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Black Gully Flying-fox Camp Management Plan

August 2018

ARMIDALE REGIONAL COUNCIL

ecology / vegetation / wildlife / aquatic ecology / GIS

Acknowledgements

Armidale Regional Council would like to thank everyone who participated in community consultation, with all comments considered in the development of this plan and incorporated where possible. Council also recognises contributions by Jackie Maisey and Dr Hugh Ford, including the provision of data on camp demographics, flying-fox health and mortality events.

Council also gratefully acknowledges the NSW state government for funding assistance to develop this Plan through the Flying-fox Grants Program (administered by Local Government NSW). We also recognise input by the NSW Office of Environment and Heritage to the Plan in developing the template upon which this Camp Management Plan is based, and Dr Peggy Eby who provided advice which was included in the template.

Acronyms and abbreviations

ABLV	Australian bat lyssavirus
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BFF	Black flying-fox (*Pteropus alecto*)
the camp	Black Gully flying-fox camp
CE	Critically endangered
Council	Armidale Regional Council
DoEE	Department of the Environment and Energy (Commonwealth)
DPI	Department of Primary Industries (NSW)
E	Endangered
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
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)
OEH	Office of Environment and Heritage (NSW)
PEPs	Protection of the environment policies
Q & A	Question and answer
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)
SEPPs	State Environmental Planning Policies
SIS	Species impact statement
TEC	Threatened ecological community
V	Vulnerable
VMP	Vegetation Management Plan

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1 Introduction

This Black Gully Camp Management Plan (the Plan) provides Armidale Regional Council (Council) with a framework for managing community impacts associated with flying-foxes, whilst ensuring flying-foxes and their ecological services are conserved. 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).

The Black Gully camp is occupied by GHFF, and at times by the highly transient LRFF. 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.

Detail of relevant legislation and policy related to flying-foxes is provided in Appendix 1. Flying-fox ecology, species profiles and roost characteristics are provided in Appendix 2.

1.1 Flying-foxes in urban areas

Flying-foxes are highly nomadic, moving across their range between a network of national camps. Camps may be permanently occupied, seasonal, temporary or sporadic, and numbers can fluctuate significantly on a daily/seasonal basis. 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).

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. 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 return to urban areas of Armidale in the future.

1.2 Objectives

The Plan has been prepared in accordance with the NSW Flying-fox Camp Management Policy (2015) framework, administered by the Office of Environment and Heritage (OEH),

The objectives of this Plan are to:

- manage community impacts and concerns associated with the camp
- ensure management activities are consistent with legislative responsibilities
- identify suitable management actions and where these will occur
- ensure flying-fox welfare during works
- effectively communicate with stakeholders during planning and implementation of management plan activities
- conserve flying-fox habitat in suitable locations.

2 Context

2.1 Camp description

The Black Gully camp is situated 990 m above sea level, along a class two (2) stream order, on Council and private land in the south west of Armidale. The camp extent during the site assessment (0.82 ha, February 2018) and the maximum known camp extent (2.38 ha) (December 2017) are shown in Figure 1.

The camp vegetation consists of a highly modified Endangered Ecological Community Ribbon Gum-Mountain Gum-Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion. The colony is roosting in ribbon gum (*Eucalyptus viminalis*) and non-natives including willow (*Salix babylonica*); the understorey contains blackberry, privet and other weeds (Figure 2). A public footpath passes across Black Gully creek underneath the colony, linking east and west of Murray Avenue (Figure 3).

2.2 Tenure

Table 1 provides a list of properties (including tenure) that comprised the maximum camp extent (December 2017) along with the area occupied by flying-foxes on that parcel. Properties are listed from those containing the largest to smallest extent of the camp.

Table 1 Properties comprising the maximum camp extent (December 2017)

Lot and DP	Tenure	Zoned	Camp area (m^2)
10/DP615040	Freehold	R1 General Residential	4,268.73
Murray Avenue Road Reserve	Armidale Regional Council	R1 General Residential	4,132.14
11/DP615040	Freehold	R1 General Residential	3,415.47
2/DP655832	Freehold	R1 General Residential RE1 Public Recreation	2,928.79
19/DP29301	Freehold	R1 General Residential	1,964.91
16/DP262475	Armidale Regional Council	RE1 Public Recreation	1,875.60
9/DP565189	Freehold	R1 General Residential	819.43
1/DP157388	Freehold	R1 General Residential	781.94
18/DP29301	Freehold	R1 General Residential	565.84
12/DP262475	Freehold	R1 General Residential	349.70
16/DP29301	Freehold	R1 General Residential	294.80
C/DP164602	Freehold	R1 General Residential	262.35
8/DP565189	Freehold	R1 General Residential	260.12

Lot and DP	Tenure	Zoned	Camp area (m^2)
13/DP262475	Freehold	R1 General Residential	235.73
2/DP242251	Freehold	R1 General Residential	230.83
10/DP262475	Freehold	R1 General Residential	192.56
3/DP242251	Freehold	R1 General Residential	187.70
8/DP262475	Freehold	R1 General Residential	174.38
4/DP242251	Freehold	R1 General Residential	174.36
11/DP262475	Freehold	R1 General Residential	167.60
5/DP242251	Freehold	R1 General Residential	144.92
1/DP1132819	Freehold	R1 General Residential	102.27
21/DP733113	Freehold	R1 General Residential	97.45
7/DP262475	Freehold	R1 General Residential	81.34
2/DP1132819	Freehold	R1 General Residential	50.05
/SP48179	Freehold	R1 General Residential	38.20
14/DP262475	Freehold	R1 General Residential	16.78
1/DP1211697	Freehold	R1 General Residential	3.78
		Total	**2,3817.78**

2.3 Other ecological values

Five threatened species are known to occur or have been recorded within 1 km of Black Gully camp (Table 2). Black Gully does not currently meet the criteria for a Nationally Important camp.

Table 2 Other ecological values known to occur or recorded within 1km of the camp

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP (DoEE 2018)	Nationally important camp	See definition Appendix 1.	Site does not currently meet criteria. However if there is another influx of more than 10,000 GHFF it will become a nationally important camp and the *Environment Protection and Biodiversity Act 1999* (EPBC Act) Referral Guidelines will apply (see Section 2.4 and Appendix 1)

Protection level	Source	Category	Values/significance	Details
	Protected Matters (DoEE 2018)	Threatened species	Regent honeyeater (*Anthochaera phrygia*) (CE) Koala (*Phascolarctos cinereus*) (V) Black-faced monarch (*Monarcha melanopsis*) (Mi) Satin flycatcher (*Myiagra cyanoleuca*) (Mi) Great egret (*Ardea alba*) (Ma)	5 species (2 birds, 1 mammal) known to occur within the area (SPRAT data not mapped)
State	Bionet (OEH 2018)	Threatened species	Koala (*Phascolarctos cinereus*) (V)	1 mammal species has been recorded within 1 km of camp
		EEC	Ribbon Gum-Mountain Gum-Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion.	

Figure 1: Black Gully camp extent

Armidale Regional Council

Flying-fox camp management plan

- Camp extent (December 2017)
- Camp extent (February 2018)
- Property boundary

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Job number: PR3232
Revision: 0
Author: KF
Date: 28/06/2018

0 25 50 100
Metres

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

PR3232_MP1_CampExtent_June2018
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Figure 2 Black Gully Camp facing west

Figure 3 Public pathway under colony facing west (left) and east (right)

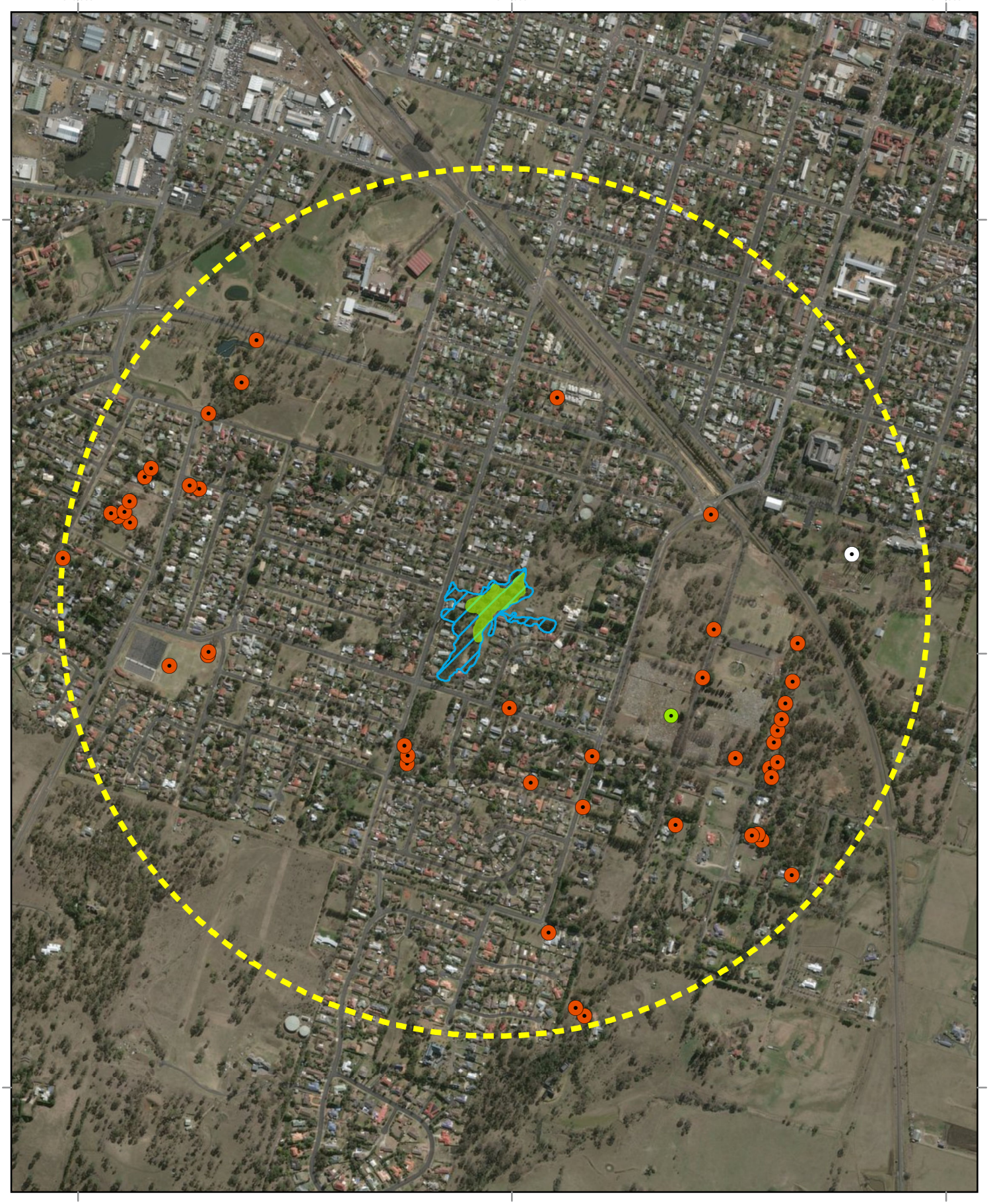

Figure 4: Bionet records within 1 km of the camp extent

Armidale Regional Council

Flying-fox camp management plan

Bionet species

- Koala
- Grey headed flying-fox
- Grey headed flying-fox (anecdotal)

- Camp extent (February 2018)
- Camp extent (December 2017)
- 1 km buffer

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Job number: PR3232
Revision: 0
Author: KF
Date: 3/07/2018

0 100 200 400
Metres

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

PR3232_MPX_BionetRecords
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2.4 History of the camp

Historically flying-foxes have not been recorded roosting in Armidale during the National Flying-fox Monitoring Program (NFFMP) monitoring period (since 2012). However, records from 2008 show 1,000 GHFF roosted temporarily behind the New England Regional Art Museum (OEH 2018) (Figure 4). Anecdotal sightings of flying-foxes using the Armidale Cemetery were reported around the arrival of flying-foxes in 2017.

According to neighbouring residents, flying-foxes arrived in the Black Gully camp in October 2017. The camp continued to increase peaking in December with reports of between 30,000-40,000 GHFF and 20,000 LRFF (Figure 5) (H. Ford 2018 pers. comm).

During the months of October to January, wildlife carer working on the site, found 393 young GHFF dead and another 40 GHFF that needed to be taken into care. Several hundred more dead GHFF were also found in backyards (J. Maisey 2018 pers. comm. 14 February).

While the camp does not currently meet criteria for a nationally important GHFF camp (see Appendix 1), mitigation measures outlined in the referral Guideline should be followed given the significant number of GHFF recorded in December 2017.

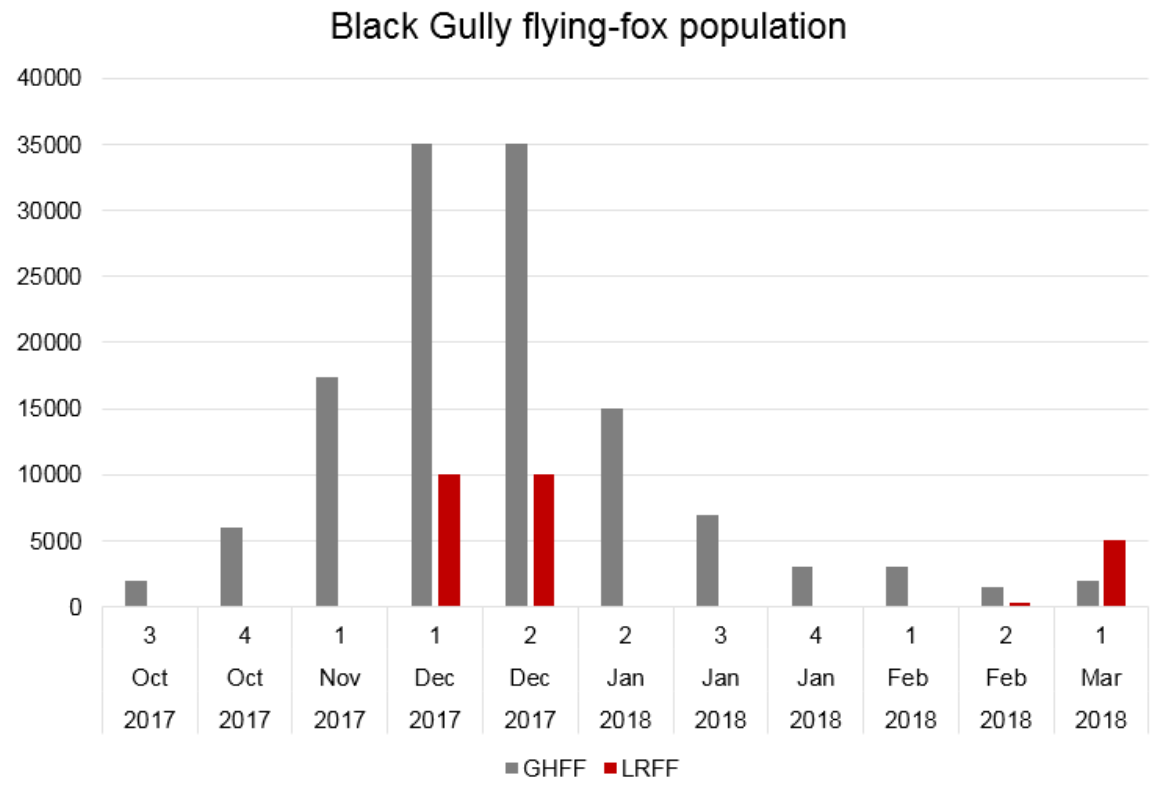

Figure 5 Black Gully flying-fox camp counts since first recorded in October 2017 (source: H. Ford 2018 pers. comm.).

2.5 Management response to date

The camp has been a source of complaints from nearby residents, mainly relating to noise, odour and faecal drop.

Council was proactive upon the arrival of flying-foxes to Black Gully in an attempt to improve the amenity of impacted residents including:

- providing car covers to residents
- providing temporary plastic covering for one resident's driveway until high pressure hosing to remove excrement could occur
- removing fallen vegetation and dead flying-foxes as part of an on-call 24 hour service.

A public meeting, opened by Councillor Bradley Widders, was held December 7th, 2017. Speakers included flying-fox expert Dr Peggy Eby, and Krister Waern from Office of Environment and Heritage (OEH). Residents were provided legislative background on flying-fox management and information regarding the ecological importance and behaviour of flying-foxes.

Council staff inspected the site in December 2017 and January 2018. Letterbox drops and a community meeting on February 2nd, 2018 informed residents of the on-site engagement session. Ecosure facilitate on-site engagement session on February 14th, 2018 to gather community input into the draft Plan.

Wildlife carers have regularly visited the camp to rescue or collect deceased flying-foxes. Hundreds of young flying-foxes died throughout the breeding season at Black Gully, and the cause is not clear, as no heat stress events occurred during this time. It is possible that lactating mothers abandoned their young (who were left to starve to death) in search of more reliable food sources, however this requires further investigation. If an event of this nature occurs again, Council should notify OEH.

Council commissioned the development of this Plan (with funding assistance through the NSW Flying-fox Grants Program), as well as an investigation into alternative flying-fox camp sites as part of a long-term strategy to minimise issues associated with the arrival of flying-foxes in Armidale (Appendix 3).

3 Community engagement

3.1 Stakeholders

There are a range of stakeholders directly or indirectly affected by flying-foxes, or who are interested in management of the camp. Stakeholders include those shown in Table 3.

Table 3 Stakeholders of Black Gully camp

Stakeholder group	Stakeholder	Interest/reported impacts
Community	Residents and business owners	The location of the camp within a residential area means there are many residents affected by amenity issues (e.g. noise, smell, faecal drop), including residents of: · Murray Avenue · Centura Crescent · Markham Street · Catherine Street · Galloway Street · Lynches Road.
	Indigenous community	Traditional owners have a general interest in flying-foxes, including the ecological services they provide and the potential for sustainable harvesting for food or medicinal purposes.
	Horse owners and managers	Horse owners, equine facility managers and local vets should be aware that Hendra virus risk is associated with foraging flying-foxes (e.g. risk is present across the entire flying-fox range), and appropriate mitigation measures.
	Orchardists and fruit growers	Fruit growers may be impacted by flying-foxes raiding orchards and should have access to wildlife friendly netting information.
	Hospitals	Any helicopter operator associated with Armidale hospitals should be made aware of flying-foxes in the area and follow risk mitigation measures (especially during dusk or dawn operations).
	Armidale Airport	Airport managers have a responsibility to reduce the risk of wildlife-aircraft strike. Armidale Airport is located 2.8 km to the west of the Black Gully camp and should be consulted regarding any management that may influence flying-fox movements or behaviour.
Government	Armidale Regional Council	Council is responsible for administering local laws, plans and policies, and appropriately managing assets (including land) for which it is responsible.
	OEH	OEH is responsible for administering state legislation relating to (among other matters) the conservation and management of native plants and animals, including threatened species and ecological communities.
	Commonwealth Department of the Environment and Energy (DoEE)	DoEE is responsible for administering federal legislation relating to matters of national environmental significance, such as the grey-headed flying-fox which roosts at Black Gully.
	Local Government NSW (LGNSW)	LGNSW is an industry association that represents the interests of councils in NSW. LGNSW also administered funds under the NSW Flying-fox Grants Program.
Non-government organisations	Wildlife carers and conservation organisations	Wildlife carers 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.

3.2 Engagement methods and results

Extensive effort has been made to engage with the community regarding the flying-fox camp. The aim of the engagement was to:

- seek feedback from the community concerning the impact of flying-foxes and advice on potential mitigation options to address potential future occurrences
- understand the impacts, positive and negative, directly and indirectly affecting the community
- share information and seek ideas about possible future management options
- correct misinformation and alleviate fears regarding health risks to people and domestic animals (see Appendix 4 for information about human and animal health)
- raise awareness about the ecological importance of flying-foxes.

During development of the Plan, three methods were used to engage with the Armidale community; an online survey, on-site workshop and public exhibition of the draft Plan (Table 4).

Table 4 Community engagement methods

Engagement method	Key dates	Outcomes
Online survey	6 February – 7 March	Results included within the draft management plan
On-site workshop	14 February 2018	Community feedback included within the draft management plan
Public exhibition of draft Plan	30 April to 28 May 2018	Submissions received by Council on the draft FFMP incorporated into the plan

3.2.1 Survey responses

The community was invited to participate in an online survey linked to Council's website. The survey period was open for two weeks and contained 19 questions that comprised:

- flying-fox awareness (6 questions)
- flying-fox issues (4 questions)
- flying-fox management (6 questions)
- respondent demographic (2 questions)
- open comment (1).

Results for survey questions are provided in Appendix 5. A total of 25 survey respondents answered all or some of the questions. The majority of respondents were aware that flying-foxes are a protected species (Figure 6) and important to long-distance seed dispersal (Figure 8).

Survey results indicated a slight majority of people (44%) generally had a positive view of flying-foxes with 36% and 20% feeling negative or neutral towards flying-foxes respectively (Figure 8). Table 3 provides comments provided to support respondents' views. Figures 8 and 9 provide impacts to the community, and Table 6 management options suggested by respondents. These suggestions were considered and incorporated into the management detailed in Section 5 where possible and appropriate.

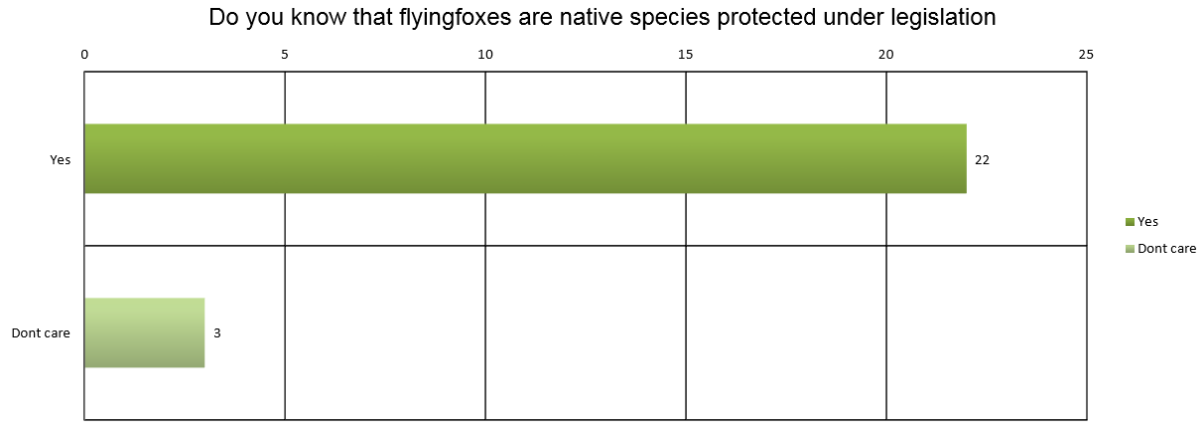

Figure 6 Community awareness of flying-foxes protected status

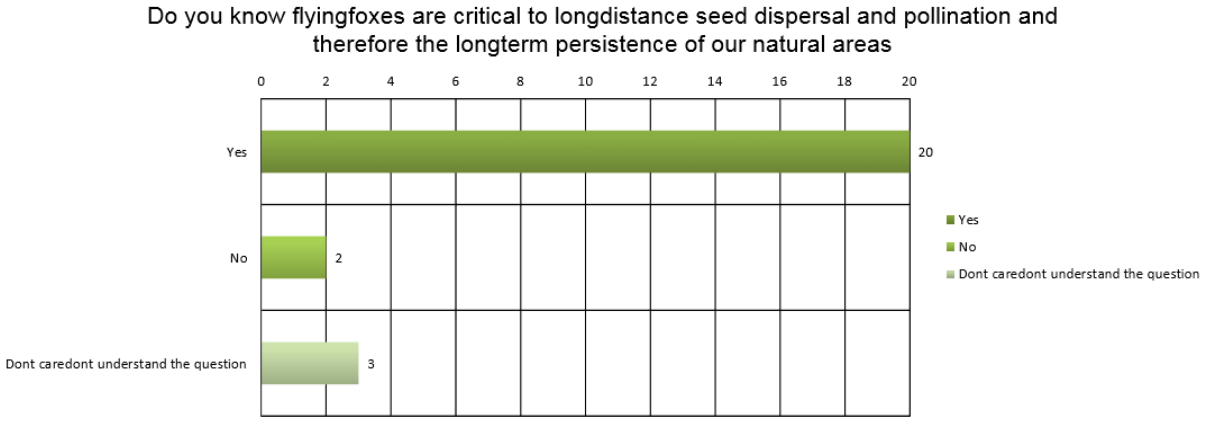

Figure 7 Community awareness of flying-foxes ecological role

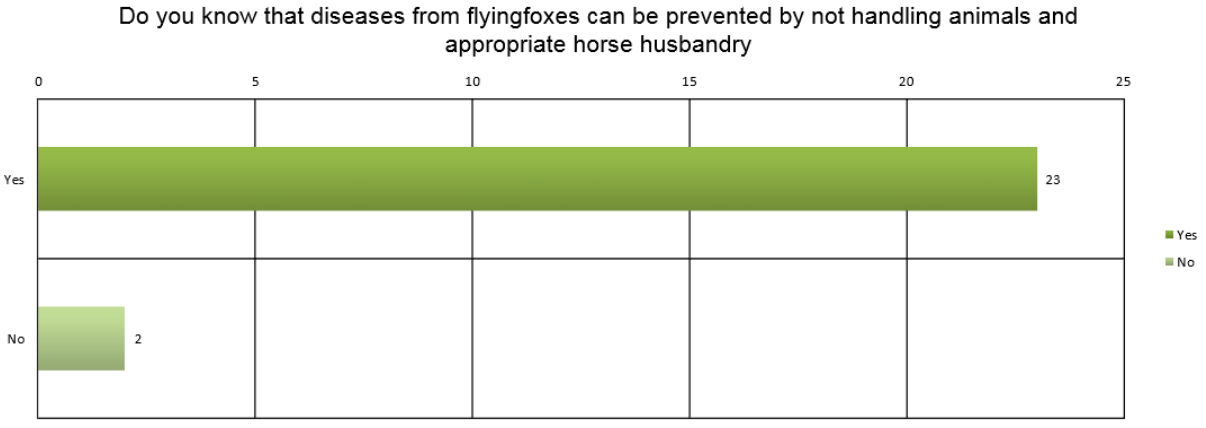

Figure 8 Community attitudes towards flying-foxes

Table 5 Comments from respondents regarding their feelings towards flying-foxes

Feeling	Location	Response
Negative	Resident in Lynches Road	*In general, I am tolerant, interested, have lived with flying foxes all my life as backyard visitors from camps in Indooroopilly, Brisbane and Bundaberg, Qld., but intolerant of them roosting in urban areas.*
Negative	Resident near Black gully	*I think the humans should be considered 1st before the bats If they come back each year the value of their homes plus even mine will decrease through no fault of theirs. Who is going to reimburse us for something that can be culled.*
Negative	Resident near Black gully	*Do not believe they are endangered. Do not believe they are critical to seed dispersal and pollination. What about migratory birds? Risk to human and other animal health is real and must not be ignored.*
Negative	Other Armidale resident	*I feel very sorry for the people living underneath the flying foxes, the stench and waste would be extremely difficult to live with. The risk of disease is too great. We need to listen to what these people are asking for.*
Negative	Other Armidale resident	*Disgusting pests*
Neutral	Resident near Black gully	*Whilst I have nothing against flying foxes, I feel that there has been a highly unfortunate impact on many directly suffering. Especially at least one household trying to sell their property.*
Neutral	Resident in Murray Avenue	*Neutral - they don't bother me too much*
Neutral	Resident in Murray Avenue	*Positive in natural environment, negative in residential areas*
Neutral	Resident near Black gully	*Flying foxes are just like any other animal, part of a larger eco-system; I'm told they have personalities, but I cannot confirm this. HOWEVER, having 50 000 flying foxes camping in densely populated suburban back-yard is a completely different matter.*
Neutral	Resident in Catherine Street	*Realize their need in the environment but preferably not at the expense of our well-being (sleep, access to property, use of close line, time cleaning up....).*
Positive	Resident in Murray Avenue	*Positive about them in the environment, but negative about them living close to residential areas*
Positive	Resident in Catherine street	*We were impacted by the smell and noise of the bats. However, given this I would still rather put up with this and support a vulnerable species. I'm fully in support of keeping the ecosystem and physical environment the way it is so the bats can live safely somewhere. I'd rather have the bats and put up with some discomfort for short periods*

Feeling	Location	Response
Positive	Resident in Catherine street	*They are an important part of our ecosystem and I have done much reading on FF since they arrived in our yard! Fascinating creatures!*
Positive	Other Armidale resident	*It is essential that we protect this vital species*
Positive	Other Armidale resident	*Flying foxes are interesting creatures to observe. However, by observing the effect of the black gully colony on residents, I understand that they can be very difficult to live next to, when they are present in large numbers*
Positive	Other Armidale resident	*Flying foxes are intelligent, gentle animals who are essential for the survival of native forests and species such as koalas that depend on the forests. While we need to mitigate their impact in a suburban environment, we are privileged to have them*
Positive	Other Armidale resident	*They are important in their own right as a species.* *I don't live in the impacted areas and I am sympathetic to these residents.*
Positive	Other Armidale resident	*They are beautiful native creatures and we should respect them and their requirements*

The survey results illustrate diverse views towards flying-foxes whether living in close proximity to the flying-fox camp or not. Most respondents understood the ecological role of flying-foxes and that flying-foxes require habitat, although believe that this habitat should not be in an urban area. It should be noted that tolerance levels of people living near the camp also varied, most expressing impacts to their wellbeing, sleep and lifestyle, yet others noting they were not bothered or even found flying-foxes fascinating. Some misconceptions still exist within the community regarding flying-foxes threatened status, flying-foxes being pests and the risk of disease being “too great”.

Respondents main concerns were damage to vegetation, noise, excrement, smell and dead flying-foxes (Figure 10). Respondents ranked their camp management options in order of preference, with number 1 being the most important. Trim and thin vegetation was the most preferred, followed by create alternative habitat and buffers (Figure 9). Additional respondent suggestions for management are provided in Table 6.

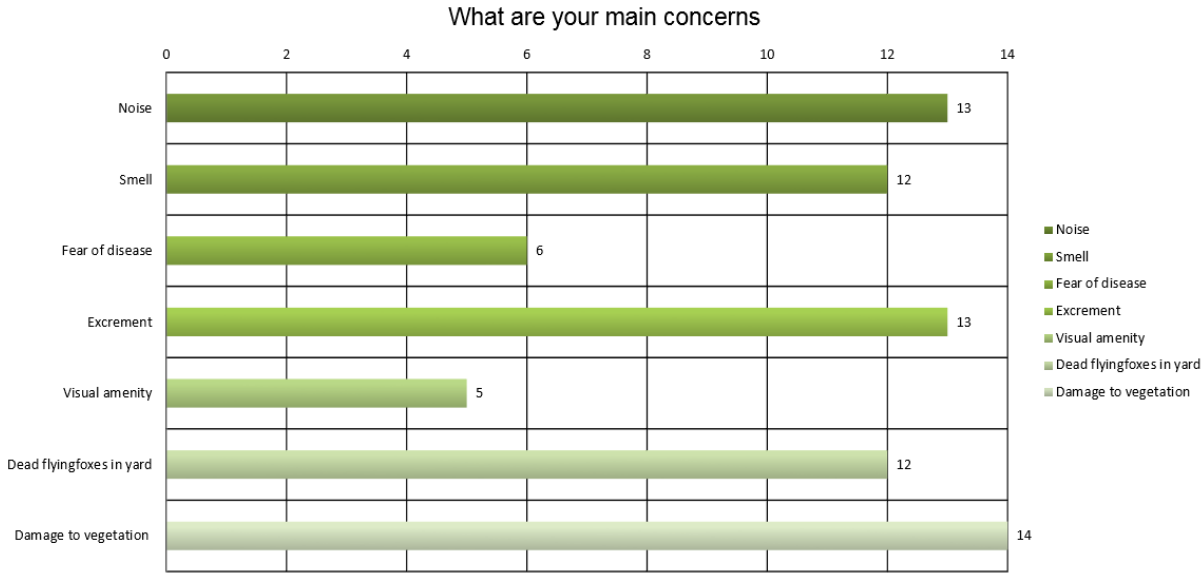

Figure 10 Community's main concerns relating to flying-foxes in Black Gully

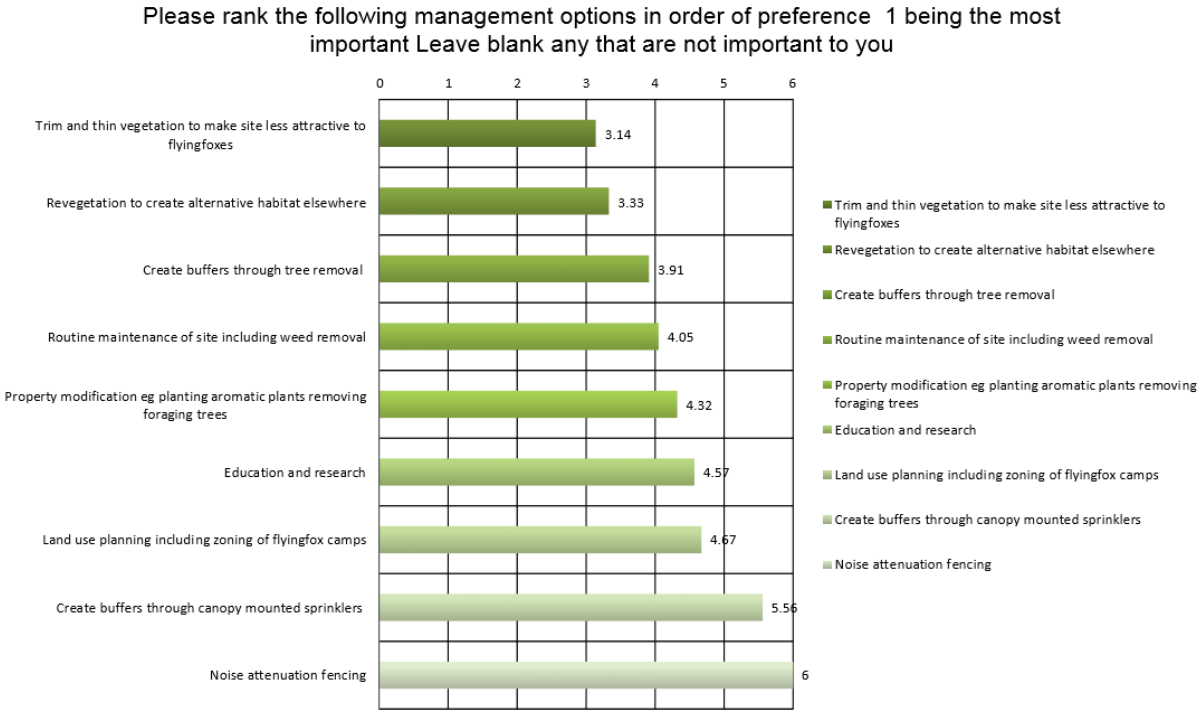

Figure 9 Respondents preferred management options

Table 6 Respondents additional suggestions for management

Respondent	Suggestions for management
Resident near Black Gully	No one should have to live through what the residents have had to put up with for the last 4 or so months. I'm not sure how you manage them without full **extermination.**
Resident near Black Gully	They should be **nudged out of the urban area** including the vicinity of the water tanks and the whole creek lands area.
Resident near Black Gully	It may be difficult but **discouragement from locating** at the present camp at the earliest signs of arrival next year. Perhaps I am unrealistic in my thinking but there would appear to be several **wooded alternative sites** on the periphery of Armidale. But how one would direct the flying foxes to them is the challenge.
Other Armidale resident	Burn eucalyptus leaves in the evening and morning to create a bush fire scent to **run them out of town.**
Other Armidale resident	Creating alternative habitat for a bat roost seems unlikely to help, as there is no guarantee that the bats would use it. There is plenty of woodland around Armidale, some of it by water, but the bats choose to live in town. **Creating a buffer** is very important, as it would greatly reduce the impact that the bats have on the neighbourhood (e.g. noise, mess and smell).
Resident near Black Gully	**Ensure the flying foxes don't return** next October and also ensure they have an **alternative colony site**.
Resident near Black Gully	Restricting suitable roost habitat to areas distant (>100m) from houses. If they return, **moving flying-foxes to areas well away from houses.**
Resident near Black Gully	To take what-ever steps are necessary to **deter the return of the flying foxes** in the Black Gully area.
Resident near Black Gully	**Leave the flying foxes alone** and move on the whinging human residents who cause more pollution, noise, smell than the bats. Education that starts with the younger residents and impact education for adults who might them be able to view the situation with a long term perspective about conservation.
Resident near Black Gully	**Noise disturbance as soon they arrive** so they move on
Other Armidale resident	The people who live on Black Gully enjoy the benefits of a beautiful gully. Flying foxes have been squeezed out of other areas. **Give the flying foxes some habitat where they can survive!**
Other Armidale resident	**Informing and educating the community** about the flying foxes and countering the negative and often inaccurate reputation is important. The bats are a vitally important part of our environment that we need to protect.

Respondent	Suggestions for management
Resident near Black Gully	Our suburban back-yards are not nature reserves - they are designated areas for people/residents to live. We pay mortgages and high rates for suburban homes and give no consent and we are not consensually handing our properties to be turned into nature reserves (e.g., flying fox camps). Flying fox habitat loss is Australia wide issue and it is completely unfair to make Armidale residents on South Hill to bear the cost of this habitat loss. **Flying foxes must live in the bush** and not in people's small backyards.
Other Armidale resident	**Plant at the sewage treatment works** two dense future roosting sites (so they can swap if they or a hail storm damages one and so people can learn from which they prefer) and patches of foraging trees. The foraging trees should not be ones that are not hard for Council to manage in seasons when the bats don't come and eat them nor exotics spread by seed but should be diverse
Resident near Black Gully	**Trimming trees** and canopy mounted sprinklers sounds like the way to go to me.
Resident near Black Gully	Move in early, equipment and staff being ready to act at the first sighting of arriving bats in spring. Then continue and expand the use of whatever **deterrent strategies** are possible within closely settled, urban areas. This might extend to temporary bright lighting of the tree canopy, including strobe lights, perhaps some unusual noise, in addition to other ideas that have been suggested.
Other Armidale resident	Improve habitat value in non-urban areas to **provide alternative sites** that will attract these animals and assist in their survival

Most respondents expressed a preference for:

- moving or nudging flying-foxes out of the urban area
- deterring or disturbing flying-foxes upon their return
- providing alternative habitat or camp sites
- creating buffers.

There appears to be an expectation that flying-foxes and their behaviour can be controlled by humans, however, evidence (e.g. Roberts & Eby 2013) shows that management techniques focussed on nudging and dispersal are rarely successful, costly and with short-term results. Although the survey results show that the Armidale community is well-informed and pragmatic regarding available management options, the development of education and awareness programs may assist in managing expectations regarding flying-fox behaviour.

3.2.2 On-site workshop

A two hour on-site workshop facilitated by Ecosure on 14th February 2018 was attended by 14 members of the community living in close proximity to the camp, as well as Council staff. Residents reported to Ecosure that their backyards were being engulfed by thousands of flying-foxes and they were being impacted by associated noise, smell and mess. Residents also testified for several hundred flying-fox carcasses found in backyards (J. Maisey 2018 pers. comm. 14 February) that they needed to dispose.

In order to garner feedback on preferred management options, participants were presented with an aerial map of the site and explained camp management options available. Participants were invited to:

- comment on suitability of available management options as they pertain to the site
- suggest locations around the camp where these options could be applied or help alleviate their issues.

Buffers through vegetation trimming and removal was the most preferred option nominated by the community with one resident indicating their interest in canopy-mounted sprinklers. Residents also advocated for education and awareness programs, routine camp maintenance, alternative habitat creation, nudging and dispersal. Locations for residents preferred management options (buffers through vegetation removal and canopy mounted sprinklers) are provided in Figure 11.

3.2.3 Public submissions on draft Plan

A total of 46 submissions were received from the community on the draft Plan. Council provided written acknowledgment of those submissions which were forwarded to Ecosure for consideration in the updated Plan. A summary of how key points within each submission have been addressed is provided in Appendix 6.

3.3 Community impacts

Concerns reported by the Armidale community include:

- fear of disease transfer to humans and domestic animals
- deceased and dying flying-foxes in yards and hanging in trees
- excessive noise, particularly depriving sleep and contributing to other health issues, and reduced amenity
- odour entering homes and reduced lifestyle amenity
- faecal drop on vehicles, washing and outdoor areas
- concerns regarding water quality of water tanks and pools
- damage to vegetation.

This Plan aims to provide Council with a framework and management actions to assist members of the community being impacted by flying-foxes, and to reduce these impacts.

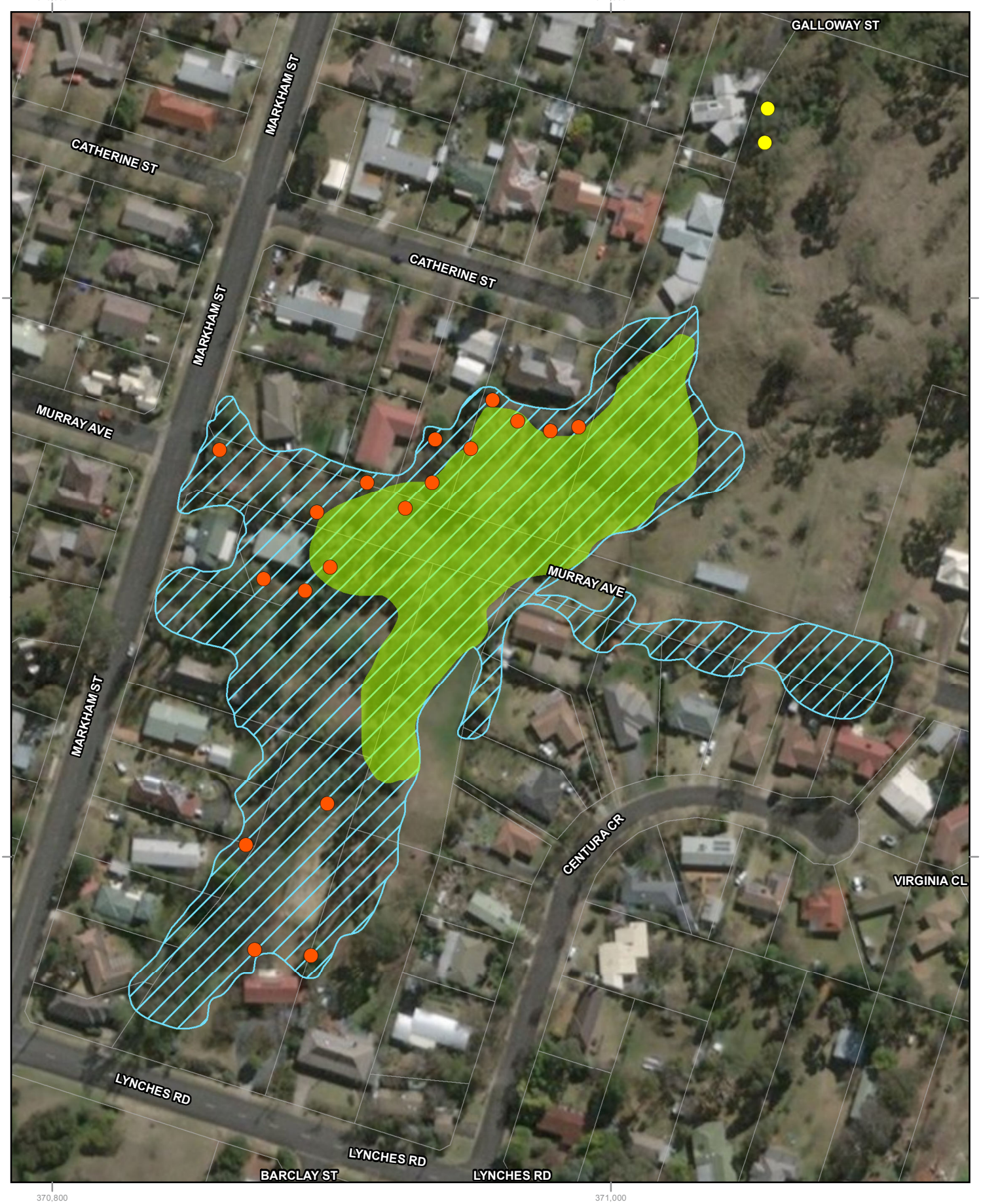

Figure 11: Preferred management options received during community workshop

Armidale Regional Council

Flying-fox camp management plan

- Canopy mounted sprinklers
- Tree trimming / removal
- Camp extent (February 2018)
- Camp extent (December 2017)
- Property boundary

ecosure

Job number: PR3232
Revision: 0
Author: KF
Date: 5/07/2018

0 12.5 25 50
Metres

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

4 Camp management options

Below is an overview of management options commonly used throughout NSW and Australia which were considered in the development of the Plan. These are categorised as Level 1, 2 or 3 in accordance with the Policy.

4.1 Level 1 actions: routine camp management

4.1.1 Education and awareness programs

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

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

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

Collecting and providing information should always be the first response to community concerns in an attempt to alleviate issues without the need to actively manage flying-foxes or their habitat. Where it is determined that management is required, education should similarly be a key component of any approach.

The likelihood of improving community understanding of flying-fox issues is high. However, the extent to which that understanding will help alleviate conflict issues is probably less so. Extensive education for decision-makers, the media and the broader community may be required to overcome negative attitudes towards flying-foxes.

It should be stressed that a long-term solution to the issue resides with better understanding flying-fox ecology and applying that understanding to careful urban planning and development

An education program may include components shown in Figure 12.

Figure 12 Possible components of an education program

4.1.2 Property modification without subsidies

The managers of land on which a flying-fox camp is located would promote or encourage the adoption of certain actions on properties adjacent to or near the camp to minimise impacts from roosting and foraging 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, should grow in dense formation between two and five metres (Roberts 2006) (or be maintained at less than 5 metres). Vegetation that produces fragrant flowers can assist in masking camp odour where this is of concern. Potential suitable native species which are unlikely to attract flying-foxes include:
    - Mint bush (*Prostanthera* var.)
    - Tantoon *(Leptospermum polygalifolium*)
    - White Sally wattle (*Acacia floribunda)*
    - Long-leaf waxflower (*Philotheca myoporoides*).

- Manage foraging trees (i.e. plants that produce fruit/nectar-exuding flowers) within properties through pruning/covering with bags or wildlife friendly netting, early removal of fruit, or tree replacement.
- Cover vehicles, structures and clothes lines where faecal contamination is an issue, or remove washing from the line before dawn/dusk.
- Move or cover eating areas (e.g. BBQs and tables) within close proximity to a camp or foraging tree to avoid contamination by flying-foxes.
- Install double-glazed windows, insulation and use air-conditioners when needed to reduce noise disturbance and smell associated with a nearby camp.
- Follow horse husbandry and property management guidelines provided at the NSW Department of Primary Industries Hendra virus web page (DPI 2015a).
- Include suitable buffers and other provisions (e.g. covered car parks) in planning of new developments.
- Turn off lighting at night which may assist flying-fox navigation and increase fly-over impacts.
- Consider removable covers for swimming pools and ensure working filter and regular chlorine treatment.
- Appropriately manage rainwater tanks, including installing first-flush systems.
- Avoid disturbing flying-foxes during the day as this will increase camp noise.

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

4.1.3 Property modification subsidies

Fully funding or providing subsidies to property owners for property modifications may be considered to manage the impacts of the flying-foxes. Providing subsidies to install infrastructure may improve the value of the property, which may also offset concerns regarding perceived or actual property value or rental return losses.

The level and type of subsidy would need to be agreed to by the entity responsible for managing the flying-fox camp.

4.1.4 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, car washing or power bills. Rate reductions could also be considered.

Critical thresholds of flying-fox numbers at a camp and distance to a camp may be used to determine when subsidies would apply.

4.1.5 Routine camp maintenance and operational activities

Examples of routine camp management actions (permissible subject to animal welfare measures listed in Appendix 7) are provided in the Policy. These include:

- removal of tree limbs or whole trees that pose a genuine health and safety risk, as determined by a qualified arborist
- weed removal, including removal of noxious weeds under the *Noxious Weeds Act 1993*, or species listed as undesirable by a council
- trimming of understorey vegetation
- the planting of vegetation
- minor habitat augmentation for the benefit of the roosting animals
- mowing of grass and similar grounds-keeping actions that will not create a major disturbance to roosting flying-foxes
- application of mulch or
- removal of leaf litter or other material on the ground.

Protocols should be developed for carrying out operations that may disturb flying-foxes, which can result in excess camp noise. 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 and advising adjacent residents of activity days. Such activities could include lawn-mowing, using chainsaws, whipper-snippers, using generators and testing alarms or sirens**.**

4.1.6 Revegetation and land management to create alternative habitat

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

Selecting new sites and attempting to attract flying-foxes to them has had limited success in the past, and ideally habitat at known camp sites would be dedicated as a flying-fox reserve. However, if a staged and long-term approach is used to make unsuitable current camps less attractive, whilst concurrently improving appropriate sites, it is a viable option (particularly for the transient and less selective LRFF). Supporting further research into flying-fox camp preferences may improve the potential to create new flying-fox habitat.

When improving a site for a designated flying-fox camp, preferred habitat characteristics detailed in Appendix 3 Alternative camp site investigation report Section 1.3 Roosting preferences should be considered.

Foraging trees planted amongst and surrounding roost trees (excluding in/near horse paddocks) may help to attract flying-foxes to a desired site. They will also assist with reducing foraging impacts in residential areas. Consideration should be given to tree species that will provide year-round food, increasing the attractiveness of the designated site. Depending on the site, the potential negative impacts to a natural area will need to be considered if

introducing non-indigenous plant species.

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 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.

4.1.7 Provision of artificial roosting habitat

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

4.1.8 Protocols to manage incidents

This management option involves implementing protocols for managing incidents or situations specific to particular camps. Such protocols may include monitoring at sites within the vicinity of aged care or child care facilities, management of compatible uses such as dog walking or sites susceptible to heat stress incidents (when the camp is subjected to extremely high temperatures leading to flying-foxes changing their behaviour and/or dying).

4.1.9 Participation in research

This management option involves participating in research to improve knowledge of flying-fox ecology to address the large gaps in our knowledge about flying-fox habits and behaviours and why they choose certain sites for roosting. Further research and knowledge sharing at local, regional and national levels will enhance our understanding and management of flying-fox camps.

4.1.10 Appropriate land-use planning

Land-use planning instruments may be able to be used to ensure adequate distances are maintained between future residential developments and existing or historical flying-fox camps. While this management option will not assist in the resolution of existing land-use conflict, it may prevent issues for future residents.

4.1.11 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.

4.1.12 Do nothing

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

4.2 Level 2 actions: in-situ management

4.2.1 Buffers

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

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

Residents within 300 metres of a flying-fox camp are likely to experience some amenity impacts at some times (SEQ Catchments 2012). A buffer to mitigate odour and noise would ideally be 50 metres (SEQ Catchments 2012), however any buffer will assist and should be as wide as the site allows.

The Black Gully camp exists in a narrow strip of vegetation and therefore it is necessary to devise a suitable buffer distance that provides relief for residents, avoids forcing flying-foxes further into backyards or splintering the camp to other problematic locations, and maintains the ecological and amenity values of the vegetation. This requires consideration of the approximate total area of the camp, the area that would need to be modified/removed to create a suitable buffer, and whether there is an equivalent replacement area available in an appropriate location for the displaced flying-foxes.

Buffers through vegetation removal

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

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

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

Suitable experts should be consulted to assist selective vegetation trimming/removal to minimise vegetation loss and associated impacts.

The importance of under- and mid-storey vegetation in the buffer area for flying-foxes during

heat stress events 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, pers. comm.) in roost trees have shown to have localised effects, with flying-foxes deterred from roosting within 1–10 metres of the deterrents. The type and placement of visual deterrents would need to be varied regularly to avoid habituation. Potential for litter pollution should be considered and managed when selecting the type and placement of visual deterrents. In the absence of effective maintenance, this option could potentially lead to an increase in rubbish in the natural environment.

- 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 current 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 heat stress events, 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.

4.2.2 Noise attenuation fencing

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

4.3 Level 3 actions: disturbance or dispersal

4.3.1 Nudging

Noise and other low intensity active disturbance restricted to certain areas of the camp can be used to encourage flying-foxes away from high conflict areas. This technique aims to actively 'nudge' flying-foxes from one area to another, while allowing them to remain at the camp site.

Unless the area of the camp is very large, nudging should not be done early in the morning as this may lead to inadvertent dispersal of flying-foxes from the entire camp site. Disturbance during the day should be limited in frequency and duration (e.g. up to four times per day for up to 10 minutes each) to avoid welfare impacts. As with dispersal, it is also critical to avoid periods when dependent young are present (as identified by a flying-fox expert).

4.3.2 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 7 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 (Appendix 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

Dispersal is more effective when a wide range of tools are used on a randomised schedule with animals less likely to habituate (Ecosure pers. obs. 1997–2015). Each dispersal team member should have at least one visual and one aural tool that can be used at different locations on different days (and preferably swapped regularly for alternate tools). Exact location of these and positioning of personnel will need to be determined on a daily basis in response to flying-fox movement and behaviour, as well as prevailing weather conditions (e.g. wind direction for smoke drums).

Active dispersal will be disruptive for nearby residents given the timing 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.

Maintenance dispersal

Maintenance dispersal refers to active disturbance following a successful dispersal to prevent the camp from re-establishing. It differs from initial dispersal by aiming to discourage occasional over-flying individuals from returning, rather than attempting to actively disperse animals that have been recently roosting at the site. As such, maintenance dispersal may have fewer timing restrictions than initial dispersal, provided that appropriate mitigation measures are in place.

4.4 Unlawful activities

4.4.1 Culling

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

4.5 Camp management options analysis

Table 7 provides an analysis of the camp management options described in Section 4 and their suitability for implementation at Black Gully Camp. An appraisal is provided for the options to be either adopted, investigated further or disregarded within this plan.

Table 7 Camp management options analysis

Management options	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site
Level 1 options					
Education and awareness programs	Fear of disease Noise Smell Faecal drop	$	Low cost, increasing awareness will help the community coexist with flying-foxes, providing options for landholders to reduce impacts is an effective long-term solution and can be undertaken quickly.	Education and advice itself will not mitigate all issues, and on its own would not be acceptable to the community.	Survey results indicate the community is in favour of a range of educational tools and methods, and that community expectation could be managed through ongoing education and awareness programs. Appraisal: Adopt
Property modification / service subsidies	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$–$$	Property modification is one of the most effective ways to reduce amenity impacts of a camp without dispersal, relatively low cost, promotes conservation of FFs, can be undertaken quickly, will not impact on the site and may add value to the property. Property modification, such as glazing windows or installing noise attenuating insulation, will greatly assist with noise impacts inside residences and businesses. Installing shade sails, a car port or covering other affected areas will reduce the impacts of faecal drop. Council could provide car covers, clothesline covers, free hire of pressure cleaners or consider rate reductions to assist with faecal drop impacts.	May be cost-prohibitive for private landholders, however subsidies would assist.	Council has already provided car covers and assistance with cleaning for residents, however an ongoing program should be investigated. Property modification can assist in reducing all amenity concerns, although may be cost prohibitive for residents – subsidies would assist. Noise attenuation fencing not suitable because of topography. Appraisal: Investigate subsidies program.

Management options	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site
Odour reducing / masking plants	Noise Smell Health/wellbeing Property devaluation	$	Planting dense screens and fragrant plants to assist with odour and noise. Provide for the trimming of vegetation to maintain a low growing form. Tall trees to be assessed and modified only by a suitably qualified arborist. Use wildlife friendly netting to prevent occupation by flying-foxes.	May take time for plants to provide the desired effect	Residents could be encouraged to modify properties by planting dense screens and fragrant plants. Appraisal: Adopt
Routine camp management	Health/well-being	$	Weed removal has the potential to reduce roost availability and reduce numbers of roosting FFs.	Will not generally mitigate amenity impacts for nearby landholders.	Any weed removal should be staged and alternative roost habitat planted, otherwise activities may constitute a Level 3 action. Appraisal: Disregard at this stage
Alternative habitat creation	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$$-$$$	If successful in attracting FFs away from high conflict areas, dedicated habitat in low conflict areas will mitigate all impacts and helps FF conservation. Rehabilitation of degraded habitat that is likely to be suitable for FF use could be a more practical and faster approach than habitat creation. Improving potential alternative camp habitat should be part of a medium-long term plan.	Generally costly, long-term approach so cannot be undertaken quickly, previous attempts to attract FFs to a new site have not been known to succeed.	The investigation of alternative camp locations within 3 km reveals a lack suitable habitat available ready to accommodate flying-foxes in the near future. (Details in Appendix 3). Further surveys outside the previous study area are required to determine the feasibility of this option. Appraisal: Investigate further
Provision of artificial roosting habitat	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$-$$	Artificial roosting habitat could be considered to supplement the narrow available roosting space along Black Gully.	No guarantee that flying-foxes would use artificial habitat, but collaborating with a researcher on varying design options would increase the likelihood of success.	Not enough evidence to explore this as a viable option to support habitat restoration. Appraisal: Disregard

Management options	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site
Protocols to manage incidents	Health/wellbeing Fear of disease	$	Low cost, will reduce actual risk of negative human/pet–FF interactions, promotes conservation of FFs, can be undertaken quickly.	Will not mitigate amenity impacts, but will reduce fear of disease.	Council could develop standard internal procedures for engaging carers to respond to sick and injured wildlife in residents backyards. Appraisal: Adopt
Research	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$	Support research that improve understanding and more effectively mitigates impacts. Develop understanding of native flowering event in area.	Generally cannot be undertaken quickly, management trials may require cost input.	Not considered an urgent action at this site. Council will endeavour to stay up to date with contemporary research as it arises. Appraisal: Investigate further
Appropriate land-use planning	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$	Suitable planning for future development will reduce potential for future conflict. Identification of degraded sites that may be suitable for long-term rehabilitation for FFs could reduce impacts.	Will not generally mitigate current impacts.	Council may consider including additional management buffer zones within their codes in future planning scheme updates if properly documented and justified. Appraisal: Investigate further
Property acquisition	All for specific property owners Nil for broader community	$$$			Not feasible for this location. Appraisal: Disregard
Do nothing	Nil	Nil	No resource expenditure.	Will not mitigate impacts and would not be considered acceptable by impacted members of the community.	Not appropriate. Appraisal: Disregard

Management options	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site
Level 2 options					
Buffers through vegetation removal	Noise Smell Health/wellbeing	$–$$	Any vegetation removal should be done using a staged approach, with the aim of removing as little native vegetation as possible and only in vegetation directly affecting residents subject to a Vegetation Management Plan	Removing vegetation can also increase visibility into the camp and noise issues for neighbouring residents which may create further conflict. Vegetation removed too quickly could cause inadvertent dispersal.	Residents indicated preference for vegetation trimming and removal on their properties during on-site community workshop. Appraisal: Adopt
Buffers without vegetation removal – visual deterrents, canopy mounted sprinklers	Noise Smell Health/wellbeing Damage to vegetation	$$	Canopy-mounted water sprinklers – This method has been effective in deterring flying-foxes from designated buffer zones in Queensland (Ecosure pers. comm.). Visual deterrents – Visual deterrents such as plastic bags, fluoro vests (GeoLINK 2012) and balloons (Ecosure 2016, pers. comm.) in roost trees have shown to have localised effects, with flying-foxes deterred from roosting within 1–10 metres of the deterrents.	This option can be logistically difficult (installation and water sourcing) and may be cost-prohibitive. Misting may increase humidity and exacerbate heat stress events, and overuse may impact other environmental values of the site. The type and placement of visual deterrents would need to be varied regularly to avoid habituation. Potentially lead to increase in rubbish in the natural environment.	Some residents were in favour of this technique which could be incorporated into buffering where residents would prefer to retain vegetation Appraisal: Adopt
Noise attenuation fencing	Noise Smell Health/wellbeing Property devaluation Lost rental return/income	$$	Standard noise attenuation fencing is intended to alleviate amenity issues for residents. Advice from an acoustic consultant may provide site-specific alternatives (see Section 9).	Noise attenuation fencing is costly and can be considered unsightly for property fencing.	The site topography and placement of dwellings in relation to camp means noise attenuation fencing is unlikely to be beneficial. Appraisal: Disregard

Management options	Relevant impacts	Cost $-$$$ Low-high	Advantages	Disadvantages	Suitability for site
Level 3 options					
Nudging	All	$$–$$$	Can encourage flying-foxes to shift away from high conflict areas next to residential areas.	May lead to inadvertent dispersal if not done at the correct time, frequency or duration.	This site is considered to be too small to nudge flying-foxes while avoiding inadvertent dispersal. Level 2 techniques including canopy mounted sprinklers can achieve the same outcome as actively 'nudging' flying-foxes away without the use of light, noise and smoke deterrents. Appraisal: Disregard
Active dispersal	All at that site but not generally appropriate for amenity impacts only	$$$	If successful can mitigate all impacts at that site.	Dispersal is rarely successful without significant vegetation removal (not appropriate at this location) or ongoing effort and excessive expenditure (e.g. several years and $1M for Sydney Botanic Gardens). Flying-foxes will almost always continue to roost in the area (generally within 600m), and often splinter into several locations nearby (including many remaining at the original site) (e.g. a single camp permanently splintered to numerous sites as a result of dispersal in Maclean, including remaining at the original site).	This option is not considered appropriate at this site. Appraisal: Disregard

5 Planned management approach

It is recommended that Council takes a risk-based approach to management based on:

- potential health, safety, wellbeing and economic implications for the community
- likelihood of management success
- lack of suitable alternative camp locations
- potential flying-fox welfare and conservation impacts
- cost of management, and who would contribute to these costs
- risk of splintering the camp to other locations that are equally or more problematic.

The management options provided herein are intended primarily to provide relief for residents living in close proximity to the camp. Management options have been staged to prevent exacerbating problems associated with the camp whilst ensuring the welfare of flying-foxes should they return to the camp. Note also that all management options, and routine maintenance, must be done in accordance with mitigation measures detailed in Appendix 7.

The proposed management approach considers feedback received during community engagement. The community indicated a preference for:

- moving or nudging flying-foxes out of the urban area
- deterring or disturbing flying-foxes upon their return
- providing alternative habitat or camp sites
- creating buffers.

Community survey results also indicated some people have an expectation that flying-foxes can be moved or controlled, that flying-foxes are not threatened, that flying-foxes are pests as well as some concern for health risks associated with flying-foxes. Therefore, it is recommended to adopt an education and awareness program to reduce misconceptions and appease fears.

Community survey results suggested alternative camp sites should be identified for the flying-foxes to inhabit. The investigation of alternative flying-fox camp sites revealed the need for restoration works (i.e. habitat creation) in order to accommodate flying-foxes at more suitable locations that mitigate future human/wildlife conflict issues (Appendix 4). Given the risk associated with attempting to relocate the camp prior to a suitable alternative being available, some level of in situ management will be required. However, due to a dearth of suitable roosting habitat available in Armidale, any management of the weedy understorey on Council's allotment should only occur if the numbers of flying-foxes and camp extent allows. Specifically, the risk of inadvertent splintering and dispersal to equally or more problematic locations must be avoided.

Management options for adoption or further investigation are outlined in Table 8 along with proposed timing: short-term (within 12 months), medium-term (within 2 years) or long-term

(within 3 years). It should be noted that management actions may result in several outcomes due to the unpredictable nature of flying-fox behaviour. These include the camp:

- becoming unattractive to some flying-foxes reducing the number on site
- becoming less suitable with flying-foxes moving into nearby backyard trees
- becoming less suitable and splintering the camp to another site or sites in Armidale (potentially equally or more problematic)
- camp is abandoned altogether.

Level 2 options, vegetation trimming or removal, were the community's preferred management options. Armidale Dumaresq Development Control Plan 2012 provides provisions within Chapter 2.2 on preserving and managing existing tree plantings including the removal and pruning approval process under the Local Environment Plan 2012. Council also follows the Australian Standard for Pruning of Amenity Trees (AS4373-2007). An arborist should be engaged to investigate which trees are suitable for trimming or removal in line with the aforementioned provisions.

A Vegetation Management Plan (VMP) will be prepared before any vegetation works to minimise the risk of escalating current issues or splintering the camp to one or several other potentially problematic locations. Based on the maximum known camp extent of approximately 2.38 ha (December 2017), it is aimed to provide buffers up to 15 m around homes depending on the availability of suitable low conflict habitat in other areas around the camp. Stage 1 vegetation works will only occur with advice from a suitably qualified arborist with vegetation management areas confirmed through a VMP. The VMP will calculate and apportion acceptable vegetation buffers to eligible residents, and ensure extents are accurate to current vegetation based on ground-truthing[1]. Buffers may consist of a combination of vegetation removal and sprinklers which can be turned off during potential influxes.

Figure 13 illustrates 15 m buffers for properties which were discussed with residents during the engagement process. Residents being impacted by flying-foxes but did not want vegetation management opted for canopy-mounted sprinklers. It is important to note, due to the narrow shape of vegetation at the camp and a shortage of suitable nearby habitat, any vegetation management at the camp must be strictly controlled. Vegetation management that aimed to disperse the flying-foxes would constitute Level 3 action, passive dispersal, and this is not the intent of Council due to the high risks and often unsuccessful outcomes.

If trees nominated by residents for vegetation management fell outside the 15 m management buffer but within the buffer of a neighbouring property, Council will not approve the removal of any trees in another property if the owners do not wish for that to happen.

Vegetation management will be considerate of habitat requirements of any threatened species that may occur in the area and will be further detailed in the VMP.

Any weed removal in the understorey (e.g. cotoneaster and privet) should be restricted to 10%

1 The aerial for the current maximum extent in Figure 13 includes some areas that appear to be devoid of roost vegetation, however from the site assessment to date some of these areas now have available canopy. The extents will be refined during ground-truthing in developing the VMP to ensure all area calculations are as precise as possible. These updated figures will inform the amount of vegetation that can be removed while minimising the risk of forcing flying-foxes to other undesirable locations.

of the camp area (i.e. no more than 2,380m^2) and should only occur in the second or third year of the plan when flying-foxes are not present.

See Table 9 for staged vegetation management and Table 10 for eligible properties and associated buffer areas. These buffer areas are estimates and will require refinement in consultation with qualified arborist.

Level 2 actions require OEH authorisation prior to commencing (see Appendix 1). Additional approvals may also be required under other legislation (refer to Appendix 1).

Table 8 Staged approach to management at Black Gully flying-fox camp. Note all actions must be done in accordance with measures in Appendix 7. Authorisation for Level 2 and 3 actions is required, and additional approvals may be required under other legislation (see Appendix 1).

Management option	Management level	Appraisal	Action(s)	Timing	Measure
Education and awareness programs	Level 1	Adopt	Increase community understanding and improve perceptions of flying-foxes. · produce webpage on Council's website summarising Council's approach to flying-fox management · conduct a letterbox drop to promote awareness of flying-fox issues that includes contact details for sick and injured flying-foxes, public health information and tips for living with flying-foxes. · install signage when flying-foxes are present advising not to touch dead or injured flying-foxes and provide phone numbers for wildlife rescue. Continue to consult with affected community members.	Short term (within 12 months)	Education and awareness program designed and initiated
Protocols to manage incidents	Level 1	Adopt	Develop disposal and rescue protocols (see Appendix 8 for a rescue protocol template) to respond to any mass mortality/morbidity event and reduce human exposure risk. This should be followed by staff, volunteers and residents, and include: · what to do if a dead, injured or orphaned flying-fox is encountered · what to do if someone is bitten or scratched · requirements for working in and around a camp. Fund collection and disposal of flying-foxes which may die during a mass-mortality event. Several incidents of residents using noise to intentionally disperse flying-foxes from backyards exacerbates issues for other residents. Properties can be maintained provided actions are not aimed at disturbing the camp. Intentional disturbance without authorization from OEH is a breach of legislation and may be prosecuted.	Short term (within 12 months)	Clear Council policy and procedure for dealing with flying-fox welfare incidents

Management option	Management level	Appraisal	Action(s)	Timing	Measure
Buffers through vegetation removal	Level 2	Adopt	Residents indicated preference for vegetation trimming and removal on their properties during on-site community workshop (Figure 10) Council has identified and recorded trees nominated for removal by residents. The VMP assessment will confirm an acceptable level of removal of total roost canopy that does not impact of flying-fox welfare. See table 9 for stages of vegetation management subject to a VMP. Table 10 comprises properties eligible for establishing buffers around homes. Trimming or thinning the canopy of trees flying-foxes roost in while they are out of season may deter them from roosting when they return. **Level 2 action and authorisation from OEH required prior to commencing.**	Short term (within 12 months)	Stage1 vegetation management commenced
Non- flying-fox-attracting vegetation and odour reducing / masking plants	Level 1	Adopt	Residents could be encouraged to modify properties by planting dense screens and fragrant plants to assist with odour. Provide a plant list to community to replace flying-fox attracting plants with non-attracting species, including aromatics (providing local plant options in addition to examples in Section 4.1.2)	Medium term (within 2 years)	Information added to education and awareness program
Property modification / service subsidies	Level 1	Investigate further	Council will provide information to residents and businesses regarding options to reduce impacts at their properties, and investigate a subsidies program to assist with property modification, services or other incentive options e.g. clean up service , external screens, car covers, clothesline covers, outdoor area cover, free hire of pressure cleaners,	Short term (within 12 months)	Information added to education and awareness program or similar
Research	Level 1	Investigate further	Support research, particularly projects which will assist in understanding local flying-fox movements and ways to mitigate impacts on the community. Develop understanding of native flowering events in area. Maintain Council database of flying-fox population at camp and mortalities.	Medium term (within 2 years)	Council to keep up to date on contemporary research and provide relevant updates to the community

Management option	Management level	Appraisal	Action(s)	Timing	Measure
Alternative habitat creation	Level 1	Investigate further	An investigation of several alternative flying-fox camp sites revealed a lack of suitable structured vegetation stands within 3 km of Black Gully to serve as an alternative camp location (Appendix 3).	Short term (within 12 months)	Council to consider broader study of LGA or rural areas for alternative sites as well as offering financial assistance or resourcing for existing restoration projects in Armidale that may support flying-foxes in the future (e.g. Mike O'Keeffe Woodland).
Canopy mounted sprinklers	Level 2	Investigate further	Liaise with landholders and an irrigation specialist regarding feasibility and costs associated with installing canopy-mounted sprinklers in the buffer zone. Design and frequency/ duration of use must also be considerate of animal welfare and other ecological values of the site. **Level 2 action and so licence from OEH required prior to installing.**	Medium term (within 2 years)	Provide supplier details to interested landholders
Appropriate land-use planning	Level 1	Investigate further	Identification of sites that may be suitable for long-term rehabilitation and zoning for FFs to mitigate impacts to residents. Measures to avoid future impacts will be considered when assessing development applications.	Long term (within 3 years)	To be investigated by Council's land use planning department

Table 9 Staged vegetation management

Stage	Action	Permissible	Eligible	Required
1 Year 1	Buffer (up to 15m from dwellings)	· Tree removal or pruning · Tree trimming · Canopy mounted sprinklers · Licence required	Properties considered during engagement (Table 10). Residents within 25 m of camp can seek Council subsidy (fixed percentage of cost of works) for vegetation management	Arborist to advise on tree trimming/removal on Council and private land. A VMP will be prepared for Stage 1.
Assess flying-fox response to changes in camp. If no issues and impacts, continue to Stage 2				
2 Year 2 -3	Weed removal	· Removal of introduced plants and introduced shrubs in understorey · Licence required	Murray Avenue Road Reserve	Stage 2 area
	Planting	· Native species to create complex structure and increase canopy area	At various restoration sites within LGA	Council to provide financial or other assistance to restoration projects such as Mike O'Keeffe Woodland and/or other council restoration sites

Following on-going engagement with affected residents, properties nominating buffer management are listed in Table 10.

Table 10 Properties nominating buffer management and associated buffer areas. Note that these indicative areas will be confirmed and refined in developing the VMP and are likely to change.

Property	Camp area within property (m^2)	Buffer area (m^2)	% of buffer area covered by camp
9/DP565189	819.43	819.43	100%
19/DP29301	1964.91	610.61	31%
11/DP615040	3415.47	578.21	17%
18/DP29301	565.84	357.33	63%
16/DP29301	294.8	260.92	89%
10/DP615040	4268.73	240.52	6%
4/DP242251	174.36	152.40	87%
21/DP733113	97.45	97.45	100%
Total camp area		3116.87m^2	

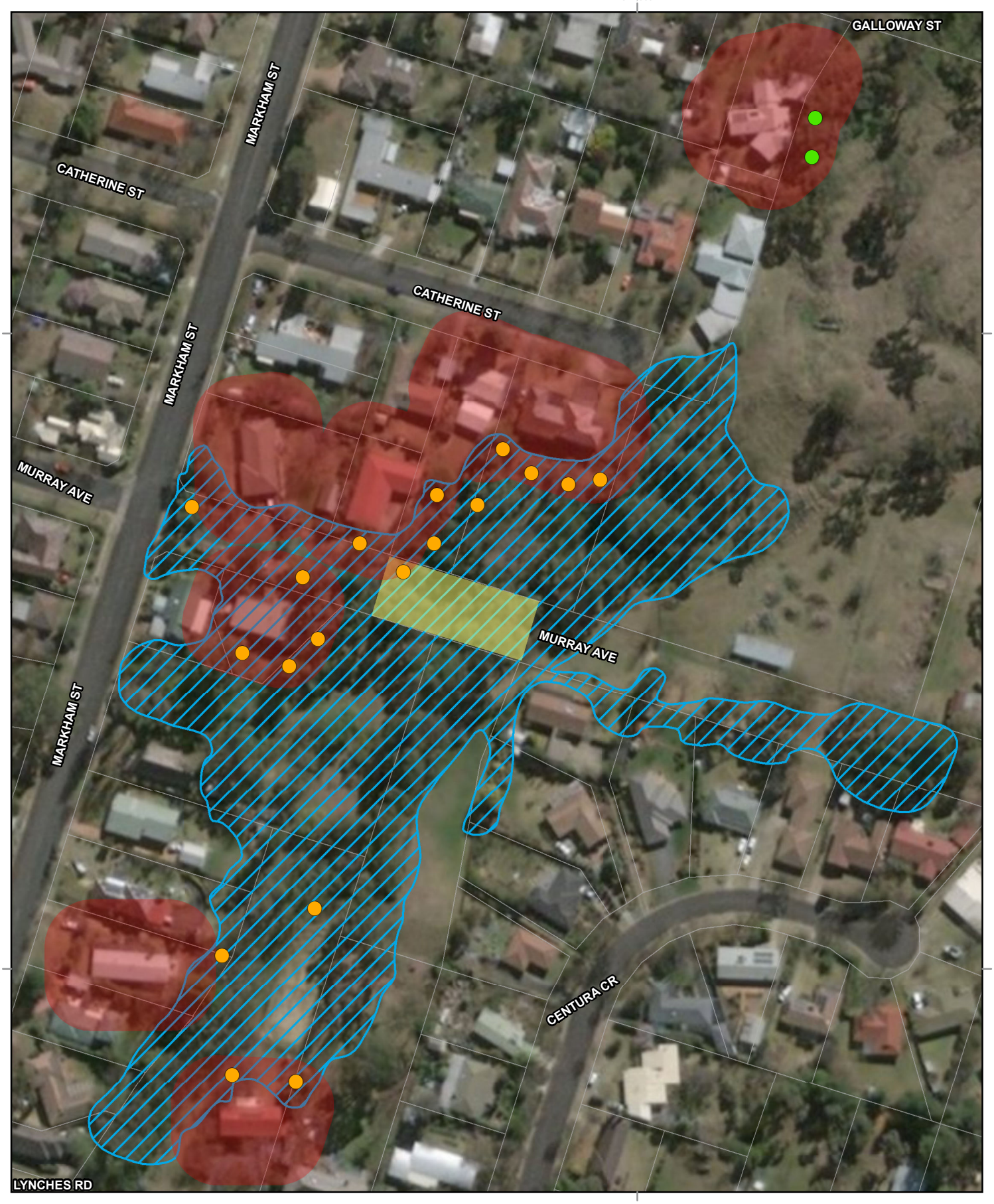

Figure 13: Staged vegetation management

Armidale Regional Council

Flying-fox camp management plan

- Canopy mounted sprinklers
- Trees nominated for trimming / removal
- Camp extent (2.38 ha) (December 2017)
- Stage 1 - Buffer (15 m from dwelling)
- Stage 2 - Weed removal
- Property boundary

ecosure

Job number: PR3232
Revision: 0
Author: KF
Date: 28/06/2018

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6 Evaluation and review

This Plan will be in operation for five years (2018-2022) with annual review of management actions set out in Section 5.

The following will trigger a reactive internal review of the Plan:

- completion of a management activity
- progression to a higher level of management
- changes to relevant policy/legislation
- new management techniques becoming available
- outcomes of research that may influence the Plan
- incidents associated with the camp.

Monitoring and reporting requirements are detailed in Section 7.

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 prior to being re-submitted to OEH.

7 Plan administration

7.1 Monitoring of the camp

Reports for Level 1 actions that comply with this Plan are not required to be submitted to OEH. It is recommended that Council keep internal records to allow the effectiveness of each management action to be evaluated.

Reports for Level 2 actions will be submitted to OEH one month after commencement of works and then quarterly in periods where works have occurred. Each report is to include:

- results of pre- and post-work population monitoring
- any information on new camps that have formed in the area
- further management actions planned to include a schedule of works
- an assessment 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 planting
- expenditure and contributors
- outcomes from evaluation and review (Section 6).

7.2 Responsibilities

Council is responsible for implementation of the Plan once it has been endorsed by OEH, licences have been obtained for Level 2 actions and resources have been allocated for implementation. Council will seek advice from OEH and other flying-fox experts as required during implementation.

Council will need to administer the Stage 1 vegetation management to ensure that approvals for vegetation removal or trimming total no more than 10 % of the total camp area. Administration may also include determining residents' eligibility for subsidies for services such as arborist advice, vegetation trimming/removal and green waste removal or providing details of suppliers for canopy mounted sprinklers.

All Council personnel, contractors and volunteers working in Black Gully are responsible for complying with mitigation measures detailed in Appendix 8. Council will ensure non-Council staff and volunteers are aware of this responsibility and will provide assistance if required. All on-ground works towards implementation of this Plan, will be performed in accordance with a Safe Work Method Statement that includes risks and mitigation measures for working in a flying-fox camp.

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.

7.3 Funding commitment

Council will commit available funds on an annual basis over the life of the five year Plan to implement actions in Table 8. Allocation of Council funding will be dependent on resources available and annual priorities. Council will also seek opportunities for funding through relevant grant programs, such as the NSW Flying-fox Grants Program.

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Appendix 1 Legislation

Local

Armidale Dumaresq Local Environmental Plan (LEP) 2012 aims:

1.2.2 (a) to encourage the orderly management, development and conservation of resources by protecting, enhancing and conserving:

(iv) native plants and animals, including threatened species, populations and ecological communities, and their habitats.

Armidale Dumaresq Development Control Plan 2012 provides provisions within Chapter 2.2 Tree Preservation on preserving and managing existing tree plantings including the tree removal and pruning approval process under LEP 2012. ARC also follows the Australian Standard for Pruning of amenity trees (AS4373-2007).

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 OEH 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.

Draft Code of Practice Authorising Flying-fox Camp Management Actions 2018

OEH has prepared a draft 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. The public exhibition period for the draft code of practice is underway and ends 7 June 2018.

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 developments 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* 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 State Environmental Planning Policy (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 (heat stress event, 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 2 Flying-fox ecology & 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*)

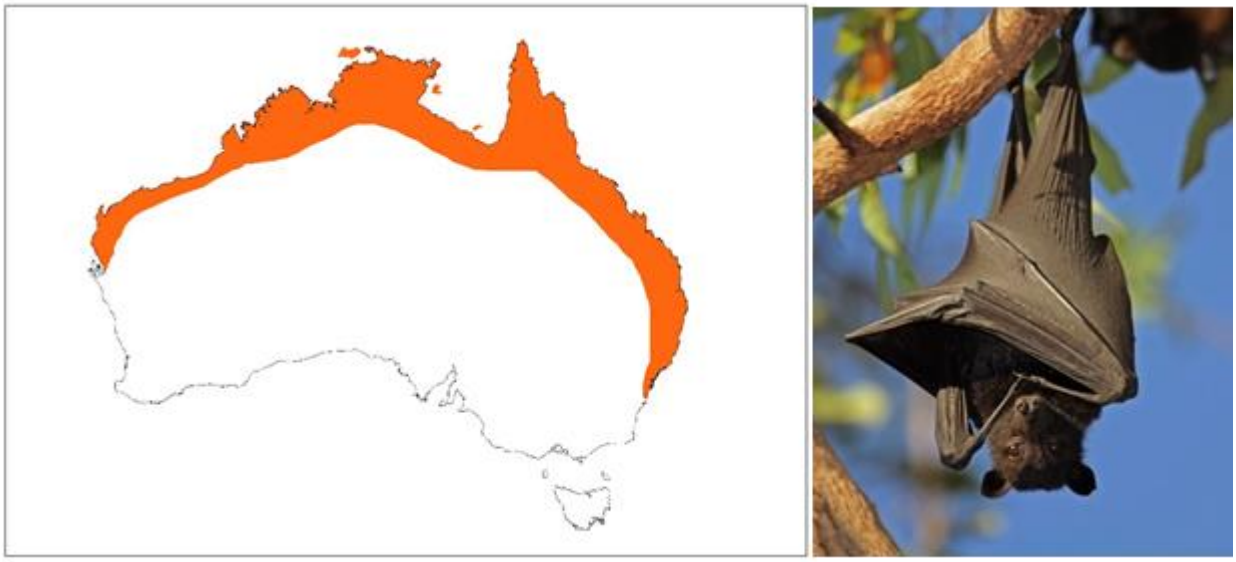

Figure 14 Black flying-fox indicative species distribution, adapted from OEH 2015a

The black flying-fox (BFF) (Figure 14) 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*)

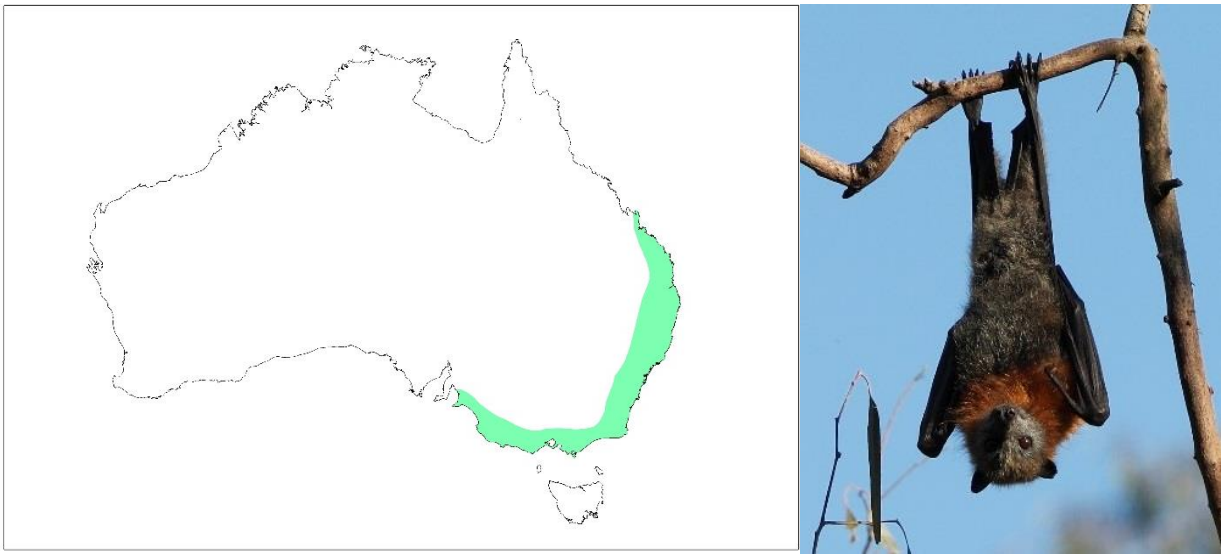

Figure 15 Grey-headed flying-fox indicative species distribution, adapted from OEH 2015a

The GHFF (Figure 15) is found throughout eastern Australia, generally within 200 kilometres 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 kilometres in a single night with a foraging radius of up to 50 kilometres from their camp (McConkey et al. 2012). They have been recorded travelling over 500 kilometres 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 (see Section 3).

Little red flying-fox (*Pteropus scapulatus*)

Figure 16 Little red flying-fox indicative species distribution, adapted from OEH 2015a

The little red flying-fox (LRFF) (Figure 16) 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 17).

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 17). 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 17 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.

Appendix 3 Black Gully alternative flying-fox camp investigation report

ecosure

Black Gully alternative flying-fox camp site

Investigation report
August 2018

ARMIDALE REGIONAL COUNCIL

ecology / vegetation / wildlife / aquatic ecology / GIS

Acknowledgements

Ecosure would like to acknowledge Richard Morsley (Armidale Regional Council) for his local knowledge and botanical advice in the development of this report.

Acronyms and abbreviations

BC Act	*Biodiversity Conservation Act 2016* (NSW)
the camp	Black Gully flying-fox camp
Council	Armidale Regional Council
GHFF	Grey-headed flying-fox (*Pteropus poliocephalus*)
LRFF	Little red flying-fox (*Pteropus scapulatus*)
MNES	Matters of national environmental significance
NERAM	New England Regional Art Museum
OEH	Office of Environment and Heritage (NSW)

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1 Introduction

Armidale Regional Council (Council) engaged Ecosure Pty Ltd to investigate potential alternative camp locations within three kilometres of Black Gully camp (Figure 1 and Figure 3). The colony currently occupies Council and freehold land and has impacted some residents (Figure 2) due to noise, odour, faecal drop, damage to vegetation as well as hundreds of carcasses of juvenile flying-foxes found in backyards. In October 2017, flying-foxes arrived in Black Gully including:

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

As with all native wildlife, both are protected under New South Wales legislation. The GHFF is also listed as Vulnerable under Commonwealth legislation (*Environment Protection and Biodiversity Conservation Act 1999;* EPBC Act), affording them additional protection.

Figure 1 Black Gully flying-fox camp

1.1 Project scope

Council is seeking a long-term strategy to manage issues associated with the arrival of flying-foxes to Armidale. The aim of this investigation was to:

- find appropriate locations that flying-foxes could occupy with the aim of mitigating human/wildlife conflict issues
- assess the suitability of proposed locations for habitat restoration works
- provide any other recommendations that may increase the success of moving the camp.

The rationale is that it may be possible to identify a more suitable flying-fox camp as a future option. This location needs to be capable of retaining an appropriate buffer from sensitive receptors such as schools, hospitals or airports or, could be zoned for future flying-fox conservation whilst ensuring an acceptable level of amenity for the community. This study forms part of the development of a Camp Management Plan for Black Gully.

1.2 Flying-foxes in urban areas

Flying-fox camps are generally seasonal, tightly tied to the flowering of their preferred food trees. Flying-foxes appear to be roosting and foraging in urban areas more frequently. There are many possible drivers for this, as summarised by Tait et al. (2014):

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

Figure 2 Black Gully flying-foxes hanging in residential backyards

1.3 Roosting preferences

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

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

This Armidale camp does not meet the generally preferred criteria of being within 50 km of the coastline or <65 metres above sea level. Flying-foxes appear to be more frequently roosting in areas outside this preferred coastal band to take advantage of resources in these areas. For example, flying-foxes are now commonly recorded in Tamworth, less than 100 km south of Armidale. As such, these criteria have not been considered when assessing potential alternative sites.

LRFF are generally less selective than the other species and will often roost in any available habitat in a suitable location. This highlights the importance of location and proximity to important resources. 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 2013). It roosts in closer congregations than other Australian flying-foxes under normal circumstances (EHP 2011). 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).

1.4 Foraging preferences and movement patterns

Flying-fox movements are typically over long distances as they track preferred foraging resources (SEQ Catchments 2012).

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 kilometres in a single night with a foraging radius of up to 50 kilometres from their camp (McConkey 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 an 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).

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).

The LRFF is the only species of flying-fox in the world that feeds almost exclusively on nectar (Birt et al. 2008). Preferred feed trees of the LRFF include species of Eucalyptus (Australian Museum 2010; Churchill, 2008); however, blossoms from Corymbia (i.e. bloodwoods) and Angophora (BCC 2010) may also form part of their diet. LRFF will also feed on fruits in the absence of nectar (Birt et al. 2008). In some instances, orchards are raided, resulting in commercial fruit loss (Australian Museum 2010; Birt 2008; EHP 2011). There is a general migration pattern in LRFF, whereby large congregations of over one million individuals can be found in northern roosting sites (e.g. Northern Territory, North Queensland) during key breeding periods (Vardon & Tidemann 1999). Outside of these periods LRFF undertake regular movements from north to south during winter-spring (July-October) (Milne & Pavey 2011).

Likely nearby foraging resources and their distance and direction from Black Gully camp include:

- Duval National Park (12.2 km N)
- Yina National Park (9 km E)
- Imbota National Park (7.8 km SE)
- Oxley Wild Rivers National Park (15.7 km SE)
- Fruit (apple, pear and stone fruit) orchard (14 km SW).

2 Desktop review

The desktop assessment of potential flying-fox camp locations included:

- proximity to current camp
- if the land was Council owned or managed
- the presence of creek lines due to flying-foxes inclination to select gullies and be near water sources
- proximity to sensitive receptors such as hospitals, airports, schools, day care, aged care and equine facilities.

The suitability of Black Gully was investigated up and down stream as a natural overflow for large influxes of the flying-fox population. Dumaresq Creek lies on a natural floodplain and therefore comprises a natural buffer with many of the adjacent parcels of land cleared of vegetation and owned or managed by Council. Site suitability for this investigation focussed on Council land as no habitat modelling was applied to the LGA. Flying-foxes may attempt to establish at other habitat within the LGA and therefore modelling could be applied to find alternative sites if developing a camp relocation plan in the future. Table 1 presents seven locations investigated in the desktop review (Figure 3).

Table 1 Description of sites within 3km identified for investigation

Name	Lot/Plan/Address	Tenure	Proximity to Black Gully	Notes
Below reservoirs	Galloway Street Road reserve	Council	Downstream 150m	Very narrow, steep part of hillside. Connects to Black Gully Creek.
Beadle Grove	70-74 Lynches road Lot 11 DP581266	Council	Upstream 200m	Possible overflow site for influxes or after vegetation works at Black Gully.
Behind NERAM (Art Museum)	Lot 3 DP1055438	Council	Downstream 800m	Anecdotal records of flying-fox there in 2007/08.
Mike O'Keeffe Woodland on Black Gully	Lot 1 DP1046262	Crown	1.4 km	Armidale Tree Group Inc. responsible for native nursery and revegetation Suitable buffers available.
Elizabeth Park	224-226 Donnelly Street Lot 1 DP559194	Council	2.1	Restoration site along Dumaresq Creek between Butler and O'Dell Streets. Suitable buffers available.
Old Council Depot	15 Grafton Road Lot 16 DP755808	Council	2.7 km	Downstream Black Gully.
Norths Playing field	28-58 Erskine St Lot 40 DP851109	Council	3.3 km	Along Dumaresq Creek.

Figure 3: Alternative flying-fox camps within a 3 km radius of Black Gully

Armidale Regional Council

Flying-fox Camp Management Plan

- Black Gully Camp
- 3 km buffer
- Beadle Grove
- Behind NERAM
- Below Reservoirs
- Black Gully Reserve
- Elizabeth Park
- Norths Playing fields
- Old Council Depot

ecosure

Job number: PR3345
Revision: 0
Author: KF
Date: 9/04/2018

0 250 500 1,000
Metres

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

Figure 4: Potential suitable alternative sites - southern sites

Armidale Regional Council

Flying-fox Camp Management Plan

Black Gully Camp
3 km buffer
Black Gully Reserve
Beadle Grove
Behind NERAM
Below Reservoirs

ecosure

Job number: PR3345
Revision: 0
Author: KF
Date: 24/04/2018

0 50 100 200
Metres

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

Figure 5: Potential suitable alternative sites - northern sites

Armidale Regional Council

Flying-fox Camp Management Plan

Black Gully Camp
3 km buffer
Elizabeth Park 2
Norths Playing Field
Old Council Depot

ecosure

Job number: PR3345
Revision: 0
Author: KF
Date: 24/04/2018

0 75 150 300
Metres

GCS GDA 1994
Datum: GDA 1994
Units: Degree

3 Site assessments

Ecosure Senior Wildlife Biologist with the assistance of ARC Program Leader, Parks and Facilities undertook a site assessment to ground truth the potential camp habitat value at locations identified in the desktop review. Specifically, the desktop review focussed on land tenure with suitable camp features and not potential habitat modelling.

3.1 Beadle Grove Park

3.1.1 Description

Beadle Grove Park was handed to the Council in Trust. Vegetation exists along a narrow strip along Black Gully containing yellowbox (*Eucalyptus melliodora)* and river sheoak (*Casuarina cunninghamiana), Acacia filicifolia, A. diphylla* in the canopy. The understorey contains planted shrubs *A. rubida, Callistemon pungens, C. sieberi,* and *Lomandra longifolia* and ground cover species includes weeds such as blackberry, ivy, honeysuckle and introduced grasses.

North East

South West

Figure 6 Beadle Grove

3.1.2 Attributes of the site

Attributes at this site generally attractive to roosting flying-foxes include:

- canopy containing native species at least 5 m high
- complex structure and microclimate regulated by grass cover and midstorey
- close proximity to water source (0 m)
- level topography
- greater than one hectare.

3.1.3 Constraints of the site

Although a dense understorey exists, the stand of vegetation is quite narrow and would require extra planting to make the site more suitable for flying-foxes, however would be relatively cost-effective because suitable structure already exists.

3.2 Below reservoirs

3.2.1 Description

The Galloway Street Road Reserve is located on the southern side of two Council reservoirs of Allingham Street. The land is managed by Council and joins up to the Black Gully creekline. The lot is predominantly cleared, comprising sparse manna gum (*Eucalyptus viminalis*) and a understorey of native and introduced grass and herbaceous plants and shrubs (*Pyracantha angustifolia, Crataegus monogyna*). Flying-foxes have been observed roosting in the trees in this location (H. Ford 2018 pers. comm. 1 March).

Figure 7 Galloway Street road reserve behind reservoirs

3.2.2 Attributes of site

Attributes at this site generally attractive to roosting flying-foxes includes a few eucalypts over 5 m high and its close proximity (0m) to water source. The lot's tenure, proximity to the current camp as well as its connectivity to Black Gully creek-line makes it suitable for habitat restoration.

3.2.3 Constraints of site

The lot itself is narrow, steep and adjacent to a public footpath. If the site was planted, the footpath between Galloway Street and Allingham Street would need appropriate buffers. The feasibility of utilizing this site for restoration needs to be in context with surrounding parcels of land, specifically the adjacent freehold property.

3.3 Behind NERAM

3.3.1 Description

Black Gully extends along the southern side of the New England Regional Art Museum (NERAM) and has had some plantings along its banks. Vegetation consists of willow (*Salix baylonica*), maple (*Acer negundo*) and white poplar (Populus sp), introduced grasses and weeds dominate the understorey. Anecdotal sightings from 2007 suggest a few hundred flying-foxes roosted here for a short period although have not returned to the site (R. Morsley 2018 pers. comm. 14 February).

North

East

South

West

Figure 8 Creek-line behind NERAM

3.3.2 Attributes of the site

Attributes at this site generally attractive to roosting flying-foxes include its proximity to water (0 m), level topography and suitable buffers from residential area.

3.3.3 Constraints of the site

Constraints of the site include a lack of complex structure in the vegetation along the creek-line. Suitably tall trees at this site are not native. Although this site may provide tourism or education opportunities for a flying-fox camp here, the variety of other public uses around this site including dog off leash area, cafés, gymnastics club, Aboriginal Cultural Centre and Keeping Place is likely to conflict with the suitability of maintaining a flying-fox camp at this location in the long-term.

3.4 Mike O'Keefe Woodland on Black Gully Reserve

3.4.1 Description

Black Gully Reserve, also known as Mike O'Keeffe Memorial Woodland is on Crown land and managed by the Armidale Tree Group. The reserve contains *Eucalyptus viminalis*, *E. stellulata, E. pauciflora, E camphora, Acacia filicifolia* and other local species planted. Native and introduced grasses and herbaceous plants including a range of callistemon, wattles, tea trees, lomandra and other local species are in the understorey. It is a remnant of natural grassy woodland vegetation, an endangered ecological community protected under NSW legislation.

Figure 9 Black Gully Reserve

3.4.2 Attributes of the site

Attributes at this site generally attractive to roosting flying-foxes include:

- canopy at least 5 m high
- complex vegetation structure
- close proximity to water source (0m)
- level topography
- greater than one hectare.

Vegetation at this site is of a composition and structure that it may soon be able to maintain flying-foxes in the future This site has suitable buffers to residential areas, understorey diversity and permanent water. Armidale Tree Group is open to working with Council regarding the site's potential to support flying-foxes in the future.

3.4.3 Constraints of the site

Although this site could undergo some damage with an influx of flying-foxes in its current state, however this could be address with on-going restoration to improve the resilience of the site.

3.5 Elizabeth Park

3.5.1 Description

This open space lot is owned and managed by Council and consists predominantly of mown grass. An older stand of white poplar (*Populus alba*) and maple (*Acer negundo*) exists on the eastern side of the park (Figure 10) and planted *Casuarina cunninghamiana*, *E. camphora*, *E. stellulata* (immature trees < 10 years) are in a narrow strip of native habitat that is being restored along Dumurasq creek (Figure 11). Understorey includes planted species with *Callistemon pungens, C. sieberi, Lomandra longifolia* and introduced grasses.

Figure 10 White poplar and maple

Figure 11 Native restoration along Dumaresq Creek

3.5.2 Attributes of the site

Attributes at this site generally attractive to roosting flying-foxes include:

- some canopy at least 5 m high
- close proximity to water source (0m)
- level topography
- greater than one hectare.

The site in located on Council land and has sufficient buffers to residential areas.

3.5.3 Constraints of the site

The taller mature trees at this site comprise non-natives and the vegetation within the restoration area is approximately 5-10 years away from being useful for flying-foxes. Although located along the creek-line, the site may also be a little too exposed for flying-foxes.

3.6 Old Council depot

The old Council Depot lot on Barney Street is a long narrow parcel of land with some occupied council buildings at the front, and Black Gully creek running through the back of the lot. Sparse willow (*Salix babylonica*) and pine (*Pinus radiata*) trees are located along a very deteriorated creekline with weedy groundcover including ivy, privet and introduced grasses.

3.6.1 Description

North

East

South

Figure 12 Old council depot

3.6.2 Attributes of the site

Attributes important for attracting flying-foxes at this site are essentially absent.

3.6.3 Constraints of the site

Although the site contains sufficient buffers from residential areas and sensitive receptors, it lacks adequate native species or structure to consider undertaking habitat restoration that is time or cost effective for the purpose of attracting flying-foxes.

3.7 Norths Playing Fields

3.7.1 Description

Dumaresq Creek runs through Council owned and managed sports fields leased to North Armidale football club. Some riparian restoration has occurred at the southern end of the lot. Vegetation comprises willow (*Salix baylonica*), maple (*Acer negundo*) and white poplar (*Populus deltoids*). Weeds include blackberry, ivy, honeysuckle, privet and introduced grasses.

Figure 13 Norths Playing Fields on Dumaresq Creek

3.7.2 Attributes of the site

Attributes at this site generally attractive to roosting flying-foxes include:

- canopy at least 5 m high

- close proximity to water source (0 m)
- level topography
- greater than one hectare.

3.7.3 Constraints of the site

Although the site contains sufficient buffers from residential areas and sensitive receptors, it lacks adequate species composition or structure to consider undertaking habitat restoration that is time or cost effective for the purpose of attracting flying-foxes.

3.8 Site summary

Table 2 provides a summary of the site assessments including each site's rank as an alternative flying-fox camp. Four of the seven sites investigated warranted consideration into a strategic plan to accommodate flying-foxes in Armidale. Of the top five, Mike O'Keefe Woodland has the highest quality and complexity of vegetation and has effective buffers. Immediately upstream of Black Gully camp, Beadle Grove Park has Council tenure, is in close proximity to the existing camp and has reasonable buffers. The Galloway street road reserve below the reservoirs lies in close proximity to current camp and has reasonable buffers, however would function better if connected with the vegetation in the adjacent private property through with Black Gully creek flows. Restoring the creek here would require landholder agreement. Elizabeth Park vegetation is immature though has effective buffers and ranked 4th.

Due to a lack of native vegetation and the high costs associated with rehabilitating the Old Council Depot and North's Playing Fields, these sites should be disregarded for alternative flying-fox camps, along with land behind NERAM due to the high potential for ongoing human wildlife conflict.

Table 2 Site investigation summary

Location	Desirable attributes	Current undesirable attributes	Proximity to Black Gully	Current habitat	Potential to improve	Rank
Mike O'Keefe Woodland on Black Gully	Armidale Tree Group working at this site. Suitable buffers exist, in close proximity to water. This site represents a suitable location for flying-foxes in 5-10 years. Council could provide additional funding for restoration here to encourage the uptake of all wildlife including flying-foxes.	Tenure – not Council owned or managed. Vegetation not quite mature enough yet to withstand impacts of flying-fox influx. Flying-foxes are yet to utilise this site.	1.5 km (medium potential for relocation)	Suitable with restoration	High	1
Beadle Grove	Reasonable buffers exist to the west and north (road) to the east (mowed park). Its proximity to the current camp makes it practical candidate for restoration.	Vegetation structure not currently complex enough for flying-fox preferences. Flying-foxes are yet to utilise this site.	~200 m (medium potential for relocation)	Suitable with restoration	Moderate	2
Below Reservoirs	Galloway Street road reserve below the reservoirs is in close proximity to existing camp and Black Gully creek. The lot's overall suitability requires neighbouring landholders cooperation to make it a viable location.	Slope and vegetation structure and complexity. Requires significant restoration. Flying-foxes are yet to utilise this site.	~200 m (high potential for relocation)	Suitable with restoration	Moderate	3
Elizabeth Park	Armidale Urban River Care Group undertaking restoration at this site.	Flying-foxes tend to prefer gullies with protection, this site is a bit exposed. Requires ongoing restoration. Flying-foxes are yet to utilise this site.	2.1 km (low potential for relocation)	Suitable with restoration	High	4
Behind NERAM	Historical use by flying-foxes at this site	This site is considered undesirable as a future flying-fox camp due to potential for conflict due to high number of public uses	950 m (high given it is a historic camp)	Suitable but considered undesirable location	Low	N/A
Norths Playing Fields	Located with suitable buffers from residential areas.	At this stage it would be cost prohibitive to focus on restoring a site lacking appropriate native species in the canopy or understorey. Flying-foxes are yet to utilise this site.	3.3 km (low potential for relocation)	Unsuitable	Low	N/A
Old Council Depot	Located with suitable buffers from residential areas.	At this stage it would be cost prohibitive to focus on restoring a site lacking appropriate native species in the canopy or understorey. Flying-foxes are yet to utilise this site.	2.6 km (low potential for relocation)	Unsuitable	Low	N/A

4 Discussion

4.1 In situ management

The lowest risk and most cost-effective option in the short-term is to manage the camp at its current location.

Given the risk associated with attempting to relocate the camp prior to a suitable alternative being available, some level of in situ management will be required regardless of the long-term strategy. This should include trimming or removal of roost trees in residential lots to increase the buffer between homes and flying-foxes. However due to a dearth of suitable roosting habitat available in Armidale, any management of the weedy understorey on Council's allotment should be staged. This will limit the risk of inadvertent splintering and dispersal to equally or more problematic locations. To avoid attracting flying-foxes, species selected for planting in residential areas and street scaping should not produce edible fruit or nectar-exuding flowers.

4.2 Habitat restoration

Mike O'Keefe Woodland on Black Gully is the preferred alternative camp location. Habitat restoration is already occurring at the site, improving the native vegetation structure and providing a more complex understorey.

A site-specific restoration plan developed in consultation with Armidale Tree Group, should aim to make the site more attractive to roosting flying-foxes as quickly as possible. Key considerations are whether mature trees or seedlings would be planted at the rehabilitation site, or if natural regeneration (assisted by irrigation) will be sufficient (i.e. provided the seed bank is likely to include favoured roosting and foraging trees).

Armidale Urban River Care Group (Landcare) is also undertaking rehabilitation and restoration of degraded habitats in Armidale. Council's ongoing support and assistance with these projects is encouraged so that alternative sites may become an option for flying-foxes and other wildlife within the next 5-10 years.

4.3 Utilisation/uptake of alternate sites

Attempting to create habitat or use attractants to entice flying-foxes to desired camp sites has shown little success in the past. For example, a range of attraction techniques were used at a pre-selected relocation site prior to dispersal from the Melbourne Royal Botanic Gardens. This included a large enclosure holding approximately 80 flying-foxes, leaf litter with droppings spread around the site, visual attractants (200 models of flying-foxes hung from ropes between trees), acoustic attractants (sounds of flying-foxes were emitted), revegetation and irrigation (Nelson 2008; in GeoLINK 2012). Despite attraction efforts to the site for a year prior to relocation and throughout the dispersal, flying-foxes have never utilised the desired site but rather two unexpected locations. Efforts continued for six months following the establishment

of these new camps, however were still unsuccessful (GeoLINK 2012).

A relocation plan will be required once the preferred alternative site(s) have been improved to maximise the chance of success, and mitigate risks associated with a relocation attempt (e.g. splintering the camp to undesirable locations). This should also include measures to make the original site less attractive to limit attempts by flying-foxes to recolonise the site.

4.4 Education

Educating the community of flying-fox ecology, behaviour, methods to minimise impacts (e.g. those associated with foraging) and the difficulties in relocating flying-fox camps will assist gaining community support and cooperation. This will greatly improve the long-term outcomes and sustainability of the management approach. Public education strategies must consider what, when and how the message should be communicated, and consider the main areas of concern for each stakeholder.

4.5 Monitoring and research

A detailed study on foraging resources in the region would assist identifying flying-fox attractants, their reliance on urban resources, and the role this plays in local camp site selection. Regular monitoring using robust methods is also important to determine flying-fox behaviour, which will inform management strategies and allow their success to be assessed.

5 Conclusion

Large stands of native vegetation as well as those with complex structures suitable for flying-foxes are essentially absent in Armidale; significant exotic plantings make up most of the mature stands of available vegetation. If a decision is made in consultation with the community to consider alternative urban sites, then significant re-vegetation would need to be undertaken, and therefore any management aimed to move the camp should be discouraged in the short-term until identified site(s) are improved.

Mike O'Keefe Woodland, Black Gully Reserve and Elizabeth Park have been the focus of restoration works in recent years, however these sites have not yet reached an appropriate canopy height or vegetation structure to support large numbers of flying-foxes. Although present with suitable buffers, the cost of restoring them from scratch and the time taken to establish a suitably complex roost, also makes these sites not feasible.

Strong site fidelity to Black Gully is likely with GHFF birthing event in 2017, with the flying-foxes probable return next year. The most cost-effective solution is to manage the Black Gully camp in situ and provide the necessary buffers to maintain residents' amenity.

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Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	09/04/2018	Black Gully alternative flying-fox camp investigation report - DRAFT	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
01	24/04/2018	Black Gully alternative flying-fox camp investigation report -DRAFT 2	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
02	05/07/2018	Black Gully alternative flying-fox camp investigation report -DR4	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	

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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 Survey results

Appendix 6 Response to submissions on draft Plan

Key topics	Details	Response to submission
Beadle Grove unacceptable as alternative camp site	The alternative camp site investigation concluded that suitable flying-fox habitat is essentially absent from Armidale. Although Beadle Grove was ranked as one of the best alternatives, as the site exists, years of restoration would be required to accommodate flying-foxes at Beadle Grove. Flying-foxes have yet to utilise Beadle Grove and Council has no plans to relocate flying-foxes during the life of the Plan.	Submissions indicate strong opposition to Beadle Grove as a future alternative camp site as it simply moves the problem to other residents. Therefore, Beadle Grove has been removed as an option for restoration for the purposes of creating flying-fox habitat within the Plan.
Active re-location of flying foxes from the Black Gully or urban area	Approximately 60% of submissions were in favour of relocating flying-foxes from Black Gully or stopping flying-foxes from living in the urban area in general. However, submissions also reflected concerns for costs, probability of success and implications for exacerbating issue if relocation was adopted. A recent study (Timmiss 2017) revealed almost three quarters of the 310 national active GHFF camps (72%) are located in urban areas. Dispersal outcomes are rarely successful, very expensive and do not reduce the number of flying-foxes within urban areas, with flying-foxes always moving less than 2 km away in unpredictable locations.	OEH Policy states that Level 3 management actions (i.e. passive or active dispersal) should not be undertaken until Level 1 (routine camp management) and Level 2 (creation of buffers) management actions have been undertaken and have failed to adequately mitigate the impacts of flying-foxes on local communities. Council has no plans to actively move the flying-foxes from Black Gully because this has the potential to fracture the population, making the conflict more widespread. Community expectation regarding the ability of people (or Council) to control flying-fox behaviour and movement will be managed through an education program.
Cost of management actions	Submissions raised concerns for management costs to the community and the burden on residents to afford tree removal or property modification. Knee-jerk reactions can be costly for local governments with limited resources and Council intends to avoid wasting rate payer funds.	This development of this Camp Management Plan has been subsided by a grant from Local Government New South Wales. Council has a budget to subsidise any tree removals that may be approved by OEH for the creation of a buffer, and will reinstate on-call assistance should flying-foxes return next year.
Manage the existing camp site and help affected residents.	Submissions favoured in-situ management. Due to a lack of alternative flying-fox habitat within Armidale, the most risk averse and cost effective option is to manage the camp in its existing position and avoid the risk of splintering the camp to other locations that are equally or more problematic.	The proposed management approach includes Level 1 and Level 2 management options to address impacts based on the OEH camp management policy based on the hierarchy of options.
Buffer distance	Submissions raised concerns for the buffer distance chosen citing the 300 m buffer (and as wide as site allows) recommended in the OEH template.	Buffers of 5 to 10 metres have been shown in other communities to provide relief for residents when paired with other forms of mitigation. A

Key topics	Details	Response to submission
	With regards to the OEH figure, 300 metres refers to a vegetative buffer. Black Gully and indeed the Armidale township lacks the stands of vegetation necessary to create a 300 m wide buffer. A lack of suitable connecting habitat also inhibits the ability of flying-foxes to nudge away from the conflict area. Buffers can also be created through the removal of vegetation which must be done in a staged approach to avoid Level 3 passive dispersal. It must also be noted that clear felling Black Gully camp constitutes Level 3 action under State policy.	lack of connecting vegetation in Black Gully constrains the proposed buffer size being any wider than 15 m to avoid inadvertent dispersal. The proposed 15 m buffer aims to provide relief for residents from faecal drop and other impacts immediately around homes.
Maximum camp extent	Submissions noted the omission of the maximum known camp extent from the draft Plan.	The maximum extent of the camp in December 2017 has been updated within mapping of the Plan.
Health concerns	Some community members find living in proximity to roosting and foraging flying-foxes fearful and may perceive their presence as an impact on their health, which can be exacerbated by sensationalist media reports. Human exposure to ABLV and HeV, the transmission and frequency of infection is extremely rare. HeV infection in humans requires transfer from an infected horse and spread of the virus directly from bats to humans has not been reported. These diseases are also easily prevented by not touching bats and through vaccination. The probability of infection is extremely low, and the overall public health risk is also judged to be low (Qld Health 2016).	Health information is available in Appendix 4. Council will adopt an education and awareness program to reduce misconceptions and appease fears related to flying-fox disease and human health.
Property value	Submissions expressed concerns for property devaluation and why acquisition of affected properties was not up for consideration.	Councils are not responsible for the evaluation of assets (whether proven or perceived) due to the occurrence of any natural phenomena such as fire, storm, flood or the presence of wildlife in any form. Acquisition is not a feasible option for Armidale Council.
Threatened status validity	Submissions questioned the status of GHFF. The Commonwealth Department of the Environment and Energy is responsible for the protection and conservation of Grey-headed flying-fox whose threatened status is declared by the Threatened Species Scientific Committee who judge the species eligibility for listing as vulnerable against five criterions based on best practice standard developed by the International Union for Conservation of Nature.	The threatened status of the GHFF is not debated by Council.

Appendix 7 Standard measures to avoid impacts to flying-foxes

The following mitigation measures will be complied with at all times during implementation of any activities within or immediately adjacent the camp.

- All personnel will be appropriately experienced, trained and inducted. Induction will include each person's responsibilities under this 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 OEH consulted in accordance with the 'stop work triggers' section of the Plan.
- 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/BFF 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.).
- OEH will be immediately contacted if LRFF are present between March and October or are identified as being in final trimester / with dependent young.
- Non-critical maintenance activities 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). Wildlife carers will be consulted 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 heat stress event has been recorded at the camp or at nearby camps, a rest period of several weeks will be scheduled to allow affected flying-foxes to fully recover. See the OEH fact sheet on Responding to heat stress in flying-fox camps.
- Any proposed variations to works detailed in the Plan will be approved, in writing, by OEH before any new works occur.
- OEH may require changes to methods or cessation of management activities at any time.
- Ensure Level 2 management actions and results are recorded to inform future planning. See the OEH fact sheet on Monitoring, evaluating and reporting.

Vegetation trimming/removal (if required)

- Dead wood and hollows will be retained on site where possible as habitat.
- Vegetation chipping/mulching is to be undertaken as far away from roosting flying-foxes as possible (at least 100 m).

Canopy vegetation trimming/removal (if required)

Prior to works

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

During works

- Any tree lopping, trimming or removal is undertaken under the supervision of a suitably qualified arborist (minimum qualification of Certificate III in Horticulture (Arboriculture) who is a member of an appropriate professional body such as the National Arborists Association) (e.g. Highland Arbor; Chris Watchirs).
- 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 metres of roosting flying-foxes.
- While most females are likely to be carrying young (generally September – January) vegetation removal within 50 metres 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 OEH for approval at least two months prior to commencing works.

Bush regeneration

- All works will be carried out by suitably qualified and experienced bush regenerators (i.e. Landcare groups), with at least one supervisor knowledgeable about flying-fox habitat requirements (and how to retain them for Level 1 and 2 actions) with knowledge regarding 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.

Stop work triggers

Management activities in or near Black Gully camp will cease and will not recommence without consulting OEH if:

- any of the animal welfare triggers occur on more than two days during the program, such as unacceptable levels of stress (Table 8)
- there is a flying-fox injury or death
- a new camp/camps appear to be establishing
- impacts are created or exacerbated at other locations
- there appears to be potential for conservation impacts (e.g. reduction in breeding success identified through independent monitoring)
- standard measures to avoid impacts cannot be met.
- Management may also be terminated at any time if:
- unintended impacts are created for the community around the camp
- allocated resources are exhausted.

Table 11 Planned action for potential impacts during any works under or near the camp. A person with experience in flying-fox behaviour (as per Appendix 5) 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 2 m 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 5 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 m from roosting animals.
Injury/death	· A flying-fox appears to have been injured/killed on site (including aborted foetuses) · dependent/crèching young present and adults likely to take flight or abandoned camp	Works to cease immediately and OEH notified AND rescheduled OR adapted sufficiently so that significant impacts (e.g. death/injury) are highly unlikely to occur, as confirmed by an independent expert OR stopped indefinitely and alternative management options investigated.

Appendix 8 Flying-fox rescue

Reference documents:

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

OEH 2011, NSW Code of Practice for Injured, Sick and Orphaned Protected Fauna, Office of Environment and Heritage, Sydney.

Purpose

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

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

Requirements

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

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

Human first aid

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

Equipment

- lidded plastic carry basket or 'pet-pack' with bedding (juveniles) / transport container with hanging perch, tall enough for bat to hang without hitting its head (in accordance with Section 5.1 of the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012))
- warm water bottle / cold brick
- wraps /towels
- teats for small bottle
- extension pole or broom
- bat first aid kit – juice drink/glucose powder, syringes, cloths for wounds, Betadine/saline, dummy for baby bats. FFs only to be offered liquids under advice from a licensed wildlife carer.

Work instructions

Case assessment

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

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

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

Rescue instructions

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

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

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

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

Example scenarios

1. Bat low in tree:

   quickly place towel around bat before it can move away

grab hold of feet, toes may curl over rescuers fingers

place in carry basket / transport container.

2. Bat high in tree:

   place pole wrapped in towel in front of bat

   coax bat onto towel

   once on towel, quickly move away from branches and lower to ground

   once on ground, cover with towel and place into carry basket / transport container.

3. A bat caught on barbed wire fence:

   two people only – one to restrain with towel, while the other untangles

   put towels on the wire strands under or around to avoid further entanglement

   if the membrane has dried onto wire, syringe or spray water onto wing

   use pliers or wire cutter if necessary.

Animal first aid

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

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

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

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

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

Transport to veterinarian / wildlife carer

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

Objective

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

Standards

a. The transport container must be tall enough for the flying-fox to hang by its feet without hitting its head on the floor.

b. The container must be designed, set up and secured to prevent injuries to the flying-fox. The sides of the container must prevent the flying-fox from poking its head or wings out.

c. The container must be designed to prevent the flying-fox from escaping.

d. The flying-fox must be allowed to hang by its feet from the top of the container or if it is unable to hang, wrapped in material (e.g. sheet or flannel) and placed in a sling so its feet are higher than its head.

e. The container must be kept at a temperature which is appropriate for the age and condition of the flying-fox. A range of 25–27°C is appropriate for an adult. A temperature of 28°C is appropriate for an orphan. A cool or warm water bottle may be required.

f. The container must be ventilated so air can circulate around the flying-fox.

g. The container must minimise light, noise and vibrations and prevent contact with young children and pets.

h. During transport, a container holding a flying-fox must have a clearly visible warning label that says 'Warning – live bat'.

i. A flying-fox must not be transported in the back of an uncovered utility vehicle or a car boot that is separate from the main cabin.

Guidelines

Flying-fox transport should be the sole purpose of the trip and undertaken in the shortest possible time.

The fauna rehabilitation group's contact details should be written on the transport container in case of an emergency.

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	14/03/2018	PR3232 Black Gully Camp Management Plan -	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
01	26/04/2018	PR3232 Black Gully Camp Management Plan - DRAFT	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
02	15/06/2018	PR3232 Black Gully Camp Management Plan – FINAL DRAFT	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
03	03/07/2018	PR3232 Black Gully Camp Management Plan – DR4	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
04	9/07/2018	PR3232 Black Gully Camp Management Plan – FI	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
05	18/07/2018	PR3232 Black Gully Camp Management Plan – FI.R1	Emily Hatfield, Senior Wildlife Biologist	Jess Bracks, Principal Wildlife Biologist	
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