics of flying-fox camps in south-east Queensland', BSc. Honours Thesis, Griffith University, Brisbane.

Roberts, BJ 2006, *Management of Urban Flying-fox Roosts: Issues of Relevance to Roosts in the Lower Clarence, NSW*, Valley Watch Inc, Maclean.

Roberts, B and Eby, P 2013, Review of past flying-fox dispersal actions between 1990–2013, publisher unknown, viewed 12 January 2016, www.environment.nsw.gov.au/resources/animals/flying-fox-2014-subs/flyingfoxsub-jenny-beatson-part2.pdf.

Roberts, BJ, Catterall, CP, Eby, P and Kanowski, J 2012, 'Long-Distance and Frequent Movements of the Flying-Fox *Pteropus poliocephalus*: Implications for Management', *PLoS ONE*, vol. 7, no. 8, e42532.

Roberts, BJ, Eby, P, Catterall, CP, Kanowski, J and Bennett, G 2011, 'The outcomes and costs of relocating flying-fox camps: insights from the case of Maclean, Australia', in Law, B, Eby, P, Lunney, D and Lumsden, L (eds), *The Biology and Conservation of Australasian Bats*, Royal Zoological Society of NSW, Mosman, NSW, viewed 12 January 2016, www.griffith.edu.au/__data/assets/pdf_file/0006/358440/Roberts-et-al.pdf.

Roberts, B, Kanowski, J and Catterall, C 2006, *Ecology and Management of Flying-fox Camps in an Urbanising Region*, Rainforest CRC Tropical Forest Landscapes, Issue 5, viewed 12 January 2016, www.rainforest-crc.jcu.edu.au/issues/ITFL_flyingfox.pdf.

SEQ Catchments 2012, *Management and Restoration of flying-fox Roosts: Guidelines and Recommendations*, SEQ Catchments Ltd funded by the Australian Government's Caring for Our Country, viewed 12 January 2016, www.environment.nsw.gov.au/resources/animals/flying-fox-2014-subs/flyingfoxsub-jenny-beatson-part3.pdf.

Shinwari, MW, Annand, EJ, Driver, L, Warrilow, D, Harrower, B, Allcock, RJN, Pukallus, D, Harper J, Bingham, J, Kung, N and Diallo, IS 2014, 'Australian bat lyssavirus infection in two horses', *Veterinary Microbiology*, vol. 173, pp. 224–231.

Snoyman S, Jasmina M & Brown C 2012, 'Nursing females are more prone to heat stress: Demography matters when managing flying-foxes for climate change', Applied Animal Behaviour Science, vol 142, pp. 90-97.

Southerton, SG, Birt, P, Porter, J and Ford, HA 2004, 'Review of gene movement by bats and birds and its potential significance for eucalypt plantation forestry', *Australian Forestry*, vol. 67, no. 1, pp. 45–54.

Stanvic, S, McDonald, V and Collins, L 2013, *Managing heat stress in flying-foxes colonies*, viewed 12 January 2016, www.fourthcrossingwildlife.com/HeatStress-StanvicMcDonaldCollins.pdf.

Tait, J, Perotto-Baldivieso, HL, McKeown, A and Westcott, DA 2014, 'Are Flying-Foxes Coming to Town? Urbanisation of the Spectacled Flying-Fox (*Pteropus conspicillatus*) in Australia', *PLoS ONE*, vol. 9, no. 10, e109810, doi:10.1371/journal.pone.0109810.

Tidemann, C, Eby, P, Parry-Jones, K and Vardon, M 1999, *The Action Plan for Australian Bats: Grey-headed Flying-fox*, Environment Australia, www.environment.gov.au/node/14622.

Tolga Bat Hospital, *Wildlife Friendly Fencing Project*, Tolga Bat Hospital partly funded by grants from WWF and Australian Government Caring for Our Country, viewed 12 January, 2016, www.wildlifefriendlyfencing.com/WFF/Home.html.

Vardon, MJ and Tidemann, CR 1999, 'Flying-foxes (*Pteropus alecto* and *P. scapulatus*) in the Darwin region, north Australia: patterns in camp size and structure', *Australian Journal of Zoology*, vol. 47, pp. 411–423.

Vardon, MJ, Brocklehurst, PS, Woinarski, JCZ, Cunningham, RB, Donnelly, CF and Tidemann, CR 2001, 'Seasonal habitat use by flying-foxes, *Pteropus alecto* and *P. Scapulatus* (Megachiroptera), in monsoonal Australia', *Journal of Zoology* London, vol. 253, pp. 523–535.

Webb, N and Tidemann, C 1995, 'Hybridisation between black (*Pteropus alecto*) and grey-headed (*P. poliocephalus*) flying-foxes (Megachiroptera: Pteropodidae)', *Australian Mammalogy*, vol. 18, pp. 19–26.

Webb, NJ and Tidemann, CR 1996, 'Mobility of Australian flying-foxes, *Pteropus* spp. (Megachiroptera): evidence from genetic variation', *Proceedings of the Royal Society London Series B*, vol. 263, pp. 497–502.

Welbergen, JA 2014, 'Canaries in the coalmine: flying-foxes and extreme heat events in a warming climate', presentation at the Griffith Climate Change Seminar, July 2014, www.griffith.edu.au/research/research-excellence/griffith-climate-change-response-program/program/?a=628188.

Welbergen, JA, Klose, SM, Markus, N and Eby, P 2008, 'Climate change and the effects of temperature extremes on Australian flying-foxes', *Proceedings of the Royal Society of London B: Biological Sciences*, vol. 275, no. 1633, pp.419–425, viewed 12 January 2016, rspb.royalsocietypublishing.org/content/275/1633/419.short.

Westcott, DA, Dennis, AJ, Bradford, MG, McKeown, A and Harrington, GN 2008, 'Seed dispersal processes in Australia's Wet Tropics rainforests', in Stork, N and Turton, S, *Living in a dynamic tropical forest landscape*, Blackwells Publishing, Malden, pp. 210–223.

Westcott, DA, McKeown, A, Murphy, HT and Fletcher, CS 2011, *A monitoring method for the Grey-headed Flying-fox,* Pteropus poliocephalus, CSIRO, Queensland, viewed 12 January 2016, www.environment.gov.au/biodiversity/threatened/species/pubs/310112-monitoring-methodology.pdf.

Zurbuchen, A, Landert, L, Klaiber, J, Muller, A, Hein, S and Dorn, S 2010, 'Maximum foraging ranges in solitary bees: only few individuals have the capability to cover long-foraging distances', *Biological Conservation,* vol. 142, no. 3, pp. 669–676.

Appendix 1: Expert assessment requirements

The Plan template 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.

Appendix 2 Legislation

State

Flying-fox Camp Management Policy 2015

The Flying-fox Camp Management Policy 2015 (the Policy) has been developed to empower land managers, primarily local councils, to work with their communities to manage flying-fox camps effectively. It provides the framework within which DPIE 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.

Flying-fox Camp Management 2018

DPIE has prepared a Code of Practice under the *Biodiversity Conservation Regulation 2017* authorising camp management actions on public land. The code defines standards for effective and humane management of flying-fox camps.

Camp management actions can only be implemented under the Code in accordance with a Camp Management Plan endorsed by the Environment Agency Head (i.e. DPIE).

The objective of the code is to enable camp managers to act quickly if flying-fox camps are causing a concern on public land. If camp management actions are consistent with the code, a Biodiversity Conservation licence will not be required.

Biodiversity Conservation Act 2016

The purpose of the *Biodiversity Conservation Act 2016* (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development including conserving biodiversity, maintaining the diversity and quality of ecosystems, regulating human interactions with wildlife, and supporting conservation and threat abatement action to slow the rate of biodiversity loss and conserve threatened species and ecological communities in nature.

The Grey-headed Flying-fox is listed as a threatened species under the BC Act.

Part 2 Division 3 of the BC Act provides for the issuing of Biodiversity Conservation Licences to authorise the doing of an act likely to result in one or more of the following:

a. harm or attempted harm to any animal that is of a threatened species or is part of threatened ecological community

b. harm or attempted harm, dealing in, or liberating a protected animal

c. the picking of any plant that is of a threatened species or is part of threatened ecological community

d. picking or dealing in protected plants

e. damage to declared areas of outstanding biodiversity value

f. damage to any habitat of a threatened species or threatened ecological community.

Part 7 of the BC Act provides for the biodiversity assessment and approvals required under the *Environmental Planning and Assessment Act 1979* for development other than complying development, activities and state significant development and infrastructure.

An assessment of impacts is required for any threatened species or threatened ecological community, or their habitats, that are likely to be harmed by the doing of an act proposed in the Plan.

Note: that the definition of 'harm' includes kill, injure or capture the animal, but does not include harm by changing the habitat of the animal, and attempt to harm an animal includes hunting or pursuing, or using anything, for the purpose of harming the animal. The definition of 'pick' includes to gather, take, cut, remove from the ground, destroy, poison, crush or injure the plant or any part of the plant. The definition of habitat includes an area periodically or occasionally occupied by a species or ecological community and the biotic and abiotic components of an area.

Local Government Act 1993

The primary purpose of this Act is to provide the legal framework for an effective, efficient and environmentally responsible, open system of local government. Most relevant to flying-fox management is that it also provides encouragement for the effective participation of local communities in the affairs of local government and sets out guidance on the use and management of community land which may be applicable to land which requires management of flying-foxes.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the conservation of nature, objects, places or features of cultural value and the management of land reserved under this Act. The Act protects Aboriginal objects and declared Aboriginal Places. An Aboriginal Heritage Impact Permit may be required under this Act to authorise camp management actions that may harm Aboriginal objects a declared Aboriginal Places.

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 purposes 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 NSW Department of Planning and Environment.

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

Development given consent under Part 4 or activities assessed under Part 5 of the EP&A Act do not require licensing under the BC Act. Consent and determining authorities are required to consider the impacts of such proposals on threatened species, threatened ecological communities, and their habitats in accordance with Part 7 of the BC Act.

Where development consent under Part 4 or assessment under Part 5 of the EP&A Act is not required, a licence under the BC Act may be required to authorise the doing of an act that harms protected animals, threatened species, or threatened ecological community, or which damages the habitat of a threatened species or ecological community. This includes the doing of an act likely to harm any flying-fox or damaging the habitat of grey-headed flying-foxes.

Where a proposal to manage a flying-fox camp involves the cutting down, destruction, lopping or removal of a substantial part of a tree or other vegetation that is not covered by a development consent or assessment under Part 5 it may still require authorisation. Depending on the land on which the vegetation occurs and the character of the vegetation, it may require an approval or a permit under the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* (SEPP) or an approval under the *Local Land Services Act 2013*.

Where flying-fox camps occur or impact on private land, private land owners are advised to contact their local council to explore management options and the appropriate approval processes for addressing arising issues.

State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

This policy aims to protect the biodiversity, and amenity values of trees, and other vegetation in non-rural areas of the State. A person must not cut down, fell, up root, kill, poison, ringbark, burn or otherwise destroy the vegetation, or lop or otherwise remove a substantial part of the vegetation to which this Policy applies without a permit granted by council, or in the case of vegetation clearing exceeding the biodiversity offset thresholds (as stated in Part 7 of the *Biodiversity Conservation Regulation 2017*), approval by the Native Vegetation Panel.

Proponents will need to consider whether the SEPP (Vegetation in Non-Rural Areas) applies to their proposal, and if any approvals under the BC Act.

Commonwealth

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth's EPBC Act provides protection for the environment, specifically matters of national environmental significance (MNES). A referral to the Commonwealth DoE 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. DoE has developed the Referral guideline for management actions in GHFF and SFF 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 ≥10,000 GHFF in more than one year in the last 10 years, or
- been occupied by more than 2500 GHFF permanently or seasonally every year for the last 10 years.

Provided that management at nationally important camps follows the mitigation standards below, DoE has determined that a significant impact to 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 DoEE will be required.

Mitigation standards

The action must not occur if the camp contains females that are in the late stages of pregnancy or have dependent young that cannot fly on their own.

The action must not occur during or immediately after climatic extremes (HSE, cyclone event), or during a period of significant food stress.

Disturbance must be carried out using non-lethal means, such as acoustic, visual and/or physical disturbance or use of smoke.

Disturbance activities must be limited to a maximum of 2.5 hours in any 12-hour period, preferably at or before sunrise or at sunset.

Trees are not felled, lopped or have large branches removed when flying-foxes are in or near to a tree and likely to be harmed.

The action must be supervised by a person with knowledge and experience relevant to the management of flying-foxes and their habitat, who can identify dependent young and is aware of climatic extremes and food stress events. This person must make an assessment of the relevant conditions and advise the proponent whether the activity can go ahead consistent with these standards.

The action must not involve the clearing of all vegetation supporting a nationally-important flying-fox camp. Sufficient vegetation must be retained to support the maximum number of flying-foxes ever recorded in the camp of interest.

These standards have been incorporated into mitigation measures detailed in Section 10.3. If actions cannot comply with these mitigation measures, referral for activities at nationally important camps is likely to be required.

Appendix 3 Flying-fox ecology and behaviour

Ecological role

Flying-foxes, along with some birds, make a unique contribution to ecosystem health through their ability to move seeds and pollen over long distances (Southerton et al. 2004). This contributes directly to the reproduction, regeneration and viability of forest ecosystems (DoE 2016a). It is estimated that a single flying-fox can disperse up to 60,000 seeds in one night (ELW&P 2015). Some plants, particularly Corymbia spp., have adaptations suggesting they rely more heavily on nocturnal visitors such as bats for pollination than daytime pollinators (Southerton et al. 2004).

GHFF may travel 100 km in a single night with a foraging radius of up to 50 km from their camp (McConkey et al. 2012) and have been recorded travelling over 500 km in two days between camps (Roberts et al. 2012). In comparison bees, another important pollinator, move much shorter foraging distances of generally less than one kilometre (Zurbuchen et al. 2010).

Long-distance seed dispersal and pollination makes flying-foxes critical to the long-term persistence of many plant communities (Westcott et al. 2008; McConkey et al. 2012), including eucalypt forests, rainforests, woodlands and wetlands (Roberts et al. 2006). Seeds that are able to germinate away from their parent plant have a greater chance of growing into a mature plant (EHP 2012). Long-distance dispersal also allows genetic material to be spread between forest patches that would normally be geographically isolated (Parry-Jones & Augee 1992; Eby 1991; Roberts 2006). This genetic diversity allows species to adapt to environmental change and respond to disease pathogens. Transfer of genetic material between forest patches is particularly important in the context of contemporary fragmented landscapes.

Flying-foxes are considered 'keystone' species given their contribution to the health, longevity and diversity among and between vegetation communities. These ecological services ultimately protect the long-term health and biodiversity of Australia's bushland and wetlands. In turn, native forests act as carbon sinks, provide habitat for other fauna and flora, 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 (EHP 2012; ELW&P 2015).

Black flying-fox (*Pteropus alecto*)

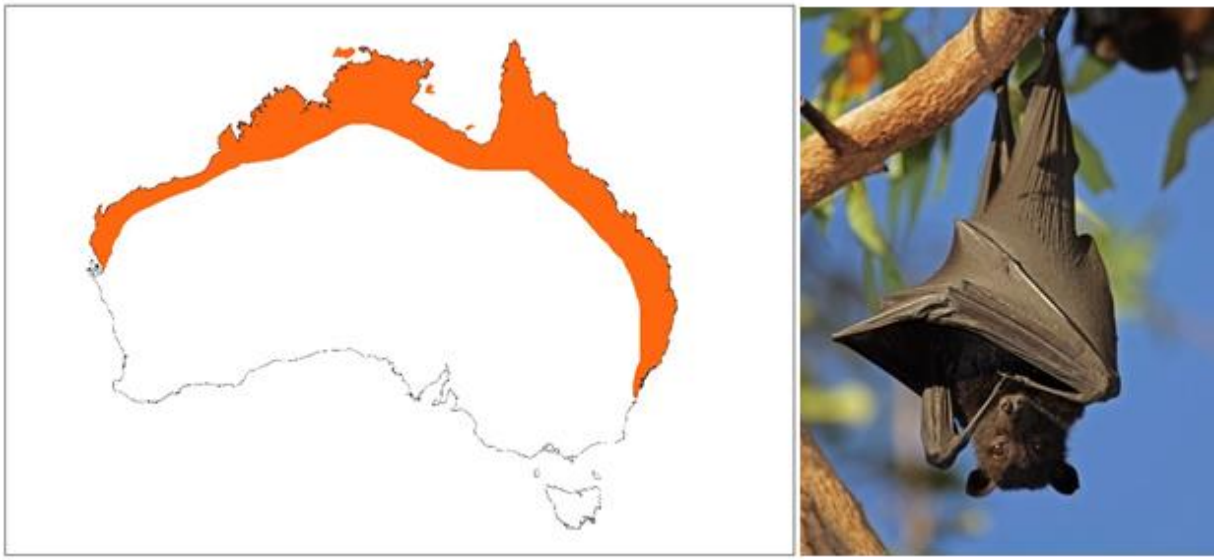


Figure 7 Black flying-fox indicative species distribution, adapted from OEH 2015a

The black flying-fox (BFF) (Figure) has traditionally occurred throughout coastal areas from Shark Bay in Western Australia, across Northern Australia, down through Queensland and into NSW (Churchill 2008; OEH 2015a). Since it was first described there has been a substantial southerly shift by the BFF (Webb & Tidemann 1995). This shift has consequently led to an increase in indirect competition with the threatened GHFF, which appears to be favouring the BFF (DoE 2016a).

They forage on the fruit and blossoms of native and introduced plants (Churchill 2008; OEH 2015a), including orchard species at times.

BFFs are largely nomadic animals with movement and local distribution influenced by climatic variability and the flowering and fruiting patterns of their preferred food plants. Feeding commonly occurs within 20 km of the camp site (Markus & Hall 2004).

BFFs usually roost beside a creek or river in a wide range of warm and moist habitats, including lowland rainforest gullies, coastal stringybark forests and mangroves. During the breeding season camp sizes can change significantly in response to the availability of food and the arrival of animals from other areas.

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

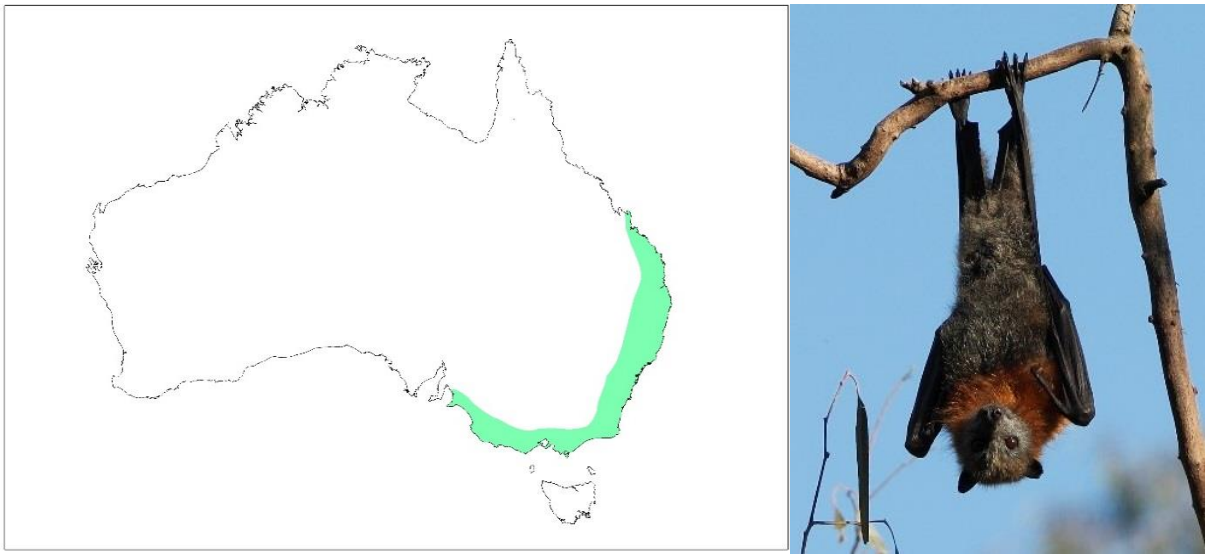


Figure 8 Grey-headed flying-fox indicative species distribution, adapted from OEH 2015a

The GHFF (Figure) is found throughout eastern Australia, generally within 200 km of the coast, from Finch Hatton in Queensland to Melbourne, Victoria (OEH 2015d). This species now ranges into South Australia and has been observed in Tasmania (DoE 2016a). 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 throughout urban and agricultural areas where food trees exist and will raid orchards at times, especially when other food is scarce (OEH 2015a).

All the GHFF in Australia are regarded as one population that moves around freely within its entire national range (Webb & Tidemann 1996; DoE 2015). GHFF may travel up to 100 km in a single night with a foraging radius of up to 50 km from their camp (McConkey et al. 2012). They have been recorded travelling over 500 km over 48 hours when moving from one camp to another (Roberts et al. 2012). 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 flying-foxes continue to return to small urban bushland blocks that may be remnants of historically-used larger tracts of vegetation.

The GHFF population has a generally annual southerly movement in spring and summer, with their return to the coastal forests of north-east NSW and south-east Queensland in winter (Ratcliffe 1932; Eby 1991; Parry-Jones & Augee 1992; Roberts et al. 2012). This results in large fluctuations in the number of GHFF in NSW, ranging from as few as 20% of the total population in winter up to around 75% of the total population in summer (Eby 2000). They are widespread throughout their range during summer, but in spring and winter are uncommon in the south. In autumn they occupy primarily coastal lowland camps and are uncommon inland and on the south coast of NSW (DECCW 2009).

There is evidence the GHFF population declined by up to 30% between 1989 and 2000 (Birt 2000;

Richards 2000 cited in OEH 2011a). There is a wide range of ongoing threats to the survival of the GHFF, including habitat loss and degradation, deliberate destruction associated with the commercial horticulture industry, conflict with humans, infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.) and competition and hybridisation with the BFF (DECCW 2009). For these reasons it is listed as vulnerable to extinction under NSW and federal legislation.

Little red flying-fox (*Pteropus scapulatus*)

Figure 9 Little red flying-fox indicative species distribution, adapted from OEH 2015a

The little red flying-fox (LRFF) (Figure) is widely distributed throughout northern and eastern Australia, with populations occurring across northern Australia and down the east coast into Victoria.

The LRFF forages almost exclusively on nectar and pollen, although will eat fruit at times and occasionally raids orchards (Australian Museum 2010). LRFF often move sub-continental distances in search of sporadic food supplies. The LRFF has the most nomadic distribution, strongly influenced by availability of food resources (predominantly the flowering of eucalypt species)(Churchill 2008), which means the duration of their stay in any one place is generally very short.

Habitat preferences of this species are quite diverse and range from semi-arid areas to tropical and temperate areas, and can include sclerophyll woodland, melaleuca swamplands, bamboo, mangroves and occasionally orchards (IUCN 2015). LRFF are frequently associated with other *Pteropus* 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).

Throughout its range, populations within an area or occupying a camp can fluctuate widely. There is a general migration pattern in LRFF, whereby large congregations of over one million

individuals can be found in northern camp sites (e.g. Northern Territory, North Queensland) during key breeding periods (Vardon & Tidemann 1999). LRFF travel south to visit the coastal areas of south-east Queensland and NSW during the summer months. Outside these periods LRFF undertake regular movements from north to south during winter–spring (July–October) (Milne & Pavey 2011).

Reproduction

Black and grey-headed flying-foxes

Males initiate contact with females in January with peak conception occurring around March to April/May; this mating season represents the period of peak camp occupancy (Markus 2002). Young (usually a single pup) are born six months later from September to November (Churchill 2008). The birth season becomes progressively earlier, albeit by a few weeks, in more northerly populations (McGuckin & Blackshaw 1991), however out of season breeding is common with births occurring later in the year.

Young are highly dependent on their mother for food and thermoregulation. Young are suckled and carried by the mother until approximately four weeks of age (Markus & Blackshaw 2002). At this time, they are left at the camp during the night in a crèche until they begin foraging with their mother in January and February (Churchill 2008) and are usually weaned by six months of age around March. Sexual maturity is reached at two years of age with a life expectancy up to 20 years in the wild (Pierson & Rainey 1992).

As such, the critical reproductive period for GHFF is generally from August (when females are in final trimester) to the end of peak conception around April. Dependent pups are usually present from September to March (Figure).

Little red flying-fox

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

.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GHFF	.	.	.	.	.	.	.	.	.	.	.	.
BFF	.	.	.	.	.	.	.	.	.	.	.	.
LRFF	.	.	.	.	.	.	.	.	.	.	.	.

Peak conception
Final trimester
Peak birthing
Crèching (young left at roost)
Lactation

Figure 10 Indicative flying-fox reproductive cycle.

Note that LRFF rarely birth and rear young in NSW. The breeding season of all species is variable between years and location, and expert assessment is required to accurately determine phases in the breeding cycle and inform appropriate management timing.

Heat stress events

Flying-foxes suffer from heat stress when the ambient temperature exceeds the physiological limits flying-foxes can endure for maintaining a comfortable body temperature (Bishop 2014). Flying-foxes are susceptible to heat stress due to their inability to sweat (Snoyman et al 2012), therefore they need to expend energy on cooling mechanisms such as fanning. BFF are considered to be more susceptible to HSE than GHFF due to the southern expansion of their range with temperature extremes increasing in severity with latitude in eastern Australia (Welbergen et al 2008).

Appendix 4 Human and animal health

Human and animal health

Flying-foxes, like many animals, carry pathogens that may pose human health risks. Many of these are viruses which cause only asymptomatic infections in flying-foxes themselves but may cause significant disease in humans or 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 below.

Excluding those people whose occupations require contact with bats, such as wildlife carers and vets, human exposure to ABLV, HeV and Menangle virus, their transmission and frequency of infection is extremely rare. HeV infection in humans requires transfer from an infected intermediate equine host (i.e. close contact with an infected horse) and spread of the virus directly from bats to humans has not been reported.

These diseases are also easily prevented through vaccination, personal protective equipment, safe flying-fox handling (by trained and vaccinated personnel only) and appropriate horse husbandry. Therefore, despite the fact that human infection with these agents can be fatal, the probability of infection is extremely low, and the overall public health risk is also judged to be low (Qld Health 2016).

Disease and flying-fox management

A recent study at several camps before, during and after disturbance (Edson et al. 2015) showed no statistical association between HeV prevalence and flying-fox disturbance. However, the consequences of chronic or ongoing disturbance and harassment and its effect on HeV infection were not within the scope of the study and are therefore unknown.

The effects of stress are linked to increased susceptibility and expression of disease in both humans (AIHW 2012) and animals (Henry & Stephens-Larson 1985; Aich et. al. 2009), including reduced immunity to disease.

Therefore, it can be assumed that management actions which 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.

Furthermore, management actions or natural 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.
- resulting in abortions and/or dropped young if inappropriate management 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 potential to cause injury which would increase the likelihood of the community coming into contact with injured/dying or deceased 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.

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 2013) 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 2013).

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 2013).

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 2013).

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 classical 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-vaccination and have their level of protection regularly assessed. Like classical 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

Flying-foxes are the natural host for Hendra virus (HeV), which can be transmitted from flying-foxes to horses. Infected horses sometimes amplify the virus and can then transmit it to other horses, humans and on two occasions, dogs (DPI 2014). There is no evidence that the virus can be passed directly from flying-foxes to humans or to dogs (AVA 2015). Clinical studies have shown cats, pigs, ferrets and guinea pigs can carry the infection (DPI 2015a).

Although the virus is periodically present in flying-fox populations across Australia, the likelihood of horses becoming infected is low and consequently human infection is extremely rare. Horses are thought to contract the disease after ingesting forage or water contaminated primarily with flying-fox urine (CDC 2014).

Humans may contract the disease after close contact with an infected horse. HeV 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 2014). Since 1994, 81 horses have died, and four of the seven people infected with HeV have lost their lives (DPI 2014).

Previous studies have shown that HeV spillover events have been associated with foraging flying-foxes rather than camp locations. Therefore, risk is 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 2014), as can appropriate horse husbandry (e.g. covering food and water troughs, fencing flying-fox foraging trees in paddocks, etc.).

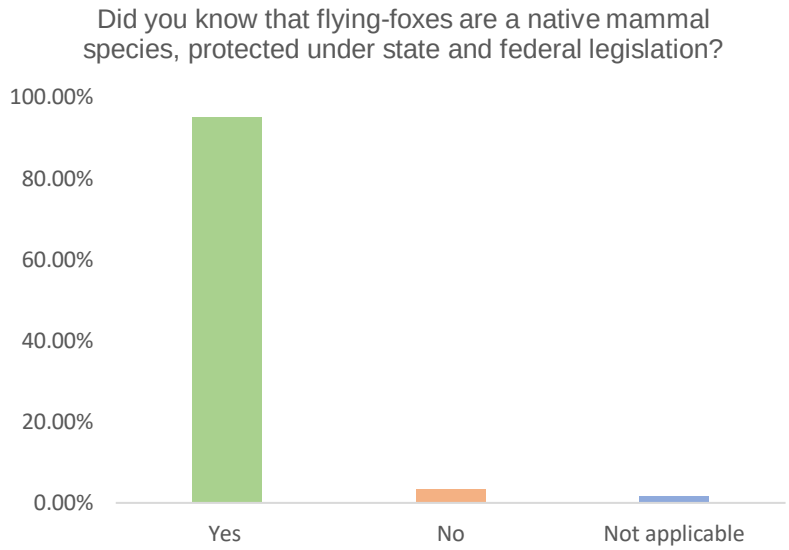
Although all human cases of HeV to date have been contracted from infected horses and direct transmission from bats to humans has not yet been reported, particular care should be taken by select occupational groups that could be uniquely exposed. For example, persons who may be exposed to high levels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

Appendix 5 Protected matters

Refer to separable linked report.

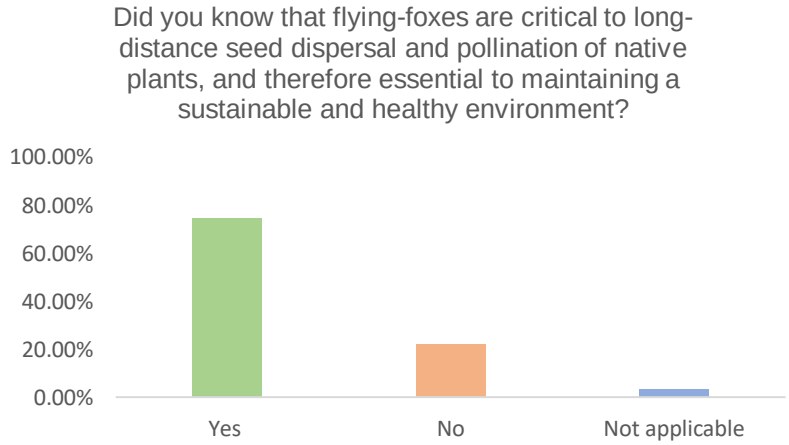
Appendix 6 Survey results

Question 1



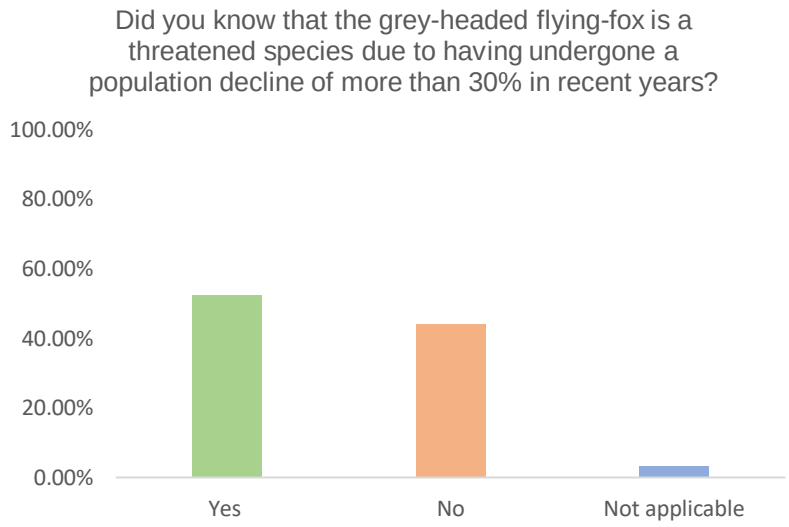
Answer	Responses	%
Yes	56	94.92
No	2	3.39
Not applicable	1	1.69

Question 2



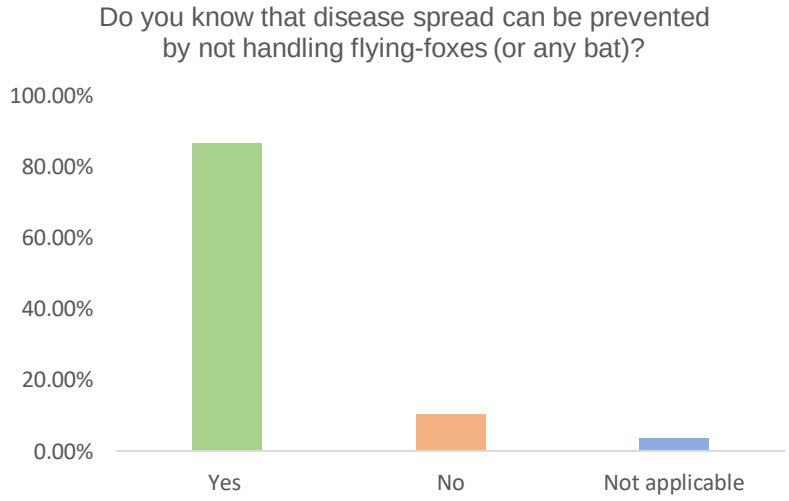
Answer	Responses	%
Yes	44	74.5
No	13	22.03
Not applicable	2	3.39

Question 3



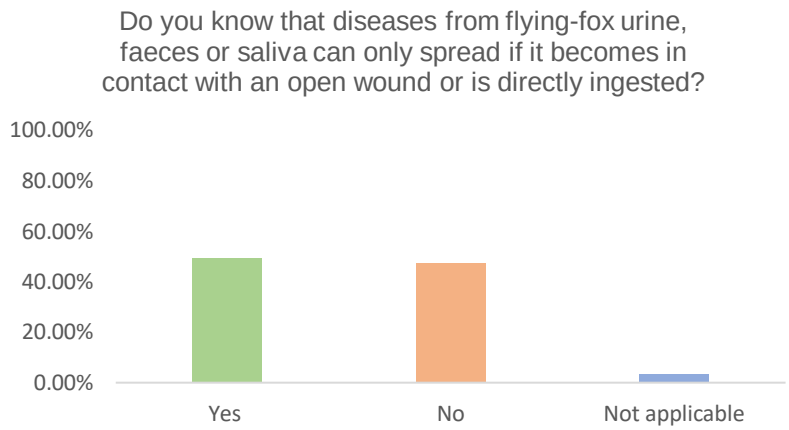
Answer	Responses	%
Yes	31	52.54
No	26	44.07
Not applicable	2	3.39

Question 4



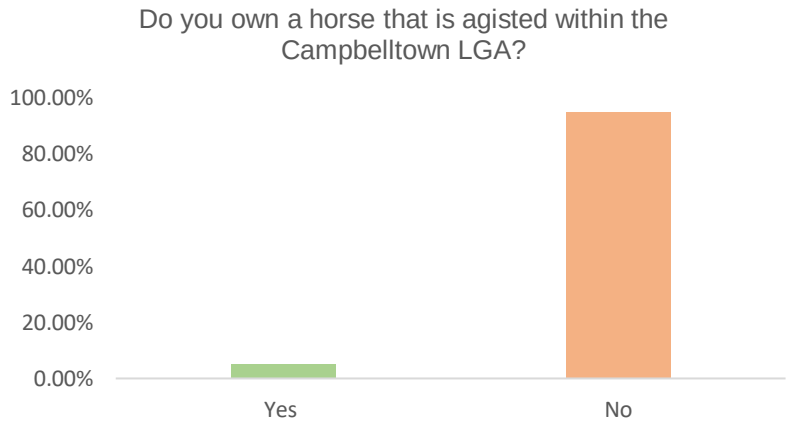
Answer	Responses	%
Yes	51	86.44
No	6	10.17
Not applicable	2	3.39

Question 5



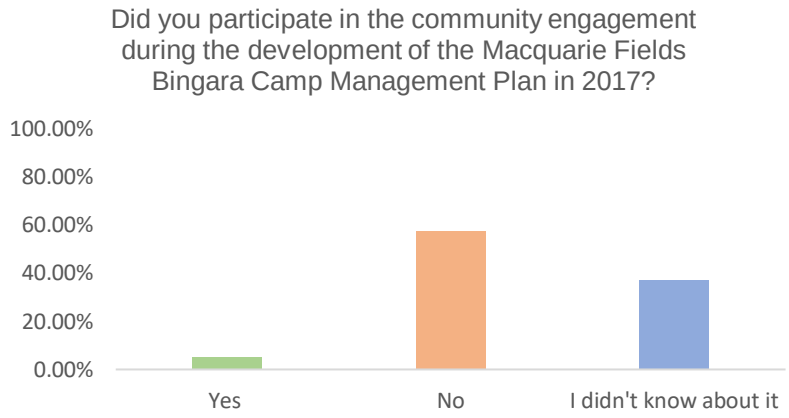
Answer	Responses	%
Yes	29	49.15
No	28	47.46
Not applicable	2	3.39

Question 6



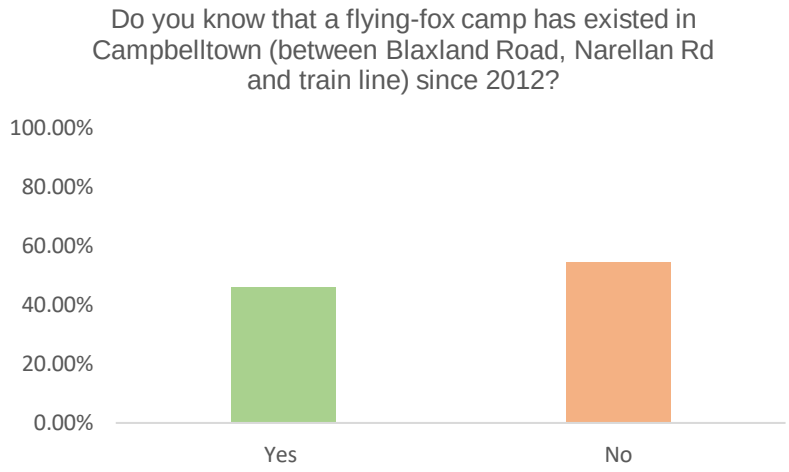
Answer	Responses	%
Yes	3	5.08
No	56	94.92

Question 7



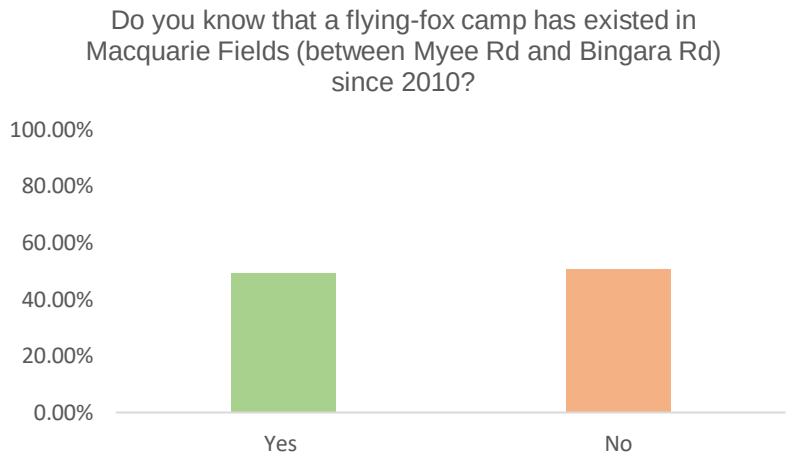
Answer	Responses	%
Yes	3	5.08
No	34	57.63
I didn't know about it	22	37.29

Question 8



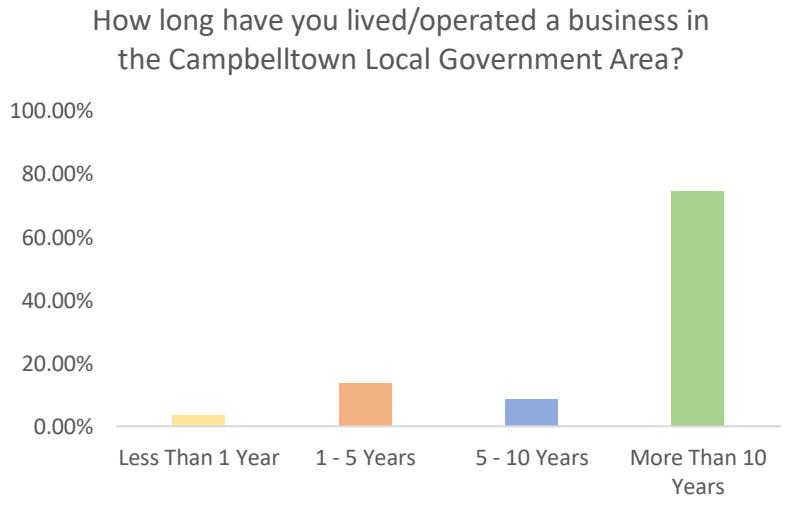
Answer	Responses	%
Yes	27	45.76
No	32	54.24

Question 9



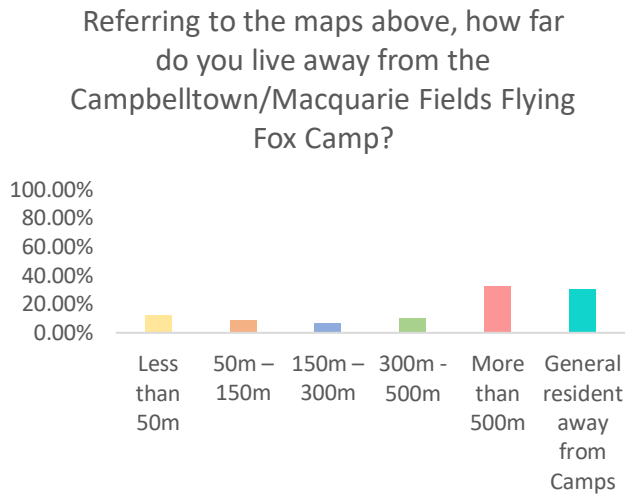
Answer	Responses	%
Yes	29	49.15
No	30	50.85

Question 10



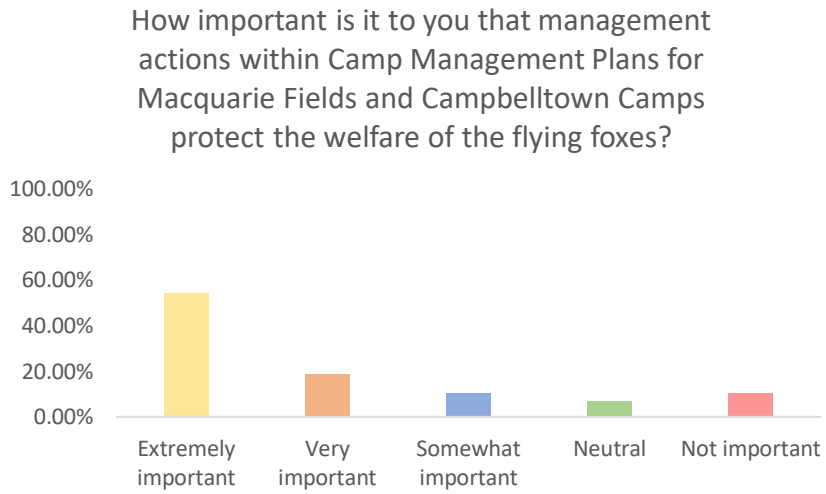
Answer	Responses	%
Less Than 1 Year	2	3.39
1 - 5 Years	8	13.56
5 - 10 Years	5	8.47
More Than 10 Years	44	74.58

Question 11



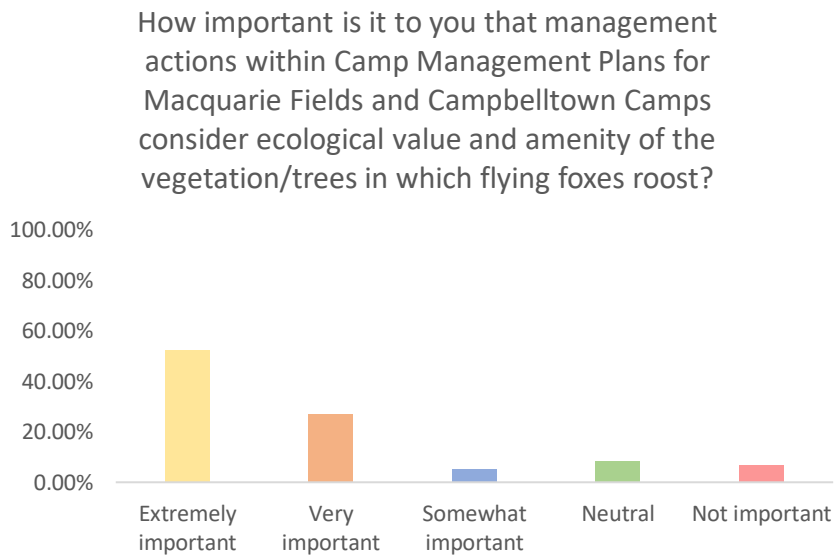
Answer	Responses	%
Less than 50m	7	11.86
50m – 150m	5	8.47
150m – 300m	4	6.78
300m - 500m	6	10.17
More than 500m	19	32.20
General resident away from Camps	18	30.51

Question 12



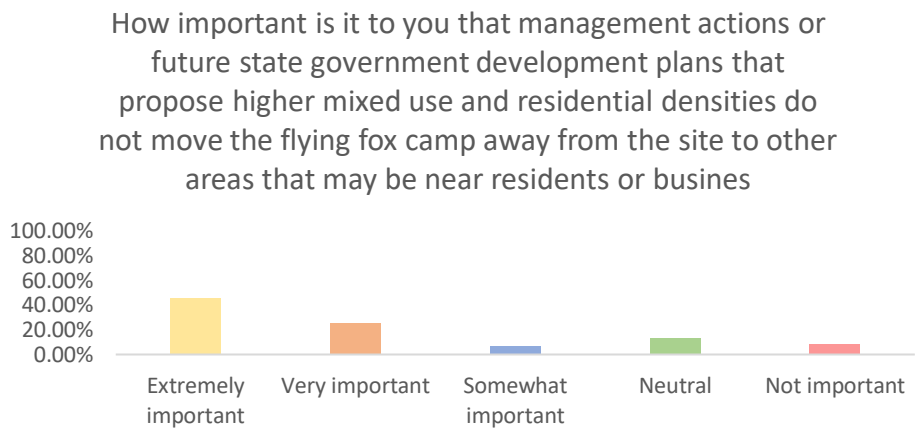
Answer	Responses	%
Extremely important	32	54.24
Very important	11	18.64
Somewhat important	6	10.17
Neutral	4	6.78
Not important	6	10.17

Question 13



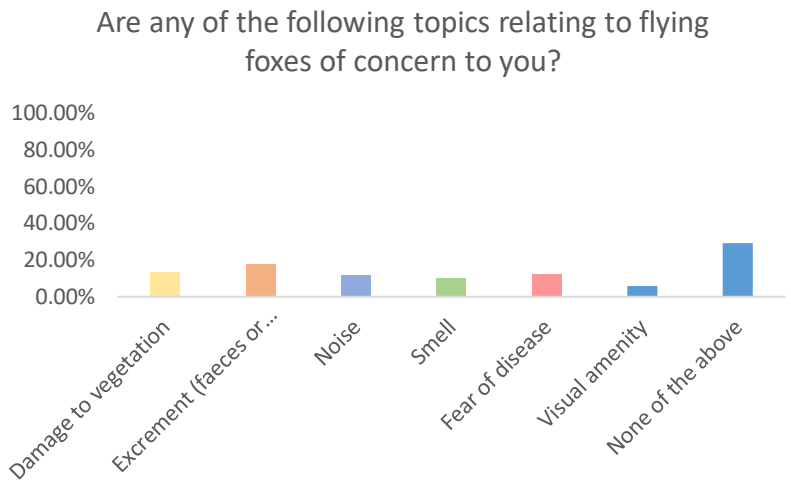
Answer	Responses	%
Extremely important	31	52.54
Very important	16	27.12
Somewhat important	3	5.08
Neutral	5	8.47
Not important	4	6.78

Question 14



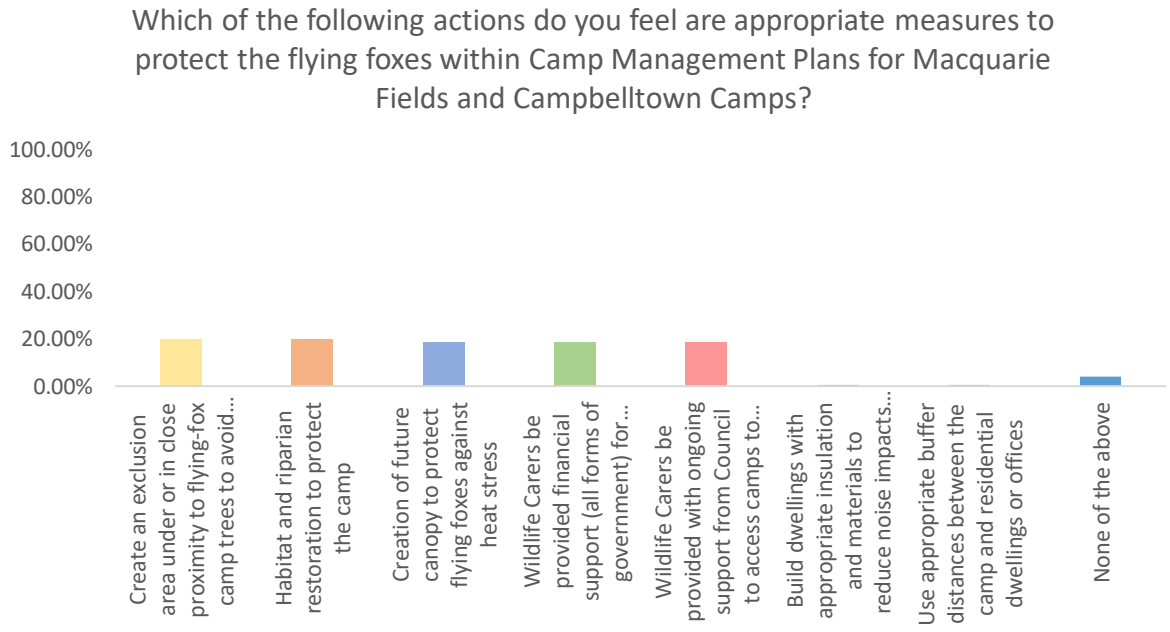
Answer	Responses	%
Extremely important	27	45.76
Very important	15	25.42
Somewhat important	4	6.78
Neutral	8	13.56
Not important	5	8.47

Question 15



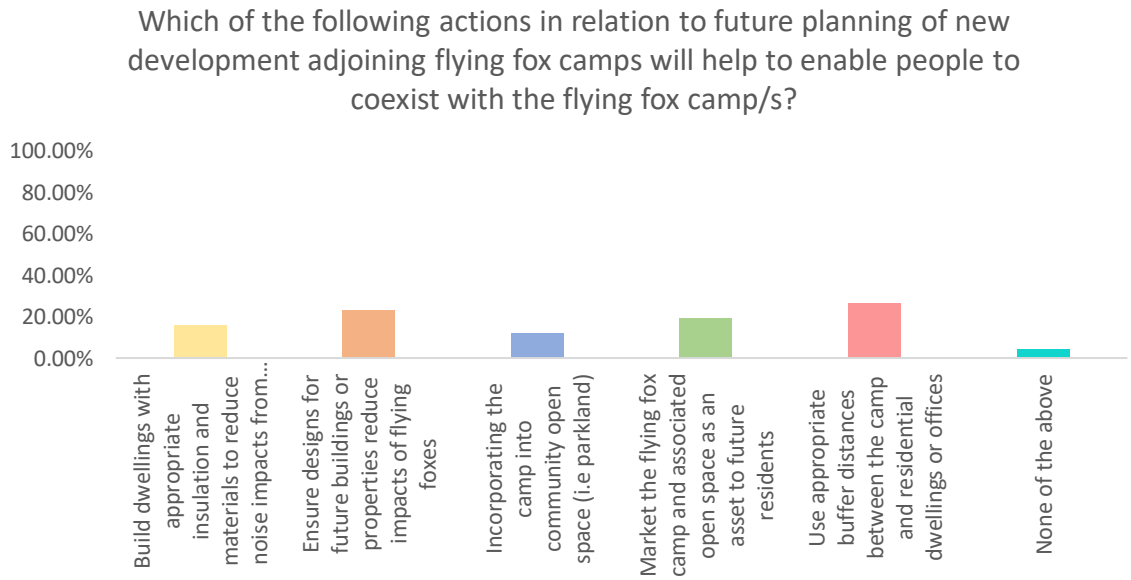
Answer	Responses	%
Damage to vegetation	16	13.33
Excrement (faeces or urine) on property	21	17.50
Noise	14	11.67
Smell	12	10.00
Fear of disease	15	12.50
Visual amenity	7	5.83
None of the above	35	29.17

Question 16



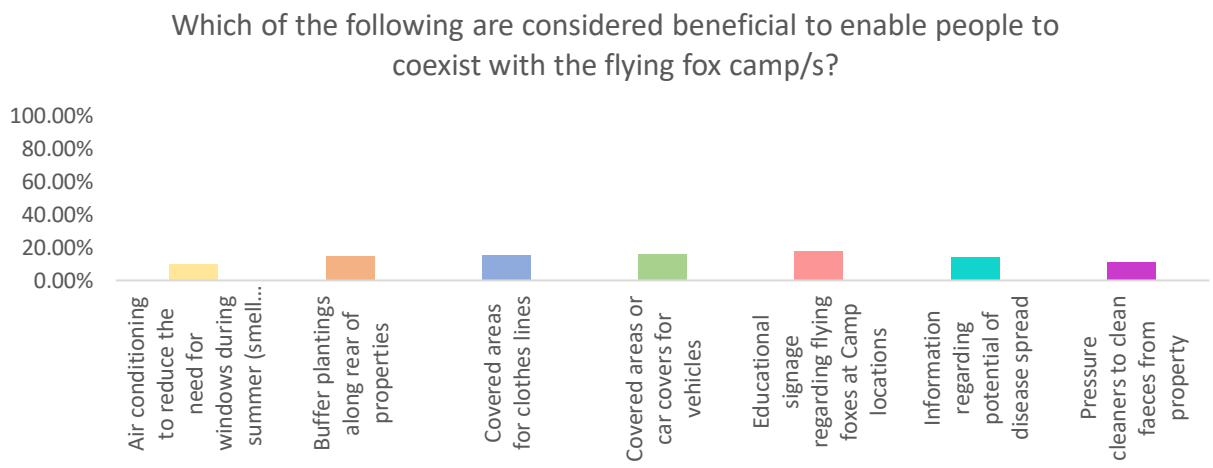
Answer	Responses	%
Create an exclusion area under or in close proximity to flying-fox camp trees to avoid unnecessary disturbance	41	19.90
Habitat and riparian restoration to protect the camp	41	19.90
Creation of future canopy to protect flying foxes against heat stress	38	18.45
Wildlife carers be provided financial support (all forms of government) for rehabilitating sick or injured flying foxes	38	18.45
Wildlife carers be provided with ongoing support from Council to access camps to treat sick or injured flying foxes	38	18.45
Build dwellings with appropriate insulation and materials to reduce noise impacts from bats	1	0.49
Use appropriate buffer distances between the camp and residential dwellings or offices	1	0.49
None of the above	8	3.88

Question 17



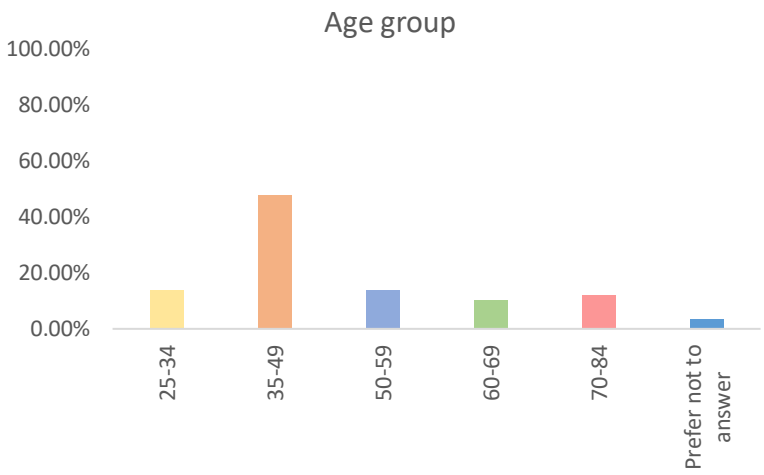
Answer	Responses	%
Build dwellings with appropriate insulation and materials to reduce noise impacts from bats	27	15.52
Ensure designs for future buildings or properties reduce impacts of flying foxes	40	22.99
Incorporating the camp into community open space (i.e parkland)	21	12.07
Market the flying fox camp and associated open space as an asset to future residents	33	18.97
Use appropriate buffer distances between the camp and residential dwellings or offices	46	26.44
None of the above	7	4.02

Question 18



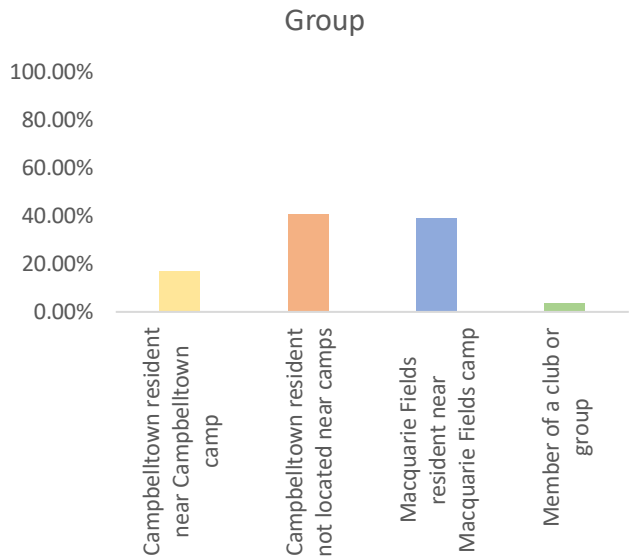
Answer	Responses	%
Air conditioning to reduce the need for windows during summer (smell and noise)	23	9.91
Buffer plantings along rear of properties	35	15.09
Covered areas for clothes lines	36	15.52
Covered areas or car covers for vehicles	37	15.95
Educational signage regarding flying foxes at Camp locations	42	18.10
Information regarding potential of disease spread	33	14.22
Pressure cleaners to clean faeces from property	26	11.21

Question 19



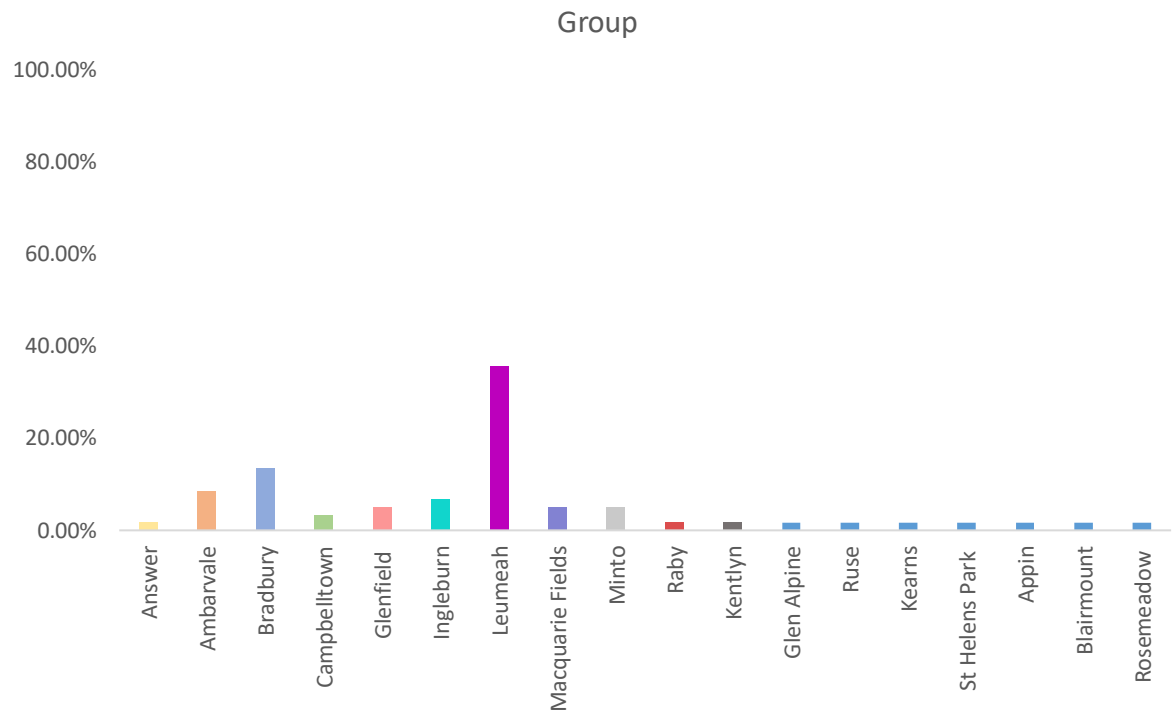
Answer	Responses	%
25-34	8	13.56
35-49	28	47.46
50-59	8	13.56
60-69	6	10.17
70-84	7	11.86
Prefer not to answer	2	3.39

Question 20



Answer	Responses	%
Campbelltown resident near Campbelltown camp	10	16.95
Campbelltown resident not located near camps	24	40.68
Macquarie Fields resident near Macquarie Fields camp	23	38.98
Member of a club or group	2	3.39

Question 21



Answer	Responses	%
Ambarvale	1	1.69
Bradbury	5	8.47
Campbelltown	8	13.56
Glenfield	2	3.39
Ingleburn	3	5.08
Leumeah	4	6.78
Macquarie Fields	21	35.59
Minto	3	5.08
Raby	3	5.08
Kentlyn	1	1.69
Glen Alpine	1	1.69
Ruse	1	1.69
Kearns	1	1.69
St Helens Park	1	1.69
Appin	1	1.69
Blairmount	1	1.69
Rosemeadow	1	1.69
Leppington	1	1.69

Is there any additional information you would like Council to know about the Macquarie Fields and Campbelltown camps that has not been captured as part of this survey?

The Campbelltown camp currently uses Bow Bowing lake at Macarthur Heights on a nightly basis as a souce of drinking water. The lake is low due to drought & no rain. The lake water levels are also being dramatically reduced due to the construction company in the area using the lake water to wet down several construction sites in the suburb. The flying foxes with suffer if there is no drinking water available.
I don't know about Macquarie Fields, but, there are no houses near the camp and there doesn't need to be any in that location. The nearby roads are already at capacity. And don't pretend that being near a train station will make a difference.
Just help them on hot days
I didnt even know we had flying fox camps until this survey
As appartment residents in Campbelltown, we don't have any problems with flying foxes. Please save the colonies.
We have a bat/flying fox that roosts in a palm tree at the back of our fence. It is not a problem for our family, we are educated on the dangers of diseases of bats/flying foxes. If we walk past it will fly away, we leave it alone but love its little sqwarks and sounds it makes.
I do have concerns with a neighbour who continually disrupts the bats during the day, banging on frypans and the fence to move them along, which of course does nothing but upset the bats. If you wish to discuss this further I am available on or email
i wish you could move them elsewhere. they are disgusting and gave killed yhe beautiful trees and scared away the beautiful birds we use to get. im sick if the shit all over my property
What are the risks of their poo in our pool and what about those impacted more than 500m from the zones?
Not sure how air conditioning to avoid opening windows, contributing to already high energy costs and usage is sustainable planning or even marketable. This can not even be combated with regulated solar panels given the potential damage from the flying foxes. Input from key stakeholders and Subject Matter Experts will be critical to the long term success of this.
I think bats get a bad rap. They're beautiful, natural, peaceful creatures. They deserve respect and care. People need to value cooexisting with nature more and be more informed and caring towards our precious native wildlife, especially since temperatures are on the rise. Our native animals need all the help and concern and care they can get. Thankyou ??
We need to educate people more and try to get them to join wildlife groups to help save these beautiful animals very hard when there's only about 5 of us in the hole of campbelltown area
Only that I love that Campbelltown has camps and I welcome them visiting my garden and am very sad about the reduced numbers due to heat stress last two years . I have really noticed the decline in numbers and feel it should be a priority to support the colonies
There is only one way to deal with pests and that is to get rid of them
The stream between the Milton Park and Myee Road Macquarie Field looks very unmanaged and looks like it has been neglected. I have seen the stream in other places such as Ingleburn and Glenfield has been properly managed and looks presentable. Stream in those places are cemented and looks very clean and odour free. But unfortunately, the stream between the Milton Park and Myee Road looks like a dumping zone. I think that if the steam is managed properly and make presentable, it will help to move the flying foxes away from that place. If that stream is made presentable, it will add value to Macquarie Fields and its beauty as a whole. I strongly request Campbelltown council to manage that stream and make it nice and presentable. There are lots of grasses growing around that area, I guess Campbelltown council need to consider doing something to improve the beauty and cleanliness of that area.
I enjoy them visiting my bottle brush trees at night during the flowering season.

there is an area of weeds/plants between the flying foxes and the walking path. we fear that this is creating a habitat for snakes in order to create a home for ghff.

I live opposite the bat colony. Most recently the bats have become a nuisance. I have lived in my residence for 11 years now & the bats were not so much of a problem. There are thousands of them now, they smell & we have droppings all over the driveway, my garage door &even my front door. Since water restrictions have come into place & we are not allowed to hose hard surfaces, I would like to know how exactly we are meant to keep it clean. A bucket of water will not suffice all the mess they make. They really are becoming a huge pest & they are destroying our beautiful trees & environment.

I think we have been realistic in our observations - we do not want inner Sydney's colony

---

after 55years living without the colony - I find trying co- exist with the colony extremely distressful

---

I don't think there's so much of a worry about clotheslines - the bats are only out at night. I think the Mynah birds are more the issue for vegetation and native species in the area.

THESE CAMPS RE INCREAESING IN SIZE AS THEY ARE FINDING ANY SUITABLE TREES TO ROOST IN AT NIGHT

My recommendation is very simple. Eliminate the problem by eradicating them out of the area. Control their numbers by culling or totally rid the area of them. They should not be protected in residential areas.

Building in the close buffer rings around a camp should be restricted. the council should consider helping with mitigation measures to help local residents that are already in the buffer areas to cope with any issues. Council should be extremely rigorous in not allowing new buildings within close proximity of established camps in the region.

Just do your very best to give them protected and safe habitat. It's great to see Campbelltown taking an interest in its wildlife at last

---

There does not seem to have been anything left out.

Get rid them

A map of their most common flight path

Not at this time

How about moving the colony to an are that residents aren't close to. It's like saying to us "Ok, so you have lived in this house for years, but the bats have more rights than you". It's just so disheartening for us residents. They are everywhere. In our trees h everywhere.

Appendix 7 Camp management options

Level 1 actions: routine camp management

Education, advice and feedback programs

Education, advice and feedback programs are key components of any plan to manage flying-foxes and their camps. Evidence has shown that keeping the community informed and making opportunities available for them to discuss and share experiences about the impacts of the camp is fundamental to achieving sustainable and acceptable outcomes.

Education, advice and feedback programs include:

- ensuring the community is aware of the critical ecological importance of flying-foxes
- managing risk and alleviating concern about health and safety issues associated with flying-foxes
- advice on how to reduce impacts from roosting and foraging flying-foxes
- up-to-date access to the program of works being undertaken at the camp and information about flying-fox numbers and flying-fox behaviour at the camp, and
- information about flying-fox numbers and flying-fox behaviour at the camp.

Delivery mechanisms could include personal contact, brochures, community information stalls at local events, information signs at the camp, working closely with local media or online updates via dedicated pages on organisational websites. The program needs to target the broader community as well as residents directly adjacent to the camp (who are most impacted by the camp, as other community members within the foraging zone of the camp (up to 50 km radius) may also be impacted by faeces, noise, tree damage and, in some cases, infrastructure problems such as power black-outs. Engaging the broader community in a proactive way will also assist should new camps form in other areas.

Property modification

There are a range of things that can be done at private properties to reduce the impacts of flying-foxes:

- 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 and should grow in dense formation between two and five metres tall (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. Suitable examples include gardenias, jasmines, native frangipani (*Hymenosporum flavum*), Bolwarra or Native Guava (*Eupomatia laurina*). Native guava would need to be managed if foraging flying-foxes are of concern (i.e. fruit removed before ripening or plants kept in pots that could be moved into areas inaccessible to flying-foxes).

- If faecal drop or noise at night is of concern, 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. Some foraging trees, such as Cocos palms, are exotic species which can also negatively impact flying-foxes and the environment. It is therefore desirable for Cocos palms to be removed.
- Where faecal drop is an issue, consider pergolas, shade-cloths or car-ports, car covers, clothes-line covers, swimming pool covers, green-houses for vegetable gardens, tarpaulins to cover property and first-flush systems on water tanks.
- Consider double-glazing windows or noise attenuation fencing to address noise issues, air-conditioners for use when strong odours prevent windows and doors from being left open (note this could mean additional electricity costs when in use) and clothes dryers for use when outdoor clotheslines may be subject to faecal drop (additional electricity costs when in use).
- Appropriate design (e.g. layout), suitable buffers and other provisions (e.g. covered car parks) for new developments.
- Avoid disturbing flying-foxes during the day as this will increase camp noise.

Providing subsidies to property owners for property modifications may be considered appropriate in order to manage the impacts of the flying-foxes. Providing subsidies to install infrastructure may in fact improve the value of the property, which could offset concerns regarding perceived or actual property devaluation or rental return losses.

Opportunities for funding assistance (e.g. environment grants) may be available for management activities that reduce the need to actively manage a camp.

Service subsidies

This management option involves providing property owners with a subsidy to help manage impacts on the property and lifestyle of residents. The types of services that could be subsidised include clothes washing, cleaning outside areas and property or car washing. Providing appliances (e.g. pressure cleaners) for free hire to assist with cleaning could also be considered.

Critical thresholds of flying-fox numbers at a camp and distance to a camp may be used to determine where subsidies would apply. The level and type of subsidy would need to be agreed to by the entity responsible for managing the flying-fox camp.

Routine maintenance to improve the condition of the site

This management option involves routine maintenance intended to improve the condition of the camp site. It is not done to manage flying-foxes. For example, it may include the removal of tree limbs that pose a genuine health and safety risk - as determined by a qualified arborist.

Other maintenance could include weed removal, trimming or mowing of understorey vegetation or the planting of vegetation and minor habitat improvements for the benefit of the flying-foxes. Also mowing of grass, applying mulch or removal of leaf litter or other material on the ground and

other similar grounds-keeping actions that will not create a major disturbance to roosting flying-foxes can be included here.

These activities can also contribute to maintaining or improving access for the community to the site. At some sites, managers have also introduced interpretation signs to describe the flying-foxes.

Guidelines for carrying out operations adjacent to camps

This management option involves land managers preparing protocols for staff and volunteers carrying out operations that disturb flying-foxes and cause excess noise and movement that can disturb residents. Such protocols could include limiting the use of disturbing activities to certain days or certain times-of-day in the areas adjacent to the camp. Such activities could include lawn-mowing, using chainsaws, whipper-snippers, using generators and testing alarms or sirens.

Health and safety guidelines to manage incidents related to the camp

The preparation of health and safety guidelines is an important part of any plan to manage flying-foxes and their camps. This may include 'Bat Watch' patrols at schools, playgrounds or sites with people more susceptible to health impacts. There should also be guidelines set out for HSEs (when the camp is subjected to extremely high temperatures leading to flying-foxes changing their behaviour and/or dying).

While this management option will not assist the resolution of existing land use conflict, it may alleviate community concerns and prevent potential issues.

Protect and enhance potential flying-fox habitat in low conflict areas

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 habitat in low conflict areas.

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. However, if a staged and long-term approach is used to make camps in undesirable locations less attractive, whilst concurrently improving appropriate sites, it may be a viable option. Supporting further research into flying-fox camp preferences will improve the likelihood of this option being successful.

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 (Section 6.4) and suitable land tenure can assist in initial alternative site selection. A feasibility study would then be required prior to site designation to assess likelihood of success and determine the warranted level of resource allocated to habitat improvement.

Provision of artificial roosting habitat

This management option involves constructing artificial structures to augment roosting habitat in current camp sites, or to provide new/alternative roosting habitat. Previous trials have been of limited success as flying-foxes only used structures very close to the available natural roosting habitat. It is thought that the structure of the vegetation below and around the artificial roost structures is important.

Research into flying-foxes and new ways to reduce community impacts

This management option involves participating or supporting research to improve knowledge of flying-fox ecology (e.g. how they choose their roost sites) and new ways to reduce community impacts. For example, potential trials with odour neutralising systems at residential boundaries.

Appropriate planning controls for future land use

Land-use planning is an important component of any plan to manage flying-foxes and their camps.

The area surrounding the Bingara Reserve camp has already been largely developed, predominantly for residential purposes. However, there is potential for residential redevelopment and infill development under existing planning controls. There is also potential for an intensification of residential use through future changes to land use zoning.

Current and future planning controls could be supported by additional planning provisions that seek to minimise amenity impacts through the design and siting of development, acoustic development measures, covered outdoor spaces and the like, whilst also minimising the impact of proposed new development on the microclimate and wellbeing of the flying-fox camp.

Property acquisition

Property acquisition may be considered if negative impacts cannot be sufficiently mitigated using other measures. This option will clearly be extremely expensive, however is likely to be more effective than dispersal and in the long-term may be less costly.

Do nothing

The management option to 'do nothing' involves not undertaking any management in relation to the flying-fox camp and leaving the situation and site in its current state.

Level 2 actions: in-situ management

Buffers

Areas between the camp and surrounding properties can be made unsuitable or unattractive to roosting flying-foxes to provide a buffer, and assist reducing amenity impacts. Buffers can be created through planting, vegetation removal and/or the installation of permanent/semi-permanent deterrents, as detailed below.

Revegetating areas with plants unattractive to roosting flying-foxes

This management option involves using plants unattractive to roosting flying-foxes to revegetate areas between residents or other conflict areas and the flying-fox camp. Such plantings can also create a visual buffer between the camp and residences or make areas of the camp inaccessible to humans. This method can be used in conjunction with options that involve vegetation removal and buffer creation.

Buffers through vegetation removal

This management option involves creating a break in vegetation between humans or conflict areas and the flying-fox camp. Selective removal and/or trimming can also be used to prevent roosting flying-foxes over-hanging residences, community infrastructure or other built areas. The amount removed will vary between sites and camps, ranging from some weed removal to removal of canopy vegetation. Removing vegetation can increase visibility into the camp and noise issues for neighbouring residents, which may create further conflict. The importance of under- and mid-storey vegetation in the buffer area for flying-foxes during HSEs also requires consideration.

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, fluoro vests (GeoLINK 2012) and balloons (Ecosure 2016, pers. comm.) in roost trees have shown to have localised effects, with flying-foxes deterred from roosting within 1–10 m 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 – For example, bagged python excrement hung in trees has previously had a localised effect (GeoLINK 2012). The smell of certain deterrents may also impact nearby residents, and there is potential for flying-foxes to habituate.
- Canopy-mounted water sprinklers – This method has been effective in deterring flying-foxes during dispersals (Ecosure personal experience), and several trials in Queensland are showing promise for 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 need to be considerate of animal welfare and

features of the site. For example, misting may increase humidity and exacerbate HSEs, and overuse may impact other environmental values of the site.

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. This option may be suitable for some residences next to the camp (e.g. those properties at or below the height of roosting animals). 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 with less ongoing management requirements than deterrents or vegetation management.

Level 3 actions: disturbance or dispersal

Nudging the camp to a nearby location

Nudging consists of discouraging flying-foxes away from high-conflict areas of the camp towards lower conflict areas. This may be done using active disturbance, or sequential habitat modification. There must be a suitable alternative site in contiguous habitat. Risks are similar to those in dispersal below, although the likelihood of these issues occurring is slightly less when there is suitable habitat nearby.

Dispersal

Dispersal aims to encourage a camp to move to another location, through either disturbance or habitat modification.

There is a range of potential risks, costs and legal implications that are greatly increased with dispersal (compared with in-situ management as above). See Appendix 4 for more details.

These include:

- 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 disease status and associated public health risk
- impacts to nearby residents associated with ongoing dispersal attempts
- excessive initial and/or ongoing capacity and financial investment
- negative public perception and backlash

- increased aircraft strike risk associated with changed flying-fox movement patterns
- unsuccessful management requiring multiple attempts, which may exacerbate all of the above.

Despite these risks, there are some situations where camp dispersal may be considered. Dispersal can broadly be categorised as 'passive' or 'active' as detailed below.

Passive dispersal

Removing vegetation in a staged manner can be used to passively disperse a camp, by gradually making the habitat unattractive so that flying-foxes will disperse of their own accord over time with little stress (rather than being more forcefully moved with noise, smoke, etc.). This is less stressful to flying-foxes, and greatly reduces the risk of splinter colonies forming in other locations (as flying-foxes are more likely to move to other known sites within their camp network when not being forced to move immediately, as in active dispersal).

Generally, a significant proportion of vegetation needs to be removed in order to achieve dispersal of flying-foxes from a camp or to prevent camp re-establishment. For example, flying-foxes abandoned a camp in Bundall, Queensland once 70% of the canopy/mid-storey and 90% of the understorey had been removed (Ecosure 2011). Ongoing maintenance of the site is required to prevent vegetation structure returning to levels favourable for colonisation by flying-foxes. Importantly, at nationally important camps such as the Bingara Reserve camp (see Section 4.2.1) sufficient vegetation must be retained to accommodate the maximum number of flying-foxes recorded at the site.

This option may be preferable in situations where the vegetation is of relatively low ecological and amenity value, and alternative known permanent camps are located nearby with capacity to absorb the additional flying-foxes. While the likelihood of splinter colonies forming is lower than with active dispersal, if they do form following vegetation modification there will no longer be an option to encourage flying-foxes back to the original site. This must be carefully considered before modifying habitat.

There is also potential to make a camp site unattractive by removing access to water sources. However at the time of writing this method had not been trialled so the likelihood of this causing a camp to be abandoned is unknown. It would also likely only be effective where there are no alternative water sources in the vicinity of the camp.

Active dispersal through disturbance

Active dispersal relies on discouraging flying-foxes from landing at the camp when returning from overnight foraging every morning for extended periods using sound, light and other physical deterrents.

Active dispersal will be disruptive for nearby residents given the timing (from 0330 each morning) and nature of activities, and this needs to be considered during planning and community consultation.

This method does not explicitly use habitat modification as a means to disperse the camp,

however if dispersal is successful, some level of habitat modification should be considered. This will reduce the likelihood of flying-foxes attempting to re-establish the camp and the need for follow-up dispersal as a result. Ecological and aesthetic values will need to be considered for the site, with options for modifying habitat the same as those detailed for buffers above.

Early dispersal before a camp is established at a new location

This management option involves monitoring local vegetation for signs of flying-foxes roosting in the daylight hours and then undertaking active or passive dispersal options to discourage the animals from establishing a new camp. Even though there may only be a few animals initially using the site, this option is still treated as a dispersal activity, however it may be simpler to achieve dispersal at these new sites than it would in an established camp. It may also avoid considerable issues and management effort required should the camp be allowed to establish in an inappropriate location.

It is important that flying-foxes feeding overnight in vegetation are not mistaken for animals establishing a camp.

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 NSW and Commonwealth legislation and will not be permitted as a method to manage flying-fox camp.

Blank Page

CAMPBELLTOWN

campbelltown.nsw.gov.au
T 02 4645 4000
E council@campbelltown.nsw.gov.au