Tamworth REGIONAL COUNCIL

Flying-fox Camp Management Plan

Peel River Camp

Front cover page

Grey-headed Flying-foxes (*Pteropus poliocephalus*).

Contact Details

Tamworth Regional Council

437 Peel Street

PO Box 555

TAMWORTH NSW 2340

Phone: 02-6767 5555

Email: trc@tamworth.nsw.gov.au

Website: www.tamworth.nsw.gov.au

Acknowledgements

We would like to thank the Office of Environment and Heritage, Armidale, the consultants Ecosure, the GIS team and Noxious Weeds team of Tamworth Regional Council for their tremendous work in helping to develop the Tamworth Regional Council – Peel River Camp – Draft Flying Fox Camp Management Plan.

We acknowledge input by the NSW Office of Environment and Heritage, and consultants Ecosure, in developing the template on which this Camp Management Plan was based. Peggy Eby also provided advice which was included in the template.

Table of contents

Acknowledgements ii

Table of contents iii

Acronyms and abbreviations vi

1 Overview 1

1.1 Objectives 1

2 Context 2

2.1 Camp area 2

2.1.1 History of the camp 2

2.2 Land tenure 3

2.3 Reported issues related to the camp 3

2.4 Management response to date 5

Community engagement 7

2.5 Stakeholders 7

2.6 Engagement methods 8

3 Legislation and policy 8

3.1 State 8

3.1.1 Flying-fox Camp Management Policy 2015 8

3.1.2 *Threatened Species Conservation Act 1995* 9

3.1.3 *National Parks and Wildlife Act 1974* 9

3.1.4 *Prevention of Cruelty to Animals Act 1979* 9

3.1.5 *Environmental Planning and Assessment Act 1979* 9

3.1.6 Protection of the Environment Operations Act 1997 10

3.2 Commonwealth 10

3.2.1 *Environment Protection and Biodiversity Conservation Act 1999* 10

4 Other ecological values of the site 12

5 Flying-fox ecology and behaviour 14

5.1 Ecological role 14

5.2 Flying-foxes in urban areas 14

5.3 Under threat 14

5.4 Camp characteristics 15

5.5 Species profiles 17

5.5.1 Black Flying-fox (*Pteropus alecto*) 17

5.5.2 Grey-headed Flying-fox (*Pteropus poliocephalus*) 18

5.5.3 Little Red Flying-fox (*Pteropus scapulatus*) 19

5.5.4 Reproduction 19
6 Human and animal health 21
6.1 Disease and flying-fox management 21
7 Camp management options 22
7.1 Level 1 actions: routine camp management 22
7.1.1 Education and awareness programs 22
7.1.2 Property modification without subsidies 23
7.1.3 Property modification subsidies 23
7.1.4 Service subsidies 24
7.1.5 Routine camp maintenance and operational activities 24
7.1.6 Revegetation and land management to create alternative habitat 24
7.1.7 Provision of artificial roosting habitat 25
7.1.8 Protocols to manage incidents 25
7.1.9 Participation in research 25
7.1.10 Appropriate land-use planning 25
7.1.11 Property acquisition 25
7.1.12 Do nothing 25
7.2 Level 2 actions: in-situ management 26
7.2.1 Buffers 26
7.2.2 Noise attenuation fencing 27
7.3 Level 3 actions: disturbance or dispersal 27
7.3.1 Nudging 27
7.3.2 Dispersal 27
7.4 Unlawful activities 29
7.4.1 Culling 29
7.5 Site-specific analysis of camp management options 30
8 Planned management approach 35
8.1 Level 1 actions 35
8.2 Level 2 actions 35
8.3 Level 3 actions 35
8.4 Stop work triggers 40
9 Assessment of impacts to flying-foxes 42
9.1 Regional context 42
9.2 Flying-fox habitat to be affected 43
9.3 Standard measures to avoid impacts 44
9.3.1 All management activities 44
9.3.2 All Level 2 and 3 actions 46

9.3.3 Vegetation trimming/removal 47
9.3.4 Canopy vegetation trimming/removal 47
9.3.5 Bush regeneration 47
9.3.6 Additional measures for Level 3 actions 48
9.3.7 Additional mitigation measures for any activity at a nationally important GHFF camp 49
10 Evaluation and review 50
11 Plan administration 50
11.1 Monitoring of the camp 50
11.2 Management structure and responsibilities 51
11.3 Adaptive management 53
11.4 Funding commitment 53
References and resources 54
Appendix 1 Tamworth Maps 60
Map 1 – Location of Peel River Camps 60
Map 2 – Land Tenure 61
Map 3 – Potentially Affected Non-Residential Stakeholders 62
Map 4 – Considered Management Areas – Tamworth 63
Map 5 – Proposed Buffer Areas 64
Map 6 – Regional Extent 65
Map 7 – Potential Conflict with Residential Land 66
Map R1 – Location of Barraba Camp 67
Map R2 – Location of Bendemeer Camp 68
Map R3 – Location of Manilla Camp 69
Map R4 – Location of Woolomin Camp 70
Map R5 –Regional Potential Conflict Map 71
Map R6 – Potential Conflict Map - Barraba 72
Map R7 – Potential Conflict Map - Bendemeer 73
Map R8 – Potential Conflict Map – Manilla 74
Map R9 – Potential Conflict Map - Woolomin 75
Map R10 – Land Tenure - Barraba 76
Map R11 – Land Tenure - Bendemeer 77
Map R12 – Land Tenure - Manilla 78
Map R13 – Land Tenure - Woolomin 79
Appendix 2 Summary of other key legislation likely to apply at some camps 80
Appendix 3 Desktop ecological assessment guideline 82
Appendix 4 Additional human and animal health information 83
Appendix 5 Dispersal results summary 86
Appendix 6 Section 91 licence application form 87
Appendix 7 Example flying-fox rescue protocol 88

Acronyms and abbreviations

ABLV	Australian Bat Lyssavirus
BFF	Black Flying-fox (*Pteropus alecto*)
DoE	Commonwealth Department of the Environment
DPI	Department of Primary Industries (NSW)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	Environmental 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
LGA	Local Government Area
LGNSW	Local Government NSW
LRFF	Little Red Flying-fox (*Pteropus scapulatus*)
MNES	Matters of national environmental significance
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 polices
the Plan	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
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1 Overview

1.1 Objectives

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

- minimise impacts to the community, while conserving flying-foxes and their habitat
- provide a reasonable level of amenity for the surrounding community
- manage public health and safety risks
- clearly define roles and responsibilities
- enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes
- effectively communicate with stakeholders during planning and implementation of management activities
- enable long-term conservation of flying-foxes in appropriate locations
- ensure management is sympathetic to flying-fox behaviours and requirements
- improve community understanding and appreciation of flying-foxes, including their critical ecological role
- ensure flying-fox welfare is a priority during all works
- ensure camp management is consistent with broader conservation management strategies that may be developed to protect threatened species/communities
- ensure camp management does not contribute to loss of biodiversity or increase threats to threatened species/communities
- clearly outline the camp management actions that have been approved and will be utilised at the camp
- ensure management activities are consistent with the NSW Flying-fox Camp Management Policy (OEH 2015)
- facilitate 5 year licence approval (where required) for actions at the camp
- implement an adaptive management approach to camp management based on evidence collected.

2 Context

2.1 Camp area

The camp is located in Tamworth and is divided into two along a stretch of riparian vegetation alongside the Peel River from the junction of the Goonoo Goonoo Creek and extends south-east along the River for a distance of up to 3 kilometres. The larger of the camp areas is located in an area bordered by the Armidale Road (New England Highway) and King George V Avenue and is referred to as the King George V Avenue camp. The other camp area is slightly smaller and lies along the Peel River between the George Fielder Bridge on Scott Road and the Footbridge leading from Bicentennial Park to the Gipps Street playing fields. This camp area is referred to as the Bicentennial Park camp (refer to Map 1).

The King George V Avenue camp has been as large as 12-14 hectares in the last two years as is shown in Map 1.

Recent use of the Bicentennial Park camp re-started during 2014/15 and consisted of an area approximately 10-13 hectares, mainly on the southern side of the river except for some influxes into the park around the MacKellar stage. There is a section of this camp that is regarded as an historical camp and this is the isthmus of land between the Peel River and the Goonoo Goonoo Creek.

The camp currently covers 0.5 hectares and is restricted to a 110 metre section of the King George V Avenue location.

2.1.1 History of the camp

Anecdotal historic reports of flying-foxes in Tamworth, while not consistent, suggest a low intensity use of the area over the past decades. Many long-time residents do not recall flying-foxes in the city until recently; others report that camps have long been present in several locations. These camps were apparently small and transient, thus causing little disturbance to humans. The species involved remains unidentified, probably comprising both Grey-headed and Little Red Flying-foxes.

Some residents along the Peel River near King George Avenue in eastern Tamworth report a camp forming in 2001 which remained for several months. The description suggests the camp comprised less than 5000 bats.

In 2004-2005 a small camp of Grey-headed Flying-foxes became established in mature suburban trees in northeast Tamworth far from the Peel River (approximately White St and Rawson St). Complaints were made by residents about faeces deposition and smell. The camp dispersed naturally after several months, and indicates the wide range of roosting habitats that flying-foxes are willing to occupy in the city.

The consistent occupancy of camps in Tamworth began in late June 2012 when approximately 4400 Grey-headed Flying-foxes and 1000 Little Red Flying-foxes occupied trees along both sides of the Peel River stretching from the Peel Street Bridge (‘Paradise Bridge’) to Hall Street. Localised changes of occupancy within this area were stimulated by humans disturbing the camp, but dispersal from any specific site did not last long. The Little Red Flying-foxes began foraging in urban Silky Oaks during mid-afternoon, thus bringing greater attention to their presence. Complaints from both camp neighbours and urban residents with foraging trees escalated and were reflected in negative local media reports. Residents near the camp were advised to move their horses and protect feed/water troughs to alleviate concerns about transmission of Hendra virus (prior to the creation and release of a vaccine a year later).

While the number of Little Red Flying-foxes decreased to 300 over the next few weeks, Grey-headed Flying-foxes gradually escalated until at least 40,000 were resident, apparently responding to heavy flowering of White Box in the region and a lack of food on the coast. Observations during September-October suggested the number may have fluctuated up to 60,000 at times.

In late October 2012 the camp rapidly declined to 1500 Grey-headed Flying-foxes. After remaining relatively stable into early summer all Grey-headed Flying-foxes departed by mid-January 2013. Low and fluctuating numbers of Little Red Flying-foxes remained (< 200).

Over 2000 Grey-headed Flying-foxes returned to the Peel River camp in early April 2013 then gradually decreased by half towards the end of May, with approximately 80 Little Red Flying-foxes also present. A gradual decline left 200 Grey-headed Flying-foxes in the camp area at the end of June 2013.

The camp re-established in mid-April 2014, rising gradually to 14,000 Grey-headed Flying-foxes by late May. Numbers fluctuated thereafter and yet the area occupied expanded. In August the camp increased to 22,000 bats, and then decreased in September to 8000 individuals with very few pregnant females remaining. Little Red Flying-foxes numbered about 1000 bats during this period.

The Grey-headed Flying-foxes gradually declined to about 3000, yet overnight on 13 January 2015 it increased to 35,000. A decline among this species occurred within two weeks then rose again to 4000 bats in early March. By late March the camp comprised over 30,000 bats of both species, which were intermixed and had expanded westward. By mid-May the Grey-headed Flying-foxes were 10,600 strong while Little Red Flying-foxes numbered 28,000. Dead pups of the latter species were commonly found by residents near the camp.

Nearly all of the Little Red Flying-foxes left in mid-June and concurrently the Grey-headed Flying-foxes increased to 60,000 and expanded eastward up the river into camp areas not occupied for 3 years. Within a week the numbers escalated to 80,000 and the bats expanded far westward to create a large secondary camp along Goonoo Goonoo Creek near the central business district, an area not occupied for over two decades. This camp eventually became the focal point for local bats, which declined slightly in August to 68,000.

By mid-September 2015 only a couple thousand Grey-headed Flying-foxes remained in Tamworth, all based around the two houses near Paradise Bridge which had been the most affected residents over the past years. By mid-October this number had decreased to 200 then disappeared entirely a week later. Three thousand Little Red Flying-foxes promptly occupied the Peel River camp then increased to over 20,000 by mid-November. In late summer that number declined to a few thousand bats which have since fluctuated little in both numbers and location. As of August 2016 the Grey-headed Flying-fox camp has re-established in small numbers (<2000), based on a moderate flowering of White Box across the region.

2.2 Land tenure

The land tenure of the King George V Avenue camp is mostly privately owned for approximately 90% of its extent. This is a mixture of RU4 which borders both sides of the Peel River, with R1 on the northern side of the river. The Bicentennial Park camp is mostly zoned RE1 and consists of the Regional Playground, Bicentennial Park and the Gipps street playing fields with a portion of RU4 on the southern side from the Scott Road Bridge to the junction of the Peel River and Goonoo Goonoo Creek (Refer to Map 2).

The Oak trees along King George V Avenue are State Heritage listed and are not normally utilised by the Flying foxes, although they have been observed occasionally in these trees. A conservation management plan is in the process of being implemented for these trees.

2.3 Reported issues related to the camp

The following list is a collation of the issues related to the camp that have been reported by the community. The list has been compiled from information collected via a range of reporting and consultation methods. Further discussion about community engagement efforts and outcomes can be found in Section 3.

It should be noted that during the 12 months up to and including the influx, Council's customer service office received 42 calls relating to flying fox impacts. When you consider that 1203 calls to council regarding "Animals" were received during the same period, 42 calls is a little over 3.5%. This shows that while there was a fair amount of comment on social media, the concerns were either not important enough to be passed on to Council or residents were relying on social media as a complaint reporting tool.

The issues that were reported to Council either during the survey or via our customer service office include:

- faecal drop on outdoor areas, cars, caravans at the adjacent caravan park, pools and washing lines, and estimated resources (time, cost) associated with cleaning areas adjacent to the camp. Residents under the flying-fox flight path also raised concerns about faecal drop on their premises
- damage to vegetation – flying-fox roosting behaviour in the King George Avenue area of the camp has led to a deterioration in the tall tree cover in that area. The larger trees have lost portions of their crowns resulting in smaller roost sites. This may have contributed to the movement of flying-foxes into the historical camp area opposite Bicentennial Park.
- smell was reported by a few residents in close proximity to the King George Avenue portion of the camp. Smell was also identified as an issue by users of Bicentennial Park.
- contamination of private drinking water supplies – this should not be not a major issue as Tamworth is serviced by a reticulated water supply, however these responses may relate to fly overs and night time foraging impacts in outlying areas.
- noise as flying-foxes depart or return to the camp (if acoustic testing has been done, provide results - although care should be taken not to imply that a particular reading will determine whether or not someone is being impacted by the noise)
- noise from the camp during the day (specify the most problematic times of the day/year, along with activities that may be causing the disturbance) (if acoustic testing has been done, provide results)
- flying-foxes overhanging residential properties appears to be a major property for the few houses directly adjacent to the King George Avenue portion of the camp. Other households reported influxes of Flying-foxes during late afternoon and early morning when the animals were heading out to and returning from foraging
- fear of disease – was shown to be a major concern during the survey with 51% of all respondents nominating human health as a concern. 24% of respondents indicated animal (horse) health as a concern. An education campaign aimed at enlightening the population about Hendra virus and Lyssavirus prior to the next influx, should help reduce these fears. The promotion of the 12 month Hendra virus booster should help alleviate the horse health fears.
- health and/or wellbeing impacts (e.g. associated with lack of sleep, anxiety). For the few households directly adjacent and under the King George Avenue portion of the camp, this is regarded as a one of the major impacts. The constant chatter and screeching combined with all the other listed impacts would certainly place these residents under a great deal of stress. Therefore, management actions that lessen these impacts are a priority.
- reduced general amenity – when the Flying-foxes moved across the river into Bicentennial Park, they caused a significant amount of disruption to the park amenity. They dropped a lot of small branches from the River Red Gums throughout the park which made walking and cycling tracks hazardous and also made lawn maintenance a very time consuming task. The faecal drop in this area also meant that large areas of the park were placed out of action, until they could be cleaned up.
- increased need for bush regeneration and associated costs - unknown

- impacts on other fauna species - unknown
- impacts on businesses – the adjacent Paradise Caravan Park located approximately 50 metres from the western point of the King George Avenue portion of the camp, was heavily impacted with faecal drop on fixed cabins and tenants vans and vehicles. They supplied guests with access to a high pressure gurney. Odour and noise were also major issues experienced by residents of the park.
- property devaluation – unknown
- diminished rental return - unknown

There were also a number of people responding to the survey who stated that they enjoy the camp and would prefer it is not managed / managed in situ. Reported positive feedback stems from people:

- recognising the landscape-scale benefits flying-foxes provide through seed dispersal and pollination
- acknowledging the need to conserve flying-foxes as an important native species
- enjoying watching flying-foxes at the camp and/or fly-out/in
- appreciating the intrinsic value of the camp
- seeing value of the camp as a tourism opportunity/attraction
- appreciating the natural values of the camp and habitat
- feeling the camp does not negatively impact on their lifestyle
- valuing the opportunity the camp provides for them and their family to get close to nature
- recognising the need for people and wildlife to live together.

2.4 Management response to date

Response to the complaints about flying-fox impacts on human residents followed two approaches, education and mitigation.

Disease: In many instances, initial complaints and fears were based on inaccurate ideas about the danger of disease transmission that flying-foxes pose to humans and horses. These misconceptions were easily corrected through the media or with personal discussions. In 2012 when flying-foxes were first present in large numbers on the Peel River, the Council and the community expressed concern that any Hendra virus reports would affect the reputation of Tamworth as an equine centre, and so extensive efforts were made to advise those with horses near the camp regarding methods to reduce horse contact with bat faeces and urine. The message was also disseminated more widely that even horses distant from the camp would potentially come in contact with flying-foxes using trees above their water troughs etc, and so precautions should be implemented if owners were concerned. Once a Hendra vaccine was developed in 2013 horse owners were repeatedly encouraged to act upon their concerns by inoculating their stock (uptake has remained low over subsequent years and complaints about the threat have continued, albeit at a lower intensity).

Movements: Education was also useful in addressing demands to “just move them on,” with complainants invariably surprised to learn that a Tamworth flying-fox might commonly consider both Sydney and Brisbane as home, and could move those distances in a matter of days. It was also enlightening to complainants to apply the analogy that the camp was a hotel, and that bats present today were often not the same individuals present next week.

Food: Some sympathy for the flying-foxes could be engendered by explaining that nectar was the main food source for the species, that a huge amount of nectar was needed to sustain such a relatively large animal, that bats often foraged 20-50 km from the camp, and that one of the serious limitation on the species that had caused an estimated halving of the population was that humans had cut down 80% of their food trees.

Fluctuations: Complainants were educated about the fluctuating nature of camps, where food resources dictated the number of flying-foxes that could be sustained in the region on a week by week basis. This highlighted that periods of low occupancy would inevitably be followed by high numbers. To date this fact has not greatly influenced residents' consideration of mitigating actions that can be applied in the absence of flying-foxes.

Mitigation: Landholders were engaged repeatedly to discuss the options they had to mitigate the impact of the camp. In general this was a progressive dialogue that started with expectations of dispersal and then gradually examined more alternatives. The resident most affected by the camp was granted a Section 95 certificate to create a buffer around her house using sonic disturbance. While this was relatively effective with Grey-headed Flying-foxes it had little impact on the occupancy of her garden by Little Red Flying-foxes.

Survey: As discussed in section 2.3, a community survey was conducted. The survey was an online map based survey that allowed residents to plot a location within the Tamworth Regional Council area and answer a series of questions. The residents were asked to answer based on how the flying foxes at the point chosen on the map, impacted their lives, negatively or positively.

The survey also sought to identify what the Flying-fox were doing at that particular location. Whether they were feeding, roosting or just flying over.

Questions on the location of previous or historical camps were also included. This was done to assist with identifying any feasible options for alternate camp sites in the camp management plan.

The responses to the survey focussed on the presence of Flying-fox in two main areas:

- Bicentennial Park (over the Peel River from Camp 2, refer to Map 1); and
- In trees adjacent to or within private residences throughout the Council area.

In the Bicentennial park area during the major influx in 2015 the Flying-fox damaged a large number of trees. This resulted in ongoing issues with small branches dropping throughout the park. This added to the impact of the excrement on park infrastructure and the noise and odour, greatly affected the patronage of the park. Council had to adapt the maintenance of the park to try and make it safe and appealing to the public.

Flying-fox flying over houses or in trees near houses were the next big response. The issues raised included excrement drop on pools, cars, rooves and garden furniture and noise from Flying-fox that occupied trees either on the way out to forage or on the way back to the roost camp from foraging.

Community engagement

2.5 Stakeholders

There are a range of stakeholders who are directly or indirectly affected by the flying-fox camp, or who are interested in its management. Stakeholders include those shown in Table 1.

Table 1 Stakeholders to the camp and Plan

Stakeholder	Interest/reported impacts
Residents	Refer to Section 2.3 Reported issues related to the camp
Business owners	Refer to Section 2.3 Reported issues related to the camp
Indigenous community	Nil reported at this stage.
Schools	Presently not a concern. If dispersal is considered, then schools may be affected by future camp sites.
Hospitals	Nil Presently not a concern. If dispersal is considered, then Hospitals may be affected by future camp sites.
Airports	Airport managers have a responsibility to reduce the risk of wildlife/aircraft strike. Tamworth Regional Council Airport is located approximately 7 kilometres away from the western most point of the camp (Refer to Map 3)
Equine facilities and vets	Equine facility managers and local vets should be aware of Hendra virus risk and appropriate mitigation measures. Where feasible, all horse owners within 20 km of the camp should be included in such communications. The Tamworth Racecourse and the existing harness racing facility is located just over 2 kilometres to the west of the camp. The Australian Equine, Livestock and Entertainment Centre (AELEC) is located almost 4 kilometres south of the camp. The proposed harness racing facility is located 5 kilometres south of the camp (Refer to Map 3).
Orchardists and fruit growers	Fruit growers may be impacted by flying-foxes raiding orchards.(Refer to Map 3).
Other/adjoining landholders; these may include government departments such as Crown Lands, Transport for NSW / Roads and Maritime Services, or neighbouring councils	As stated in Section 2.2 Land Tenure, the majority of the land in the King George Avenue portion is privately owned. The majority are residential or small rural lots. There is a caravan park in close proximity to this portion. The land adjacent to the Bicentennial Park portion is either privately owned rural land used for irrigation or Council owned land utilised for recreation (parks and sporting fields).
Local government	Local government has responsibilities to the community and environment of the area for which it is responsible in accordance with the *Local Government Act 1993*. Council is also responsible for administering local laws, plans and policies, and appropriately managing assets (including land) for which it is responsible.
OEH	OEH is responsible for administering legislation relating to (among other matters) the conservation and management of native plants and animals, including threatened species and ecological communities.
Commonwealth Department of the Environment (DoE) (relevant to camps with Grey-headed Flying-foxes or other matters of national environmental significance)	DoE is responsible for administering Federal legislation relating to matters of national environmental significance, such as the Grey-headed Flying-fox and any other Federally-listed values of the camp site.
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.

2.6 Engagement methods

Extensive effort has been made to engage with the community regarding the flying-fox camp to:

- understand the issues directly and indirectly affecting the community
- raise awareness within the community about flying-foxes
- correct misinformation and allay fears
- share information and invite feedback about management responses to date
- seek ideas and feedback about possible future management options
- invite people to join stakeholder committees.

The types of engagement that have been undertaken include:

- telephone conversations to record issues and complaints
- face-to-face meetings and telephone calls with adjacent residents
- media (radio, television, print, social media)
- website pages and links
- direct contact with adjacent residents including letters, brochures and emails
- public meetings
- face-to-face opportunities in shopping centres, community centres and markets
- online surveys.

In August-September 2015 an online, interactive survey was undertaken. At the time the Flying-fox influx was at its peak and they were very active during daylight hours. The survey received 210 responses, with 197 relating to the Tamworth camp. The remainder related to the small camp located in the Cherry Street park area of Barraba.

The draft Flying-fox CMP will initially be shown to the Council at a workshop to explain the aims and objectives. The Councillors will have the opportunity to provide feedback on the CMP and changes that are required will be made before it is taken to a meeting of Council. At this meeting approval will be sought for the draft CMP to be placed on public exhibition for a period of 30 days. During this time a media promotion will occur to raise awareness of the CMP and seek feedback from the community.

Following the public exhibition the feedback will be reviewed and any necessary changes will be made to the CMP. The CMP will then return to Council for formal adoption and will be made a public document.

3 Legislation and policy

3.1 State

3.1.1 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.

3.1.2 *Threatened Species Conservation Act 1995*

The objects of the *Threatened Species Conservation Act 1995* (TSC Act) include to conserve biological diversity and protect the critical habitat of those threatened species, populations and ecological communities. The Grey-headed Flying-fox is listed as threatened under the TSC Act (see also http://www.environment.nsw.gov.au/animals/flying-fox-grey-headed.htm).

Section 91 of the TSC Act provides for the application of licences if the proposed action is likely to result in one or more of the following:

(a) harm to any animal that is of, or is part of, a threatened species, population or ecological community

(b) the picking of any plant that is of, or is part of, a threatened species, population or ecological community

(c) damage to critical habitat

(d) damage to habitat of a threatened species, population or ecological community.

Section 94 of the Act provides factors (the 7-part test) to assess whether the proposed action is likely to have a significant effect on any threatened species or their habitats, population or ecological community (note, this is therefore not just applicable to flying-foxes). If OEH determines that a significant effect is likely, it may require a Species Impact Statement (SIS) to be prepared and publicly exhibited. If OEH assesses a section 91 licence application and determines that a significant impact is unlikely, a section 95 certificate will be issued (Appendix A in the Policy provides a flow chart for this process).

3.1.3 *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. All native animals and many species of native plants are protected under the NPW Act. All native fauna, including flying-foxes, are specifically protected under section 98.

Under this Act, licences can be issued for actions such as harming or obtaining any protected fauna for specified purposes, picking protected plants or damaging habitat of a threatened species, population or ecological community. Note that the definition of 'harm' includes to *hunt, shoot, poison, net, snare, spear, pursue, capture, trap, injure or kill*. The definition of 'pick' includes to *gather, pluck, cut, pull up, destroy, poison, take, dig up, crush, trample, remove or injure the plant or any part of the plant*.

3.1.4 *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.

3.1.5 *Environmental Planning and Assessment Act 1979*

The objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act) are to encourage proper management, development and conservation of resources, for the purpose of the social and economic welfare of the community and a better environment. It is also aimed at sharing of responsibility for

environmental planning between different levels of government and to 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 Act should consider flying-fox camps so that planning, design and construction of future developments is appropriate to avoid future conflict.

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

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

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

3.1.6 Protection of the Environment Operations Act 1997

Any activities that are undertaken to manage the camp that give rise to pollution either noise, water or land pollution may be deemed to be offences under the Protection of the Environment Operations Act 1997. Consultation by Council with the NSW EPA would be required prior to potentially polluting management activities being carried out.

3.2 Commonwealth

3.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection for the environment, specifically matters of national environmental significance (MNES). A referral to the Commonwealth DoE is required under the EPBC Act for any action that is likely to significantly impact on a 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 Grey-headed Flying-fox (*Pteropus poliocephalus*; GHFF) is listed as a vulnerable species under the EPBC Act, meaning it is a MNES. It is also considered to have a single national population. DoE has developed the Referral guideline for management actions in GHFF and SFF[1] 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 those that have either:

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

[1] Spectacled Flying-fox (*P. conspicillatus*)

Provided that management at nationally important camps follows the below mitigation standards, 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 determining whether a significant impact is likely, otherwise consultation with DoE 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[2], cyclone event[3]), or during a period of significant food stress[4].
- 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.

[2] A 'heat stress event' is defined for the purposes of the Australian Government's Referral guideline for management actions in GHFF and SFF camps as a day on which the maximum temperature does (or is predicted to) meet or exceed 38°C.

[3] A cyclone event is defined as a cyclone that is identified by the Australian Bureau of Meteorology (www.bom.gov.au/cyclone/index.shtml).

[4] Food stress events may be apparent if large numbers of low body weight animals are being reported by wildlife carers in the region.

4 Other ecological values of the site

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

Species name	Common name	NSW Status	Likelihood of occurring
Fauna			
Litoria booroolongensis	Booroolong Frog	Endangered	Very unlikely to occur on site
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Vulnerable	Does not occur on site
Hieraaetus morphnoides	Little Eagle	Vulnerable	Observed hunting in the vicinity of the site twice during 4 years of monitoring the camp.
Lophoictinia isura	Square-tailed Kite	Vulnerable	Not observed on site during long-term monitoring of the camp, but may forage in the habitat on occasion or be transient.
Falco subniger	Black Falcon	Vulnerable	Very unlikely to occur on site
Glossopsitta pusilla	Little Lorikeet	Vulnerable	Not observed on site during long-term monitoring of the camp, but may forage in the habitat on occasion or be transient.
Lathamus discolor	Swift Parrot	Endangered	Not observed on site during long-term monitoring of the camp, but may forage in the habitat on occasion or be transient.
Neophema pulchella	Turquoise Parrot	Vulnerable	Not observed on site during long-term monitoring of the camp, but may forage in the habitat on occasion or be transient.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	Not observed on site during long-term monitoring of the camp, but may forage in the habitat on occasion or be transient.
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Very unlikely to occur on site
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	Not observed on site during long-term monitoring of the camp, but may forage in the habitat on occasion or be transient.
Stagonopleura guttata	Diamond Firetail	Vulnerable	Not observed on site during long-term monitoring of the camp, but may forage in the habitat on occasion or be transient.
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Does not occur on site
Phascolarctos cinereus	Koala	Vulnerable	Very unlikely to occur on site; transient
Petaurus norfolcensis	Squirrel Glider	Vulnerable	Very unlikely to occur on site; transient
Mormopterus	Eastern Freetail-	Vulnerable	Very unlikely to occur on site; transient

norfolkensis	bat		
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	May rarely use the site for foraging
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable	May rarely use the site for foraging
Flora			
Syzygium paniculatum	Magenta Lilly Pilly	Endangered	Does not occur on site
Dichanthium setosum	Bluegrass	Vulnerable	Does not occur on site
Euphrasia ruptura		Presumed Extinct	Does not occur on site
Threatened Ecological Communities			
White Box Yellow Box Blakely's Red Gum Woodland			Does not currently occur in proximity to the site but does occur in the region and provides foraging for flying-foxes.

5 Flying-fox ecology and behaviour

5.1 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).

Grey-headed Flying-foxes 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 5,400 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 eucalpyt 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 and 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).

5.2 Flying-foxes in urban areas

Flying-foxes appear to be more frequently roosting and foraging in urban areas. 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
- 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.

5.3 Under threat

Flying-foxes more frequently roosting and foraging in urban areas results in the belief that their populations are increasing. However the GHFF is in decline across their range. The Grey-headed flying-fox was listed as Vulnerable by the NSW government through the TSC Act in 2001.

At the time of listing, the species was considered eligible for listing as Vulnerable as counts of flying-foxes over the previous decade suggested that the national population may have declined by up to 30 per cent. It was also estimated that the population would continue to decrease by at least 20 per cent in the next three generations given the continuation of the current rate of habitat loss and culling.

The main threat to Grey-headed Flying-foxes in NSW is clearing or modification of native vegetation. This threatening process removes appropriate roosting and breeding sites and limits the availability of natural food resources, particularly winter-spring feeding habitat in north-eastern NSW. The urbanisation of the coastal plains of south-eastern Queensland and northern NSW has seen the removal of annually-reliable winter feeding sites, and this threatening process continues.

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

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

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

5.4 Camp characteristics

All flying-foxes are nocturnal, roosting during the day in communal camps. These camps may range in number from a few to hundreds of thousands, with individual animals frequently moving between camps within their range. Typically, the abundance of resources within a 20-50 km radius of a camp site will be a key determinant of the size of a camp (SEQ Catchments 2012). Therefore, flying-fox camps are generally temporary and seasonal, tightly tied to the flowering of their preferred food trees. However, understanding the availability of feeding resources is difficult because flowering and fruiting are not reliable every year, and can vary between localities (SEQ Catchments 2012). These are important aspects of camp preference and movement between camps, and have implications to long-term management strategies.

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.

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

5.5 Species profiles

5.5.1 Black Flying-fox (*Pteropus alecto*)

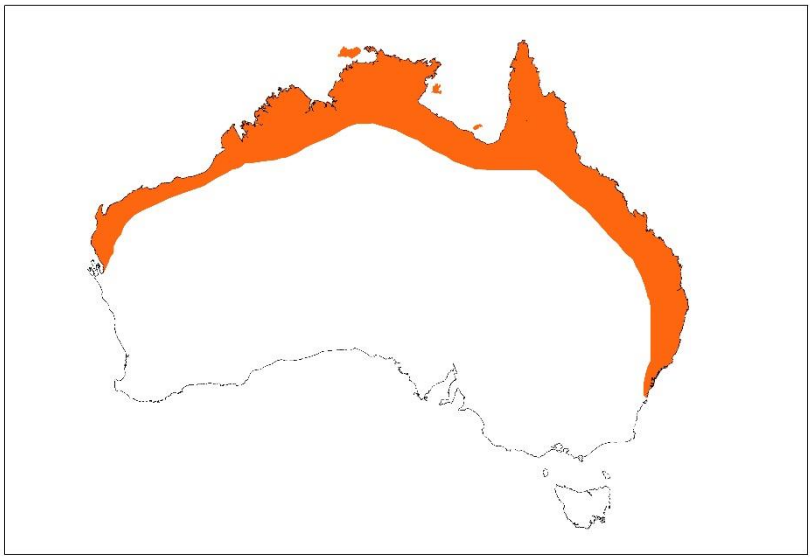


Figure 1 Black Flying-fox indicative species distribution, adapted from OEH 2015a.

The Black Flying-fox (BFF) (Figure 1) has traditionally occurred throughout coastal areas from Shark Bay in Western Australia, across Northern Australia, down through Queensland and into New South Wales (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.

BFF 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).

BFF 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.

BFF have not been recorded/sighted/observed in the Tamworth Regional Council area.

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

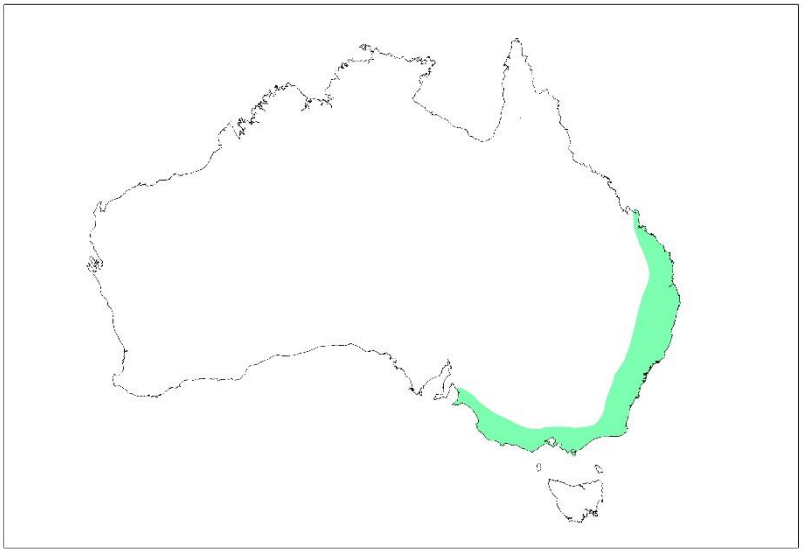


Figure 2 Grey-headed Flying-fox indicative species distribution, adapted from OEH 2015a.

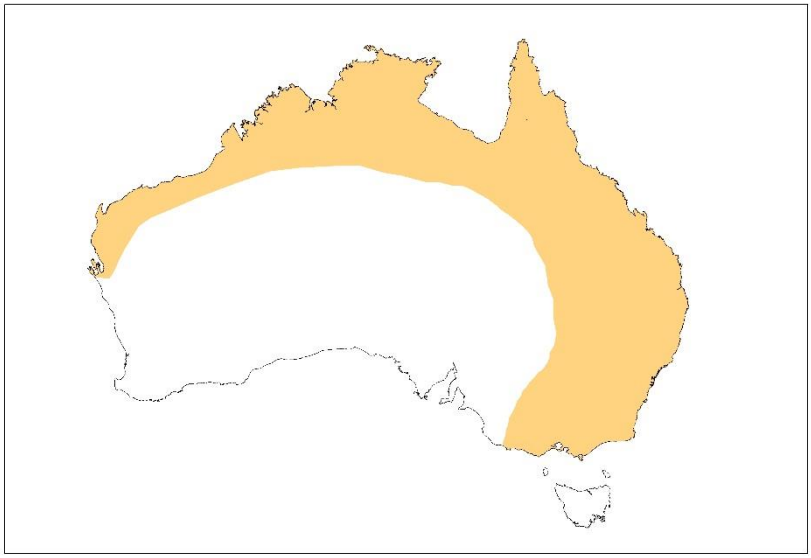
The Grey-headed Flying-fox (GHFF) (Figure 2) is found throughout eastern Australia, generally within 200 km of the coast, from Finch Hatton in Queensland to Melbourne, Victoria (OEH 2015d). This species now ranges into South Australia and has been observed in Tasmania (DoE 2016a). It requires foraging resources and camp sites within rainforests, open forests, closed and open woodlands (including Melaleuca swamps and Banksia woodlands). This species is also found throughout urban and agricultural areas where food trees exist and will raid orchards at times, especially when other food is scarce (OEH 2015a).

All the GHFF in Australia are regarded as one population that moves around freely within its entire national range (Webb & Tidemann 1996; DoE 2015). GHFF may travel up to 100 km in a single night with a foraging radius of up to 50 km from their camp (McConkey et al. 2012). They have been recorded travelling over 5,400 km over 48 hours when moving from one camp to another (Roberts et al. 2012). GHFF generally show a high level of fidelity to camp sites, returning year after year to the same site, and have been recorded returning to the same branch of a particular tree (SEQ Catchments 2012). This may be one of the reasons flying-foxes continue to return to small urban bushland blocks that may be remnants of historically-used larger tracts of vegetation.

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

There is evidence the GHFF population declined by up to 30% between 1989 and 2000 (Birt 2000, Richards 2000 cited in OEH 2011a). There is a wide range of ongoing threats to the survival of the GHFF, including habitat loss and degradation, deliberate destruction associated with the commercial horticulture industry, conflict with humans, infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.) and competition and hybridisation with the BFF (DECCW 2009). For these reasons it is listed as vulnerable to extinction under NSW state and Federal legislation (see Section 4).

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



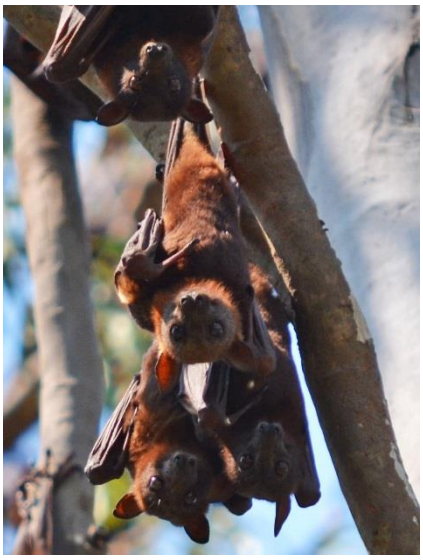


Figure 3 Little Red Flying-fox indicative species distribution, adapted from OEH 2015a.

The Little Red Flying-fox (LRFF) (Figure 3) 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 southeast Queensland and New South Wales during the summer months. Outside these periods LRFF undertake regular movements from north to south during winter-spring (July-October) (Milne & Pavey 2011).

5.5.4 Reproduction

Black and Grey-headed Flying-foxes

Males initiate contact with females in January with peak conception occurring around March to Apri/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 (Person & Rainey 1992).

As such, the critical reproductive period for GHFF and BFF 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 (see Figure 4).

Little Red Flying-fox

The LRFF breeds approximately six months out of phase with the other flying-foxes. Peak conception occurs between around October to November, with young born between March and June (McGuckin & Blackshaw 1991; Churchill 2008) (Figure 4). Young are carried by mothers 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).

Indicative flying-fox breeding cycle

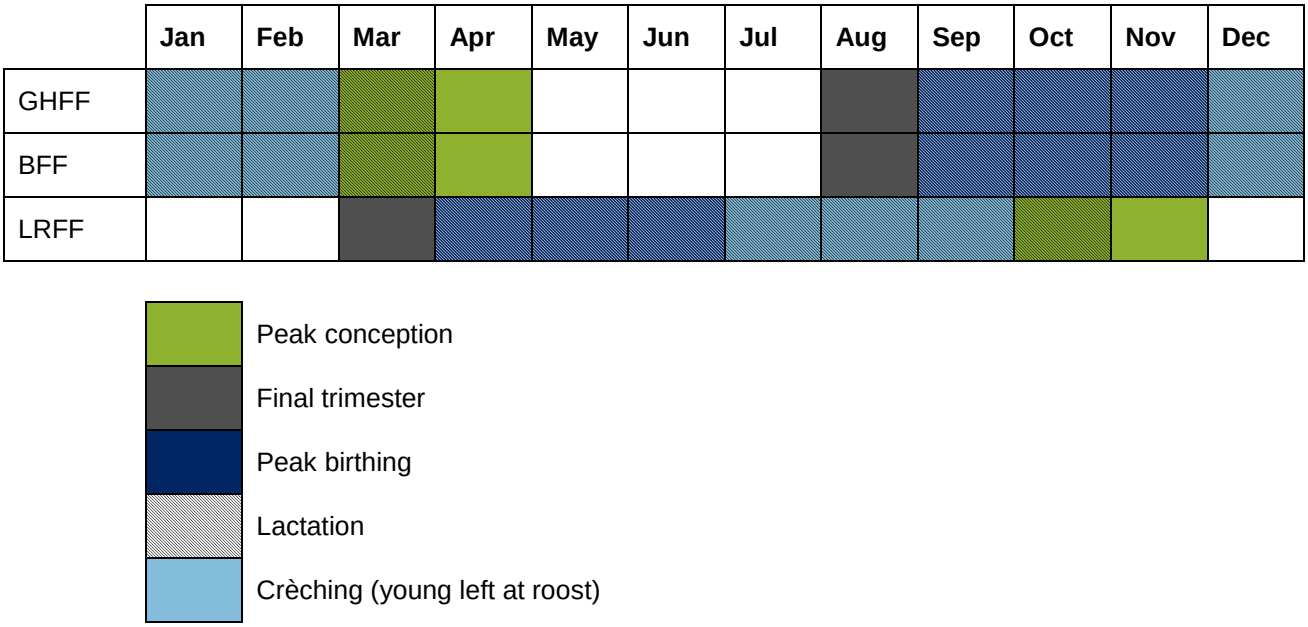


Figure 4 Indicative flying-fox reproductive cycle. Note that LRFF rarely birth and rear young in NSW. The breeding season of all species is variable between years and location, and expert assessment is required to accurately determine phases in the breeding cycle and inform appropriate management timing.

6 Human and animal health

Flying-foxes, like all 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 other animals that are exposed. In Australia the most well-defined of these include Australian Bat Lyssavirus (ABLV), Hendra virus (HeV) and Menangle virus. Specific information on these viruses is provided in Appendix 5.

Outside of an occupational cohort, including wildlife carers and vets, human exposure to these viruses is extremely rare and similarly transmission rates and incidence of human infection are very low. In addition, HeV infection in humans apparently requires transfer from an infected intermediate equine host and direct transmission from bats to humans has not been reported. Thus despite the fact that the consequence of human infection with these agents can be fatal, the probability of infection is extremely low and the overall public health risk is judged to be low (Qld Health 2016).

6.1 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 on-going 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 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 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.

7 Camp management options

7.1 Level 1 actions: routine camp management

7.1.1 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 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, 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 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. See also Section 3 and incorporate an education and awareness program into any community engagement plan.

An education program may include components shown in Figure 5.

Figure 5 Possible components of an education program

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.

7.1.2 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 or near to the camp to minimise impacts from roosting and foraging flying-foxes. (Note that approval may be required for some activities, refer to Section 4 for further information):

- Create visual/sound/smell barriers with fencing or hedges. To avoid attracting flying-foxes, species selected for hedging should not produce edible fruit or nectar-exuding flowers, should grow in dense formation between two and five metres (Roberts 2006) (or be maintained at less than 5 m). Vegetation that produces fragrant flowers can assist masking camp odour where this is of concern.
- manage foraging trees (i.e. plants that produce fruit/nectar-exuding flowers) within properties through pruning/covering with bags or wildlife friendly netting, early removal of fruit, or tree replacement.
- 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 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 rain water 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.

7.1.3 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.

7.1.4 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.

7.1.5 Routine camp maintenance and operational activities

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

- removal of tree limbs or whole trees that pose a genuine health and safety risk, as determined by a qualified arborist
- weed removal, including removal of noxious weeds under the Noxious Weeds Act 1993 or species listed as undesirable by a council
- trimming of understorey vegetation or 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 chain-saws, whipper-snippers, using generators and testing alarms or sirens.

7.1.6 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 have had limited success in the past, as our understanding of complex habitat requirements is still somewhat limited. Therefore habitat at known camp sites would ideally be dedicated as flying-fox reserves, and relocation to such sites has a higher chance of success compared with sites not used by flying-foxes in the past (and as such are lower risk). 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 Section 6.3 should be considered.

Foraging trees planted amongst and surrounding roost trees (excluding in/near horse paddocks) may assist to attract flying-foxes to a desired site. It 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 naturally unavailable, however may be cost-prohibitive.

Potential habitat mapping using camp preferences (see Section 6.3) 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.

7.1.7 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.

7.1.8 Protocols to manage incidents

This management option involves implementing protocols for managing incidents or situations specific to particular camps. Such protocols may include 'bat watch' patrols at sites that host vulnerable people, management of pets at sites popular for walking dogs or heat stress incidents (when the camp is subjected to extremely high temperatures leading to flying-foxes changing their behaviour and/or dying).

7.1.9 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.

7.1.10 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 the resolution of existing land use conflict, it may prevent issues for future residents.

7.1.11 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.

7.1.12 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.

7.2 Level 2 actions: in-situ management

7.2.1 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.

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

Buffers through vegetation removal

Vegetation removal aims to alter the area of the buffer habitat sufficiently so that it is no longer suitable as a 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 2016, pers. comm.) in roost trees have shown to have localised effects, with flying-foxes deterred from roosting within 1-10 m of the deterrents. The type and placement of visual deterrents would need to be varied regularly to avoid habituation.
- Noise emitters on timers – noise needs to be random, varied and unexpected to avoid flying-foxes habituating. As such these emitters would need to be portable, on varying timers and a diverse array of noises would be required. It is likely to require some level of additional disturbance to maintain its effectiveness, and ways to avoid disturbing flying-foxes from desirable areas would need to be identified. This is also likely to be disruptive to nearby residents.

- Smell deterrents – for example, bagged python excrement hung in trees has previously had a localised effect (GeoLink 2012). The smell of certain deterrents may also impact nearby residents, and there is potential for flying-foxes to habituate.
- Canopy-mounted water sprinklers – this method has been effective in deterring flying-foxes during dispersals (Ecosure personal experience), and a current trial in Queensland is 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.
- Wildlife-friendly netting – netting key roost trees may be effective in deterring flying-foxes from small areas. It is critical that nets are made of suitable material and properly installed to avoid wildlife entanglement (see The Wildlife Friendly Netting Project website).

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

The use of visual deterrents, in the absence of effective maintenance, could potentially lead to an increase of rubbish in the natural environment.

7.2.2 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.

7.3 Level 3 actions: disturbance or dispersal

7.3.1 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).

7.3.2 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 6 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 (defined in Section 4.2.1) sufficient vegetation must be retained to accommodate the maximum number of flying-foxes recorded at the site.

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

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

Active dispersal through disturbance

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 preferentially 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 (see Section 10).

7.4 Unlawful activities

7.4.1 Culling

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

.

7.5 Site-specific analysis of camp management options

Table 3 Analysis of management options. Definitions and descriptions of each management option are provided above in Section 8. Costs are broadly divided into the following categories: Low = <$10,000 ($); Moderate = $10,000-100,000 ($$); High = >$100,000 ($$$)

Management option	Relevant impacts	Cost	Advantages	Disadvantages	Site-specific detail
Level 1 actions					
Education and awareness programs and tourism potential	Fear of disease Noise Smell Faecal drop	$	Low cost, promotes conservation of FFs, contributes to attitude change which may reduce general need for camp intervention, increasing awareness and providing options for landholders to reduce impacts can be an effective long-term solution, can be undertaken quickly, will not impact on ecological or amenity value of the site.	Education and advice itself will not mitigate all issues, and may be seen as not doing enough.	Tamworth Regional Council, supported by OEH, will continue to consult with the community (especially those adjacent to the camp) to ensure residents and business owners understand the actual (low) risk, basic seasonal patterns, have access to up to date information and are aware of measures to mitigate risk and impacts. The camp could be promoted as a tourist attraction with interpretative signage and viewing platforms, which would benefit the caravan park and other local businesses.
Property modification	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$-$$	Property modification is one of the most effective ways to reduce amenity impacts of a camp without dispersal (and associated risks), relatively low cost, promotes conservation of FFs, can be undertaken quickly, will not impact on the site, may add value to the property.	May be cost-prohibitive for private landholders, unlikely to fully mitigate amenity issues in outdoor areas.	Council will ensure all adjacent residents and business managers are aware of ways to modify property that will both increase property value and reduce impacts from flying-foxes. Potential for a Council-funded program will be investigated to assist landholders by either subsidising property modification/services/rates or providing other assistance (e.g. car covers, clothes line covers, pressure cleaners, etc.). Criteria will need to be set for level of assistance considering distance to the camp and periods of camp occupancy (e.g. King George V Ave eligible for highest level of assistance given proximity to core camp area).
Routine camp management	Health/wellbeing	$	Will allow property maintenance, likely to improve habitat, could improve public perception of the site, will ensure safety risks of a public site can be managed. Weed removal has the potential to reduce roost availability and reduce numbers of roosting FF. To avoid this weed removal should be staged and alternative roost habitat	Will not generally mitigate amenity impacts for nearby landholders.	All residents and property managers can maintain their property as required, such as mowing, gardening, mulching, tidying etc. providing these activities are not aimed at disturbing the camp. Any tree that poses a health and safety risk (as determined by a qualified arborist) can be removed provided flying-foxes are not in the tree or likely to be harmed. If works on a roost tree are urgently needed Council will provide advice following consultation with a flying-fox expert.

Management option	Relevant impacts	Cost	Advantages	Disadvantages	Site-specific detail
			planted, otherwise activities may constitute a Level 3 action.		
Alternative habitat creation	All	$$-$$$	If successful in attracting FFs away from high conflict areas, dedicated habitat in low conflict areas will mitigate all impacts, promotes FF conservation. Rehabilitation of degraded habitat that is likely to be suitable for FF use could be a more practical and faster approach than habitat creation.	Generally costly, long-term approach so cannot be undertaken quickly, previous attempts to attract FFs to a new site have not been known to succeed.	Alternative habitat creation/improvement will form a key part of the management strategy to provide a lasting solution to human/flying-fox conflict. The current camp at King George V Ave is in close proximity to a number of residents and businesses. Moderate buffers are planned, however these can only be increased and maintained during large influxes with the provision of additional habitat in lower conflict areas. See Section 9.
Protocols to manage incidents	Health/wellbeing	$	Low cost, will reduce actual risk of negative human/pet-FF interactions, promotes conservation of FFs, can be undertaken quickly, will not impact the site.	Will not generally mitigate amenity impacts.	Council will ensure protocols are in place for both staff, and to advise the community (key points can be used in community education materials): · 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.
Research	All	$	Supporting research to improve understanding may contribute to more effectively mitigating all impacts, promotes FF conservation.	Generally cannot be undertaken quickly, management trials may require further cost input.	Council has supported research in the past (e.g. tracking study of flying-foxes from the Tamworth camp) and will continue to do so. Of particular interest is research that will improve understanding of and potential to predict flying-fox movements in and out of the Tamworth local government area.
Appropriate land-use planning	All	$	Likely to reduce future conflict, promotes FF conservation. Identification of degraded sites that may be suitable for long-term rehabilitation for FF could facilitate offset strategies should clearing be required under Level 2 actions.	Will not generally mitigate current impacts, land-use restrictions may impact the landholder.	Council will consider appropriate planning provisions when assessing development applications to help limit future conflict.
Property acquisition	All for specific property owners Nil for broader community	$$-$$$	Property acquisition will reduce conflict for current residents and, if combined with alternative habitat creation has potential to consolidate the camp in a relatively low conflict area.	Owners may not want to move. Only improves amenity for those who fit criteria for acquisition. Expensive.	There are three main options for property acquisition: · some or all of the private property immediately adjacent the core camp area. This would solve the issue for the most affected residents. Mitigation measures (buffers, subsidy program) would still be required to for the caravan park and other nearby residents. Revegetation would also be necessary to limit the camp footprint during influxes.

Management option	Relevant impacts	Cost	Advantages	Disadvantages	Site-specific detail
					· property along Peel River further south of the core camp, but still in the area where flying-foxes have roosted in the past. Revegetation would be required to accommodate seasonal influxes. · a portion of private property to the south of the Bicentennial camp site to allow additional habitat creation. Benefit of this option is that the area has already shown to be able to accommodate 60-70,000 flying-foxes and so while creating additional habitat is desirable, it will be suitable in the medium-term in its current condition. Some effort (e.g. nudging/deterrents) may be required to deter flying-foxes from Bicentennial Park, particularly during large influxes (See Section 9).
Do nothing	Nil	Nil	No resource expenditure.	Will not mitigate impacts and unlikely to be considered acceptable by the community.	Not appropriate.
Level 2 actions					
Buffers through vegetation removal	Noise Smell Health/wellbeing Property devaluation Lost rental return	$-$$	Will reduce impacts, promotes FF conservation, can be undertaken quickly, limited maintenance costs	Will impact the site, will not generally eliminate impacts, vegetation removal may not be favoured by the community.	Buffers will initially be created by tree trimming/removal with the aim of creating unattractive roost habitat and increase separation between residents and flying-foxes. Larger buffers are planned in the medium-term in combination with alternative habitat creation. See Section 9.
Buffers without vegetation removal	Noise Smell Health/wellbeing Damage to vegetation Property devaluation Lost rental return	$-$$	Successful creation of a buffer will reduce impacts, promotes FF conservation, can be undertaken quickly, options without vegetation removal may be preferred by the community	May impact the site, buffers will not generally eliminate impacts, maintenance costs may be significant, often logistically difficult, limited trials so likely effectiveness unknown.	Deterrents may be considered in buffer areas where vegetation removal is not possible or desirable. See Section 9.
Level 3 actions					
Nudging	All	$$-$$$	If nudging is successful this may	Costly, FFs will continue attempting to recolonise the area unless	Nudging the core camp slightly up or down Peel River would likely increase impacts to other residents. It would

Management option	Relevant impacts	Cost	Advantages	Disadvantages	Site-specific detail
			mitigate all impacts.	combined with habitat modification/deterrents.	also require: · provision of additional habitat as contiguous habitat is currently sparse and/or degraded (likely in combination with land acquisition) · modification of core camp habitat to limit attempts to re-establish at their preferred site. This option is considered less favourable than attempting to provide alternative habitat elsewhere (as detailed in Section 9).
Passive dispersal through vegetation management	All at that site but not generally appropriate for amenity impacts only (see Section 8)	$$	If successful can mitigate all impacts at that site, compared with active dispersal: less stress on FFs, less ongoing cost, less restrictive in timing with ability for evening vegetation removal.	Costly, will impact site, risk of removing habitat before outcome known, potential to splinter the camp creating problems other locations (although less than active dispersal), potential welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk (see Section 7.1), potential to impact on aircraft safety.	Modifying habitat in the King George V camp area will form part of a longer-term plan in combination with providing additional alternative habitat elsewhere. See Section 9.
Active dispersal	All at that site but not generally appropriate for amenity impacts only (see Section 8)	$$$	If successful can mitigate all impacts at that site, often stated as the preferred method for impacted community members.	May be very costly, often unsuccessful, ongoing dispersal generally required unless combined with habitat modification, potential to splinter the camp creating problems in other locations, potential for significant animal welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk (see Section 7.1), potential to impact on aircraft safety.	Active dispersal is not recommended from Peel River camp sites given risks detailed in Section 8.3.2.
Early dispersal	All at that site	$$-$$$	Potential advantages as per other dispersal methods, but more likely	Potential disadvantages as per other dispersal methods, but	Council will initiate early intervention dispersal if a camp appears to be establishing in a new, undesirable location

Management option	Relevant impacts	Cost	Advantages	Disadvantages	Site-specific detail
before a camp is established at a new location			to be successful than dispersal of a historic camp.	possibly less costly and slightly lower risk than dispersing a historic camp. Potential to increase pressure on FFs that may have relocated from another dispersed camp, which may exacerbate impacts on these individuals.	(e.g. in town). See Section 9.

8 Planned management approach

8.1 Level 1 actions

Level 1 actions outlined in Table 3 are generally ongoing and will be implemented over the entire life of the plan.

The option of a subsidy program will be investigated immediately, however is not sufficient to suitably mitigate impacts to King George V Ave residents.

Council will designate flying-fox camp habitat. The location most likely to succeed is the other known camp site upstream opposite Bicentennial Park given that:

- flying-foxes have used this area in the past and therefore are more likely to establish here than a new site elsewhere
- habitat in this area has accommodated a large number of flying-foxes (60-70,000) and therefore it is immediately suitable for regular numbers
- it has lower level of conflict compared to other potential habitat in the vicinity (e.g. is away from residents).

Designating this area as habitat should be combined with the following Level 1 actions:

- education, including signage in the park.
- restricted access to the bank immediately opposite desirable location (refer to Map 4 Section A) to limit disturbance. This can be done through fencing (recommended in the short-term) or with dense planting (potentially spiky plants to further limit access). Minimising camp disturbance will avoid increased noise and smell associated with disturbance, and will increase the likelihood that this will become the established camp site.
- provision of additional habitat. Ideally land would be acquired near the Peel and Goonoo Goonoo Creek creek junction (refer to Map 4) which can be revegetated. If this is possible, Section A should also be densely planted to provide additional habitat adjacent the creek, but on the opposite side of Bicentennial Park. If additional land cannot be acquired, both Section A and B should be densely planted to provide sufficient habitat to accommodate temporary large influxes.

Residents and businesses will be encouraged to modify properties and property boundaries (e.g. planting dense screens) in the interim to Level 2 and 3 actions, and should planned Level 3 actions be unsuccessful.

8.2 Level 2 actions

A buffer up to 50 m from affected dwellings immediately adjacent to core camp habitat, as shown on Map 5, is planned for immediate implementation. Exotic plants will be removed and native trees trimmed (i.e. no native tree removal) to deter flying-foxes from the buffer area. Measures to avoid impacts are detailed in Section 10 and will be complied with at all times.

Council, with assistance from OEH, will then assess remaining resources, the level of amenity achieved and flying-fox response and activity, to determine whether additional buffer work on primary affected residential lots is required. Should this be considered necessary and feasible, Council will consult with OEH and apply for a separate s91 licence.

8.3 Level 3 actions

If the site opposite Bicentennial Park is designated as flying-fox camp habitat, the following is planned over the life of this CMP (planned in the order listed):

1. Access restricted to the bank immediately opposite the main desired camp area (through permanent fencing or planting - if planting, temporary fencing will be erected in the interim to planting restricting access).
2. Habitat acquisition to be investigated.
3. Dense planting of site-appropriate, fast-growing species (e.g. river oak) to commence in Section A and acquired land or otherwise Section A and B. Providing additional roost habitat will reduce the impact of flying-foxes on tree health, however some tree replacement will likely be required over time.
4. Habitat modification as follows (working sequentially towards the camp with the aim of nudging flying-foxes north along Peel River towards the desired site) (Refer to Map 4):
    - Area 1 – weed removal, native tree trimming and selective thinning if necessary, potential installation of deterrents.
    - Area 2 – weed removal is anticipated to be sufficient to alter this heavily weed-infested and less favourable flying-fox habitat. Native tree trimming may be required but no native tree removal will occur in this area.
    - Area 3 – core roost habitat, weed removal, vegetation thinning and selective tree removal if required, potentially installation of deterrents (Refer to Map 5).
    - Bicentennial Park and areas north of Peel River– if flying-foxes spill over into Bicentennial Park or other surrounding areas north of Peel River, occasional nudging may be required and/or deterrents.

Should the opportunity present itself, works in Area 3 will be commenced as soon as possible subject to Council approval of funding, in order to alleviate the impact that the Flying-foxes are having on residents in that area. The remainder of the management actions in Areas 1 and 2 may commence in the future subject to a fully costed plan of works being endorsed by Council.

Deterrents may include any of those described in Section 8.2.1. Installation and operation will be guided by a suitably qualified flying-fox expert.

Habitat modification of the core roost area will only be done in the non-breeding season, or when flying-foxes are naturally absent.

The intention of these actions is to nudge/passively disperse flying-foxes from the King George V Ave area to the Bicentennial Park area. This will mitigate impacts to residents, and consolidate the camp in a more appropriate location. Limiting the camp footprint will reduce impacts to the general community. Consolidating the camp into one larger, contiguous area of higher quality camp habitat is also likely to improve conditions for flying-foxes (anticipated to reduce daytime flights, which greatly increased community concern and impacts during the 2015 influx).

Although considered unlikely given the amount of available habitat that will remain available along Peel River, Council will initiate early intervention dispersal if a camp appears to be establishing in a new, undesirable location (e.g. in town).

Table 4 Management approach overview

Issue	Management aim	Success measures	Management actions to be considered.		
			Level 1 actions	**Level 2 actions**	**Level 3 actions**
Noise/smell/faecal drop	Mitigate amenity impacts.	Reasonable level of amenity achieved based on independent assessment.	Education and awareness (e.g. managing foraging attractants and tips to reduce impacts / fear of disease). Property modification (including providing subsidies if possible). Appropriate land use planning. Dense planting to create screens at boundaries. Revegetate and manage land to create alternative habitat. Subsidise services to reduce impacts if feasible. Protocols to manage incidents.	Buffers around residences.	Level 3 actions will not be considered to mitigate this issue.
Flying-foxes overhanging residences	Prevent flying-foxes overhanging properties.	No roosting flying-foxes overhanging residential dwellings.	-	Buffers around residences.	Level 3 actions will not be considered to mitigate this issue.
Fear of disease	Promote awareness of actual low disease risk.	All concerned community members have received and have access to factual information on disease.	Education and awareness programs (e.g. ensuring community understand actual low risk of disease transfer and simple mitigation measures). Protocols to prevent incidents.	Buffers around residences.	Level 3 actions will not be considered to mitigate this issue.
Health / wellbeing impacts	Mitigate health and wellbeing impacts.	Health and wellbeing impacts are not being created by the camp as assessed by an independent professional.	Education and awareness programs. Property modification (including subsidies) to prevent wellbeing impacts associated with noise. Protocols to prevent incidents. Routine management actions to improve the site. Revegetate land to create alternative habitat.	Buffers. Noise attenuation fencing.	Nudging/ Passive dispersal.
Damage to vegetation	Mitigate impacts to vegetation.	Long-term viability of vegetation not at risk / can be rehabilitated (need to assess cost/benefit of impacts associated with damage to vegetation	Routine management actions to improve the site. Provision of artificial roosting habitat.	Deterrents from select trees (e.g. netting, wires, sprinklers, etc.).	Nudging/ passive dispersal not considered to mitigate this issue in this

Issue	Management aim	Success measures	Management actions to be considered.		
			Level 1 actions	**Level 2 actions**	**Level 3 actions**
		against environmental services provided by flying-foxes and risks of other impacts if camp is dispersed).	Revegetate land to create alternative habitat.		situation.
Property devaluation	Reduce economic loss associated with potential property devaluation.	Property value not being impacted for owners that purchased property prior to camp formation, as assessed through independent valuation.	Property modification (including subsidies). Subsidise services to reduce impacts. Off-set through funding or incentives (e.g. rate reduction). Appropriate land-use planning. Dense planting to create screens at residential boundaries. Revegetate to create alternative habitat.	Buffers.	Nudging / passive dispersal.

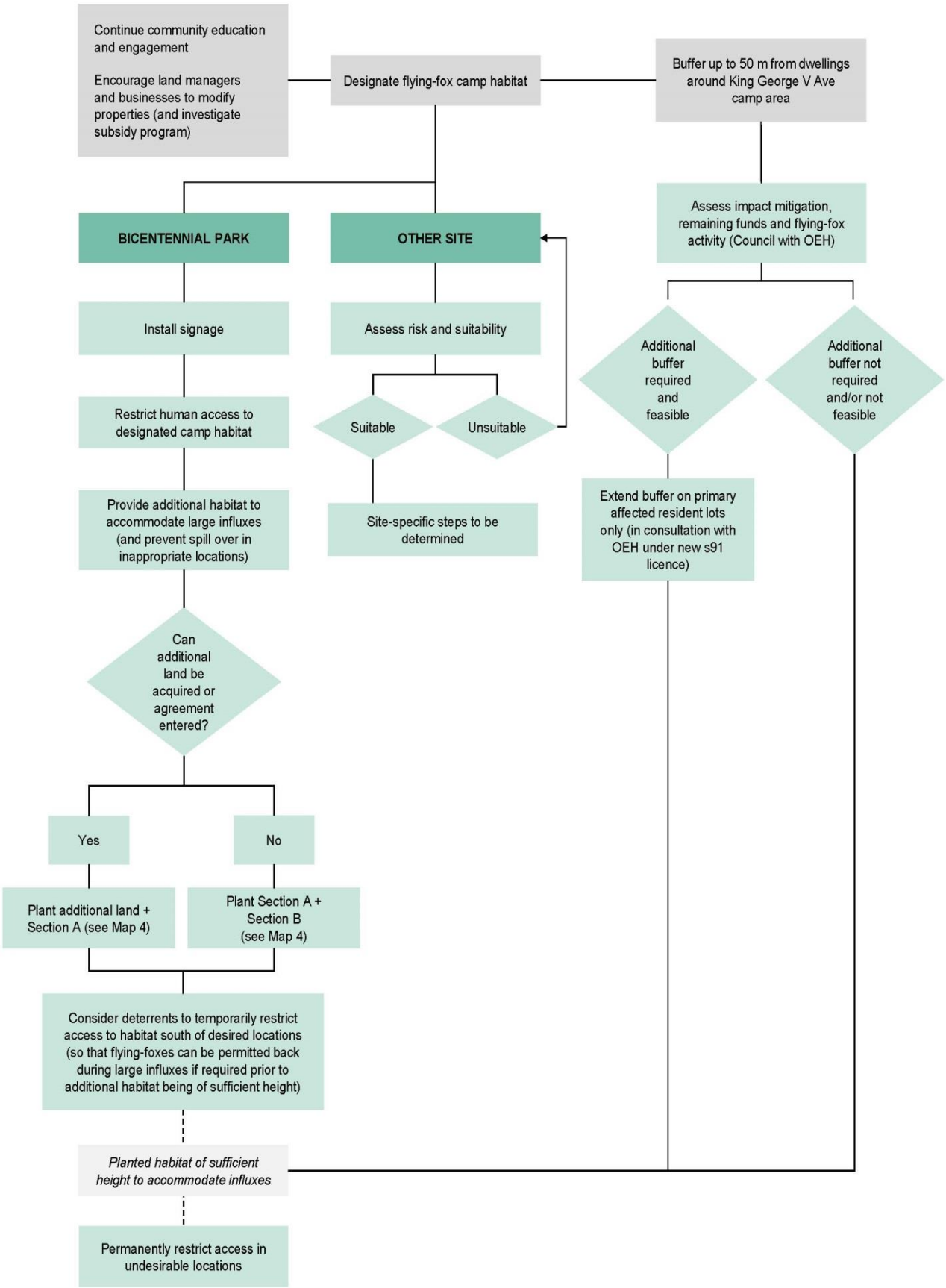


Figure 6 Example flow chart to demonstrate the planned process for management decision-making.

8.4 Stop work triggers

The management program will cease and will not recommence or progress to subsequent levels 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 (see Table 5)
- there is a flying-fox injury or death
- a new camp/camps appear to be establishing
- impacts are created or exacerbated at other locations
- there appears to be potential for conservation impacts (e.g. reduction in breeding success identified through independent monitoring)
- standard measures to avoid impacts (detailed in Section 10.3) 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.

Management will cease if:

- there is proliferation of splinter colonies in unsuitable locations (as determined by the land manager or OEH)
- splinter camps become established in inappropriate locations and for ecological, social or other reasons, a dispersal at the splinter location is not appropriate (as determined by the land manager or OEH).

If the program is stopped it may be permanently abandoned and other strategies considered, or reassessed and resumed in consultation with OEH.

Table 5 Planned action for potential impacts during management. A person with experience in flying-fox behaviour will monitor for welfare triggers and direct works in accordance with the below.

Welfare trigger	Signs	Action
Unacceptable levels of stress	If any individual is observed: · panting · saliva spreading · located on or within 2 m off 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 Dispersal · low flying · laboured flight · settling despite dispersal efforts	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. Dispersal Works to cease for the day.
Injury/death	· a flying-fox appears to have been injured/killed on site (including aborted foetuses) · any flying-fox death is reported within one km of the dispersal site that appears to be related to the dispersal · females in final trimester · dependent/crèching young present · loss of condition evident	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 (see Appendix 1) OR stopped indefinitely and alternative management options investigated.

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

9 Assessment of impacts to flying-foxes

9.1 Regional context

There are six camps within the Tamworth Regional Council area. Map 6 shows the general location of these camps. Maps R1-R4 show the exact location of each of the camps outside the Tamworth CBD.

None of the four camps outside the Tamworth CBD could be considered a suitable alternate camp for the main camps in Tamworth. This is due to their close proximity to villages, towns and water supplies.

Map 7 and R5 to R9 shows the potential for conflict at each camp. Areas of high conflict are shown in red. This shows areas of vegetation that are within 50m of residential properties. The vegetation could be used for roosting habitat or for foraging.

9.2 Flying-fox habitat to be affected

BioMetric survey guidelines were followed for desktop analysis, however simple field assessment was sufficient given that management will focus on weed removal rather than removal of native vegetation.

The camp area is not mapped in any critical habitat (although constitutes nationally important GHFF habitat; see Section 4.2.1), nor is it located within the NSW key habitat climate change corridors for threatened species. The Peel River is mapped as a potential subregional corridor in the Nandewar bioregion.

Tamworth is located in the Nandewar Bioregion and Peel subregion (NAN04). Both Peel River and Goonoo Goonoo Creek lie in the Namoi Catchment. No wetlands mapped under the State Environmental Planning Policy 14 (SEPP 14) wetland mapping occur in the vicinity of the camp.

The entire maximum camp extent (refer to Map 4) occurs on habitat mapped by the Namoi CMA as Eastern Riverine Forests- River Oaks- Rough-barked Apple- Red Gum- Box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions.

The community is typically dominated by river oaks (*Casuarina cunninghamiana*) usually 10 – 40 m tall. Other species which may occur include *Acacia floribunda*, *Acacia mearnsii*, *Glocidion ferdinandi* and sedges and forbes. These communities occur along riparian corridors in open terrain up to 800 m above sea level. The soils are generally sandy with boulders and cobbles.

The area lies in the Nandewar Peel Channels and Floodplain Mitchell Landscape. These landscapes are defined by having channel, floodplain, swamps, lagoon and terrace remnant on Quaternary alluvium. The vegetation in these landscapes is dominated by river oak, river red gum (*Eucalyptus tereticornis*), rough-barked apple (*Angophora floribunda*) and yellow box (*Eucalyptus melliodora*).

These vegetation communities are correct, with the entire camp footprint being dominated by river oak and river red gum. Other non-endemic species are used as roost trees (e.g. willows, ironbark, lemon-scented gum). Approximately 50% of the roost vegetation (including mid-storey used by LRFF) is dominated by weeds, especially osage orange (*Maclura pomifera*), multiple stands of locust (*Robina pseudoacacia*), privet (*Ligustrum spp.*), Chinese empress trees (*Paulownia tomentosa*), giant reed (*Arundo donax*) and feral fruit trees. There are also stands of ornamental deciduous trees including white cedar (*Melia azedarach*), box elder (*Acer negundo*) and poplar (*Populus spp.*).

As outlined in Section 9, habitat modification around the King George V Ave camp will focus on:

- weed and non-native removal
- trimming native trees
- selective removal of river oaks only if additional habitat modification is required.

Given that works around King George V Ave are focused on removing non-native species, overall biodiversity values of the area will be improved. There will be no habitat removed around the Bicentennial Park, but rather planted in these areas (which will offset the lost roost area around King George V Ave).

Care will be taken to ensure bank stability during weed removal (e.g. retaining root systems of mature trees) and re-planting ground cover species if necessary.

9.3 Standard measures to avoid impacts

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

9.3.1 All management activities

- 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 produce 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 gradually towards the camp 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 – 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 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.
- Evening works may commence after fly-out. Noise generated by the works should create a first stage disturbance, with any remaining flying-foxes taking flight. Works should be paused at this stage to monitor for any remaining flying-foxes (including crèching young, although December – February should be avoided for this reason) and ensure they will not be impacted. All Level 1 and 2 works (including pack up) will cease by 0100 to ensure flying-foxes returning early in the morning are

not inadvertently dispersed. Works associated with Level 3 actions may continue provided flying-foxes are not at risk of being harmed.

- If impacts at other sites are considered, in OEH's opinion, to be a result of management actions under this Plan, assistance will be provided by the proponent to the relevant land manager to ameliorate impacts. Details of this assistance are to be developed in consultation with OEH.
- 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 cease management activities at any time.
- Ensure management actions and results are recorded to inform future planning. See the OEH fact sheet on Monitoring and Reporting.

Human safety

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

Post-works

- Reports for Level 1 actions will be provided to OEH annually. Reports for Level 2 and 3 actions will be submitted to OEH one month after commencement of works and then quarterly for the life of the Plan (up to 5 years) (for all Level 3 actions and in periods where works have occurred for Level 2 actions). Each report is to include:
    - results of pre- and post-work population monitoring
    - any information on new camps that have formed in the area
    - impacts at other locations that may have resulted from management and suggested amelioration measures
    - an assessment of how the flying-foxes reacted to the works, with particular detail on the most extreme response and average response, outlining any recommendations for what aspects of the works went well and what aspects did not work well
    - further management actions planned including a schedule of works
    - an assessment[5] of how the community responded to the works, including details on the number and nature of complaints before and after the works
    - detail on any compensatory plantings undertaken or required
    - expenditure (financial and in-kind costs)

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

- Plan evaluation and review (see Section 10).

9.3.2 All Level 2 and 3 actions

Prior to works

- Residents adjacent to the camp will be individually notified one week prior to on-ground works commencing. This will include information on what to do if an injured or orphaned flying-fox is observed, a reminder not to participate or interfere with the program, and details on how to report unusual flying-fox behaviour/daytime sightings. Relevant contact details will be provided (e.g. Program Coordinator). Resident requests for retention of vegetation and other concerns relating to the program will be taken into consideration.
- Where the Plan is being implemented by Council, information will be placed on Council's website along with contact information.
- OEH will be notified at least 48 hours before works commence.
- A protocol, in accordance with the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012), for flying-fox rescue will be developed including contact details of rescue and rehabilitation organisations. This protocol will be made available to all relevant staff, residents and volunteers prior to the action commencing. See Appendix 7 for an example protocol.
- A licensed wildlife carer will be notified prior to beginning works in the event that rescue/care is required.

Monitoring

- A flying-fox expert will undertake an on-site population assessment prior to, during works and after works have been completed, including:
  - number of each species
  - ratio of females in final trimester
  - approximate age of any pups present including whether they are attached or likely to be crèched
  - visual health assessment
  - mortalities.

  Counts will be done at least:
  - once immediately prior to works
  - daily during works
  - immediately following completion
  - one month following completion
  - 12 months following completion.

During works

- A flying-fox expert will attend the site as often as OEH considers necessary to monitor flying-fox behaviour and ensure compliance with the Plan. They must also be able to identify pregnant females, flightless young, individuals in poor health and be aware of climatic extremes and food

stress events. This person will make an assessment of the relevant conditions and advise the supervisor/proponent whether the activity can go ahead.

- Deterrents in buffer areas will be assessed by a flying-fox expert so that those that may cause inadvertent dispersal (e.g. canopy-mounted sprinklers) are not used during fly-in.
- At least one flying-fox rest day with no active management will be scheduled fortnightly, preferably weekly. Static deterrents (e.g. canopy-mounted sprinklers) may still be used on rest days.

9.3.3 Vegetation trimming/removal

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

9.3.4 Canopy vegetation trimming/removal

Prior to works

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

During works

- Any tree lopping, trimming or removal is undertaken under the supervision of a suitably qualified arborist (minimum qualification of Certificate III in Horticulture (Arboriculture) who is a member of an appropriate professional body such as the National Arborists Association).
- Trimming will be in accordance with relevant Australian Standards (e.g. AS4373 Pruning of Amenity Trees), and best practice techniques used to remove vegetation in a way that avoids impacting other fauna and remaining habitat.
- No tree in which a flying-fox is roosting will be trimmed or removed. Works may continue in trees adjacent to roost trees only where a person experienced in flying-fox behaviour assesses that flying-fox(es) are not at risk of being harmed. A person experienced in flying-fox behaviour is to remain on site to monitor when canopy trimming/removal is required within 50 m of roosting flying-foxes.
- While most females are likely to be carrying young (generally September – January) vegetation removal within 50 m of the camp will only be done in the evening after fly-out, unless otherwise advised by a flying-fox expert.
- Native 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.

9.3.5 Bush regeneration

- All works will be carried out by suitably qualified and experienced bush regenerators, with at least one supervisor knowledgeable about flying-fox habitat requirements (and how to retain them for Level 1 and 2 actions) and trained in working under a camp.
- Vegetation modification, including weed removal, will not alter the conditions of the site such that it becomes unsuitable flying-fox habitat for Level 1 and 2 actions.

- Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys at all times.
- Weed control in the core habitat area will be undertaken using hand tools only (or in the evening after fly-out while crèching young are not present).
- Species selected for revegetation will be consistent with the habitat on site, and in buffer areas or conflict areas should be restricted to small shrubs/understorey species to reduce the need for further roost tree management in the future.

9.3.6 Additional measures for Level 3 actions

Prior to dispersal

- Prepare a communications plan in relation to the program and provide a copy to OEH.
- Councils that manage camps within 50 km and airports within 50 km will be informed of the intended start date, likely duration, and encouraged to report any change in flying-fox movements.
- Council will liaise with the Environmental Protection Authority (EPA) in regard to management of noise issues.

Monitoring

Additional monitoring requirements for dispersal actions (including maintenance dispersal and splinter camp dispersal):

- Potential flying-fox habitat within 3 km of the site monitored within two weeks of works commencing and at the completion of works.
- Daily checks of 'potential flying-fox habitat' within 600 m, twice weekly checks of 'potential flying-fox habitat' within 3 km and weekly checks of known camps within 20 km of the site.
- Where weekly counts are already being undertaken by flying-fox experts at other camps within 20 km, counts at these camps are not required, provided there is an agreement with these experts to access these data.

A count is also required at any known camp site within a 25 km radius once within two weeks of works commencing and again at the completion of works.

During dispersal

- At least one person experienced in dispersal, vaccinated against ABLV and able to rescue flying-foxes if required, is to be present at all times. For maintenance dispersals only, this person may be on-call rather than on site, however maintenance dispersal personnel will still have suitable experience in flying-fox behaviour and monitoring.
- Dispersal of an occupied camp will only occur when females are not in final trimester or dependent young are present (generally May and July). If flying-foxes in the region are recorded as being visibly pregnant dispersal will cease.
- Dispersal methods will not have the potential to harm flying-foxes and may include only noise, spotlights, laser pointers, smoke from contained fires, canopy-mounted sprinklers, and visual deterrents such as balloons.
- Dispersal may continue for up to a total of up to 2.5 hours in a 12 hours period, early morning and/or in the evening. Morning dispersal will not continue past sunrise. Evening dispersal will not begin

before sunset. If flying-foxes are showing signs of distress or are tiring, dispersal will cease for the day as per 'stop work triggers' in the Plan.

- The duration of dispersal each day will be minimised as much as possible.
- A section of the camp will be designated as a rest area for flying-foxes during dispersal, to be progressively reduced in size over time, unless the nominated flying-fox expert justifies a reason not to do so.
- During any dispersal action, liaison with wildlife carers is required to monitor whether there is an increase in the number of flying-foxes being taken into care or showing signs of stress. If increases are apparent, OEH will be consulted before continuing the action.
- Maintenance dispersal activities (i.e. deterring flying-foxes from recolonising a dispersed or otherwise empty camp) may be undertaken. During November to February it is essential that camps are checked to ensure there are no crèched young in the camp or individuals in visibly poor health, as determined by a suitably qualified expert. While females are likely to be in final trimester or carrying young (generally August to January), maintenance dispersal will be implemented at a reduced intensity using smoke, lights, continuous noise (no sudden noises) and passive deterrents (e.g. canopy mounted sprinklers turned on prior to possible fly-in, visual deterrents, etc.).
- Residents will be notified of a maintenance action, within a timeframe as agreed to by the residents.
- Splinter camp dispersals are subject to conditions above. Adequate consultation will be undertaken with neighbouring landowners and land managers.
- No actions are to be undertaken at any splinter camps without consulting OEH.

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

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

10 Evaluation and review

The Plan will have a scheduled review annually, which will include evaluation of management actions against measures shown in Section 8.

The following will trigger a reactive 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.

Results of each review will be included in reports to OEH (as per reporting timing in Section 10.3.1).

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

11 Plan administration

11.1 Monitoring of the camp

Monitoring of the camp when management actions are not occurring will be undertaken by TRC staff with the guidance of OEH. During approved management actions Monitoring, Evaluation and Reporting (MER) will occur in accordance with the monitoring fact sheet associated with the NSW Flying-fox Camp Management Policy 2015. MER will be undertaken by Flying-fox experts and/or ecologists, as required.

11.2 Management structure and responsibilities

Table 6 Roles and responsibilities

Role	Who	Required experience/approvals	Responsibilities/authority	Communication lines
Program Coordinator	Ross Briggs Manager Regulatory Services TRC	Project management. Human resource management. Community engagement. Reporting.	Inform and consult with stakeholders and interested parties Community engagement Evaluate program Submit reports to OEH/DoE Ensure all landowners have provided consent prior to works	Reports to: (insert) Direct reports: Project Manager
Project Manager	Ross Briggs Manager Regulatory Services TRC	Project management. Team leadership and coordination. Data management.	Coordinate field teams and ensure all personnel appropriately experienced and trained for their roles Induct all personnel to the program Collect and collate data Liaise with OEH and DoE Liaise with wildlife carers/veterinarians (for orphaned/injured wildlife only)	Reports to: Program Coordinator Direct reports: Supervisor, Contractor
Supervisor	Uncertain – to be contracted	Knowledgeable in flying-fox biology, behaviour and camp management (see Appendix 1 for detail). ABLV-vaccinated and trained in flying-fox rescue. Team training, leadership and supervision.	Pre- and post-management monitoring Surrounding camp monitoring Coordinate daily site briefings Coordinate daily activities Monitor flying-fox behaviour Rescue flying-foxes if required (and no carer/vet on site) Determine daily works end point Participate in management activities	Reports to: Project Manager Direct reports: Team members, Observers/support
Team member	Uncertain	Recommended ABLV-vaccinated (employer to assess risk) Ideally all team knowledgeable in flying-fox biology, behaviour and camp management however not required.	Attend daily site briefings Participate in relevant management activities	Reports to: Supervisor Direct reports: Nil
Contractor (insert type e.g. arborist)	Uncertain	Relevant licences and experience in field.	Conduct specified activities (e.g. tree trimming) Adhere to all directions given by Supervisor.	Reports to: Project Manager Direct reports: Nil

Role	Who	Required experience/approvals	Responsibilities/authority	Communication lines
Observer/support	Uncertain	Approval to access site.	Provide care of injured/orphaned wildlife (under licence) if required.	Reports to: Supervisor Direct reports: Nil

11.3 Adaptive management

Adaptive management will occur in response to the Evaluation and Review that will be undertaken in accordance with Section 10. OEH will be consulted prior to any changes being made to the CMP.

11.4 Funding commitment

Funding has been sought under the Local Government NSW Flying-fox grants program to help commence the implementation of this Plan. An application for grant funding of $50,000 has been sought with a total project cost of $140,000 (including the grant) estimated to undertake a portion of the management actions.

Tamworth Regional Council will commit to spend up to $100,000 (cash and in-kind) to undertake the works in the LGNSW FFGP and will seek further grant funding to ensure the CMP can be fully implemented.

Section 7.5 outlines the range of expenditure needed to undertake all the management actions allowed under the NSW Flying-fox Camp Management Policy 2015.

References and resources

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

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

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

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

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

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

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

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

DAF 2012, *Zoonotic Diseases*, Department of Agriculture and Fisheries, viewed 12 January 2016, https://www.daf.qld.gov.au/animal-industries/animal-health-and-diseases/zoonoses.

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

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

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

Den Exter, K, Roberts, B, Underwood, A & Martin, L 2011, A discussion paper on flying foxes and the implications for bush regeneration at their camp sites, Big Scrub Landcare, viewed 12 January 2016, https://bigscrubrainforest.org.au/?p=129.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Ecosure 2014, *Cannes Reserve flying-fox management strategy*, Ecosure Pty Ltd, Report to Pittwater Council, Sydney.

Ecosure 2014, *Outcomes of a new flying-fox management framework: Review of management actions 2013-2014*, unpublished data collected in collaboration with Griffith University (Industry Affiliates Program).

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

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

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

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

EHP 2013d, *Living with Wildlife - Flying-foxes*, Department of Environment and Heritage Protection, Queensland, viewed 12 January 2016, http://www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/index.html.

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

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

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

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

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

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

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

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

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

Lunney, D, Richards, G & Dickman, C 2008, *Pteropus poliocephalus*, The IUCN Red List of Threatened Species 2008: e.T18751A8554062. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T18751A8554062.en.

Lunney, D, Richards, G & Dickman, C 2008, *Pteropus poliocephalus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2, viewed 12 January 2016, www.iucnredlist.org.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Pierson, E.D. & W.E. Rainey (1992). The biology of flying foxes of the genus Pteropus: A Review. In: Wilson, D.E & G.L Graham, eds. *Pacific Island Flying Foxes*: *Proceedings of an International Conservation Conference*. Page(s) 1-17. US Department of the Interior- Biological Report no. 90.

Qld Health 2016, *Bats and Human Health*, Queensland Health, viewed 12 January 2016, http://access.health.qld.gov.au/hid/InfectionsandParasites/ViralInfections/batsAndHumanHealth_is.asp

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

RBG 2009, *Flying-foxes*, NSW Government documents dispersal documents, Royal Botanic Gardens and Domain Trust, viewed 12 January 2016 http://www.rbgsyd.nsw.gov.au/welcome/royal_botanic_garden/gardens_and_domain/wildlife/flying-foxes/NSW_Government_documents.

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

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

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

Roberts, BJ, Catterall, CP, Eby, P and Kanowski, J, 2012, Long-Distance and Frequent Movements of the Flying-Fox *Pteropus poliocephalus*: Implications for Management. *PLoS ONE* 7(8): e42532.

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

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

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

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

Southerton SG, Birt P, Porter J, & Ford HA. 2004, 'Review of gene movement by bats and birds and its potential significance for eucalypt plantation forestry', *Australian Forestry,* 67(1), pp. 45-54.

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

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

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

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

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

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

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

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

Welbergen, JA 2014, *Canaries in the coalmine: flying-foxes and extreme heat events in a warming climate*, Presentation at the Griffith Climate Change Seminar, July 2014:

https://www.griffith.edu.au/research/research-excellence/griffith-climate-change-response-program/program/?a=628188

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

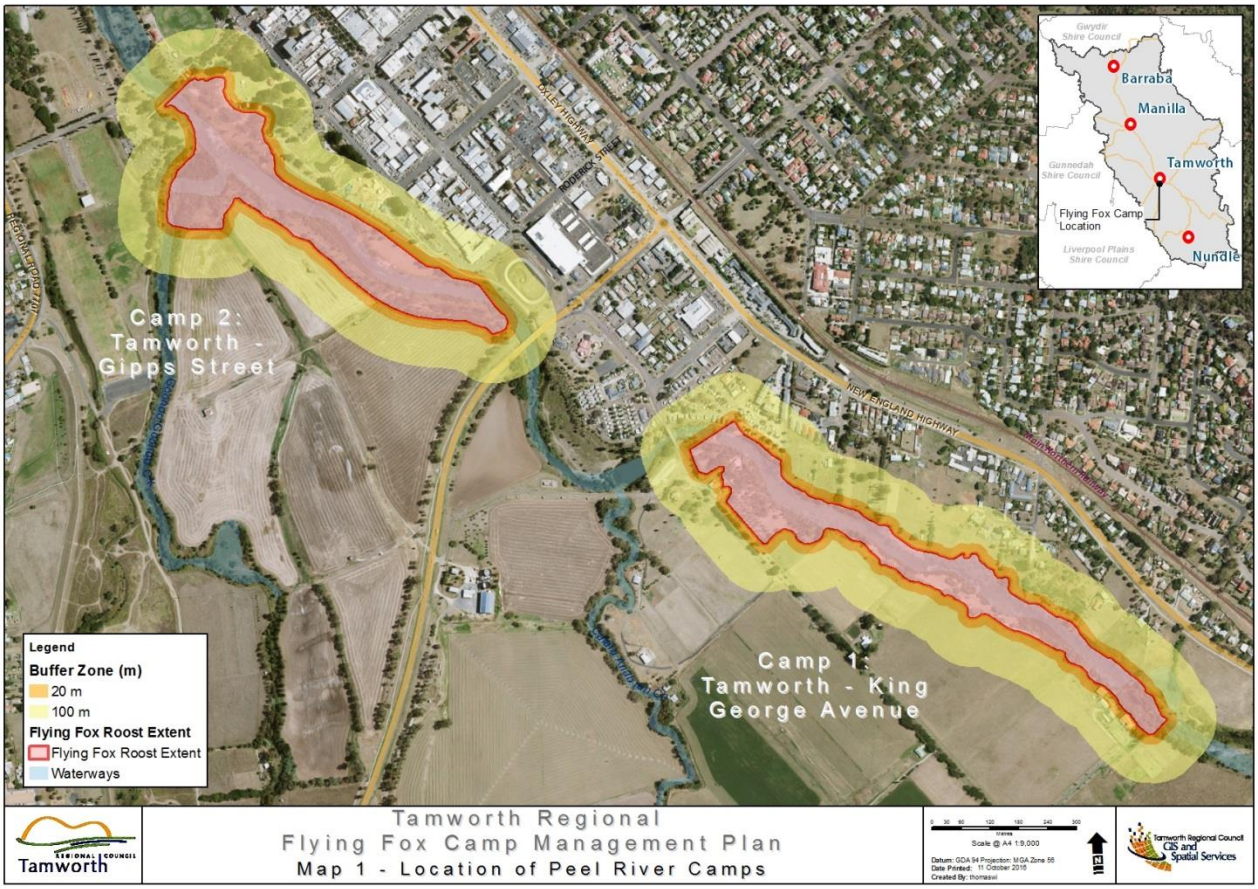
Westcott, DA, Dennis, AJ, Bradford, MG, McKeown, A & Harrington, GN 2008, 'Seed dispersal processes in Australia's Wet Tropics rainforests', in Stork N & Turton S, *Living in a dynamic tropical forest landscape*, Blackwells Publishing, Malden, pp. 210-223.

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

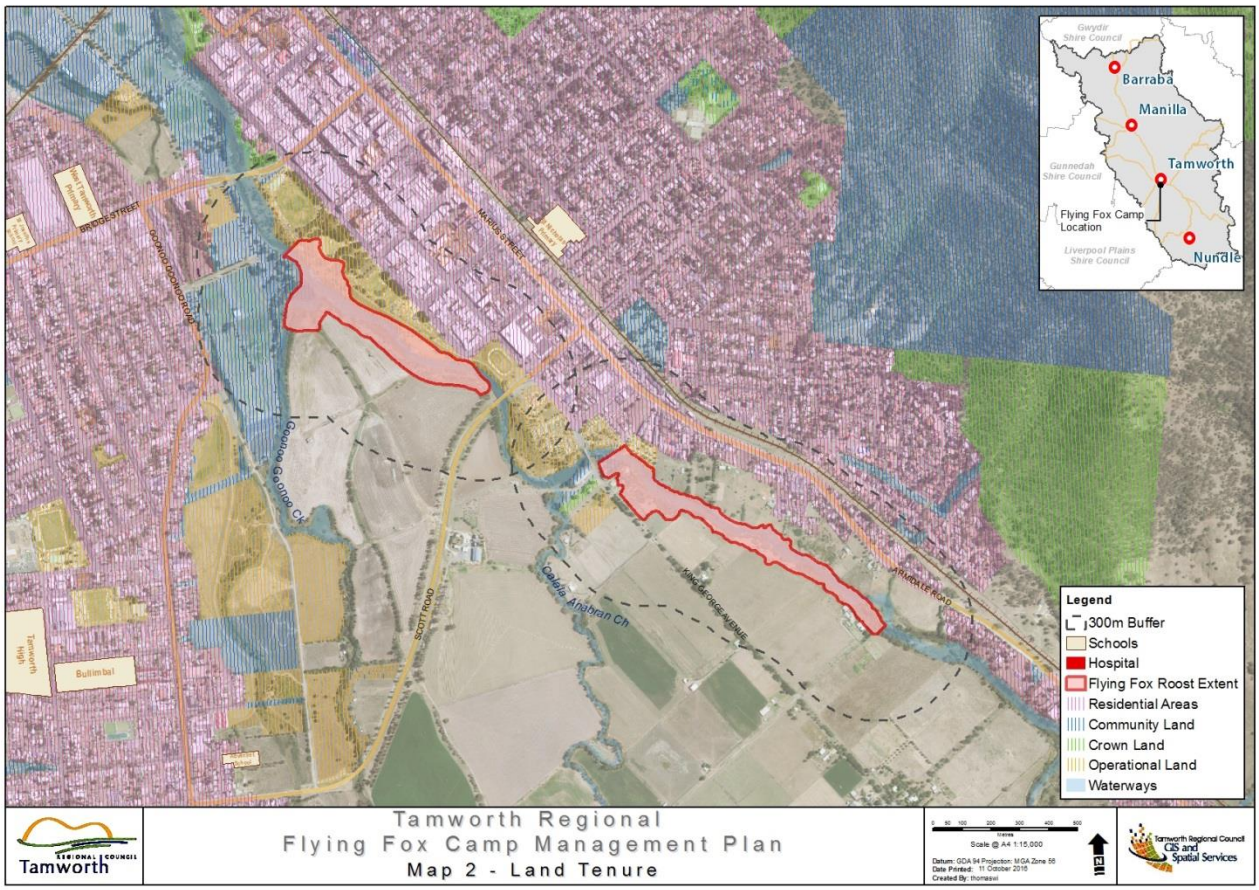
Zurbuchen, A, Landert, L, Klaiber, J, Muller, A, Hein, S & Dorn, S 2010, 'Maximum foraging ranges in solitary bees: only few individuals have the capability to cover long-foraging distances, *Biological Conservation,* vo. 142, no. 3, pp. 669-676.

Appendix 1 Tamworth Maps

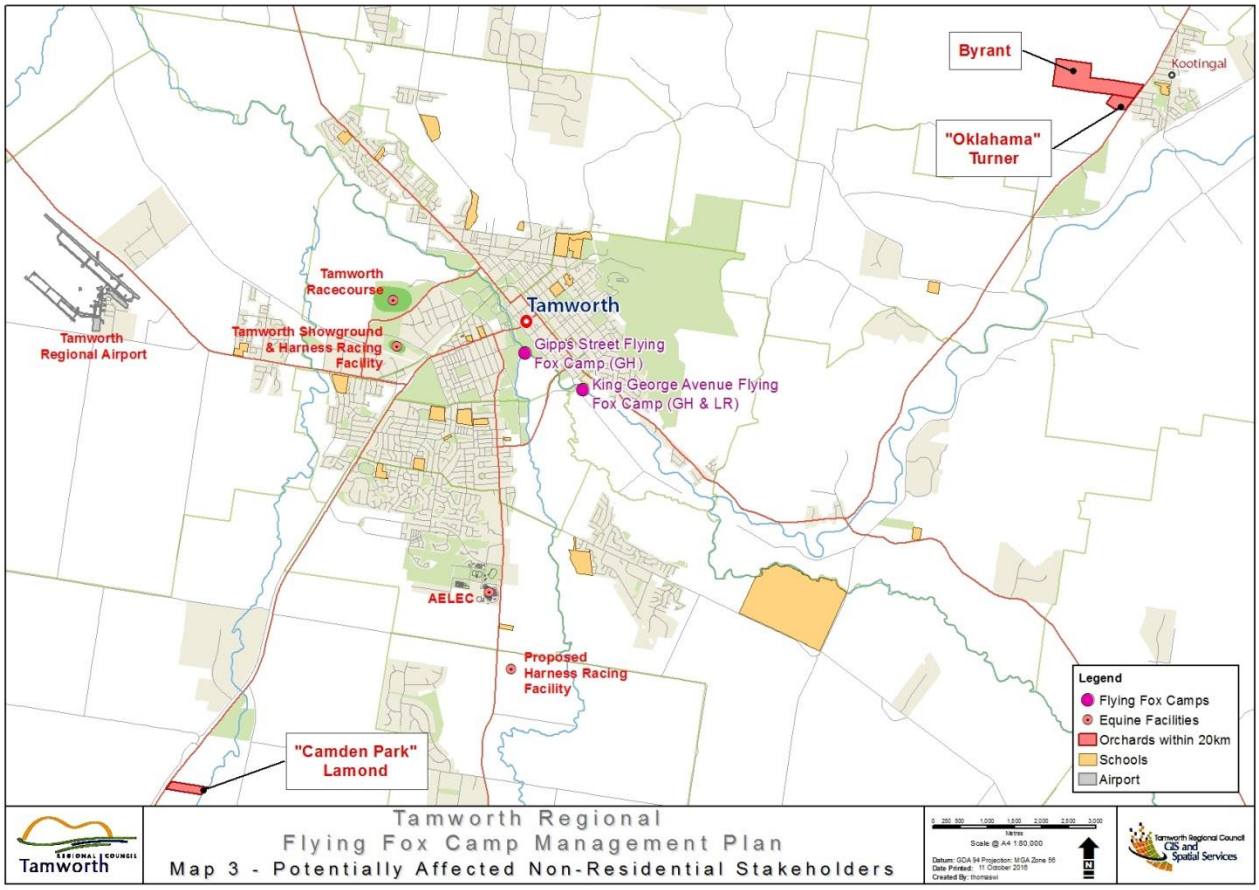
Map 1 – Location of Peel River Camps



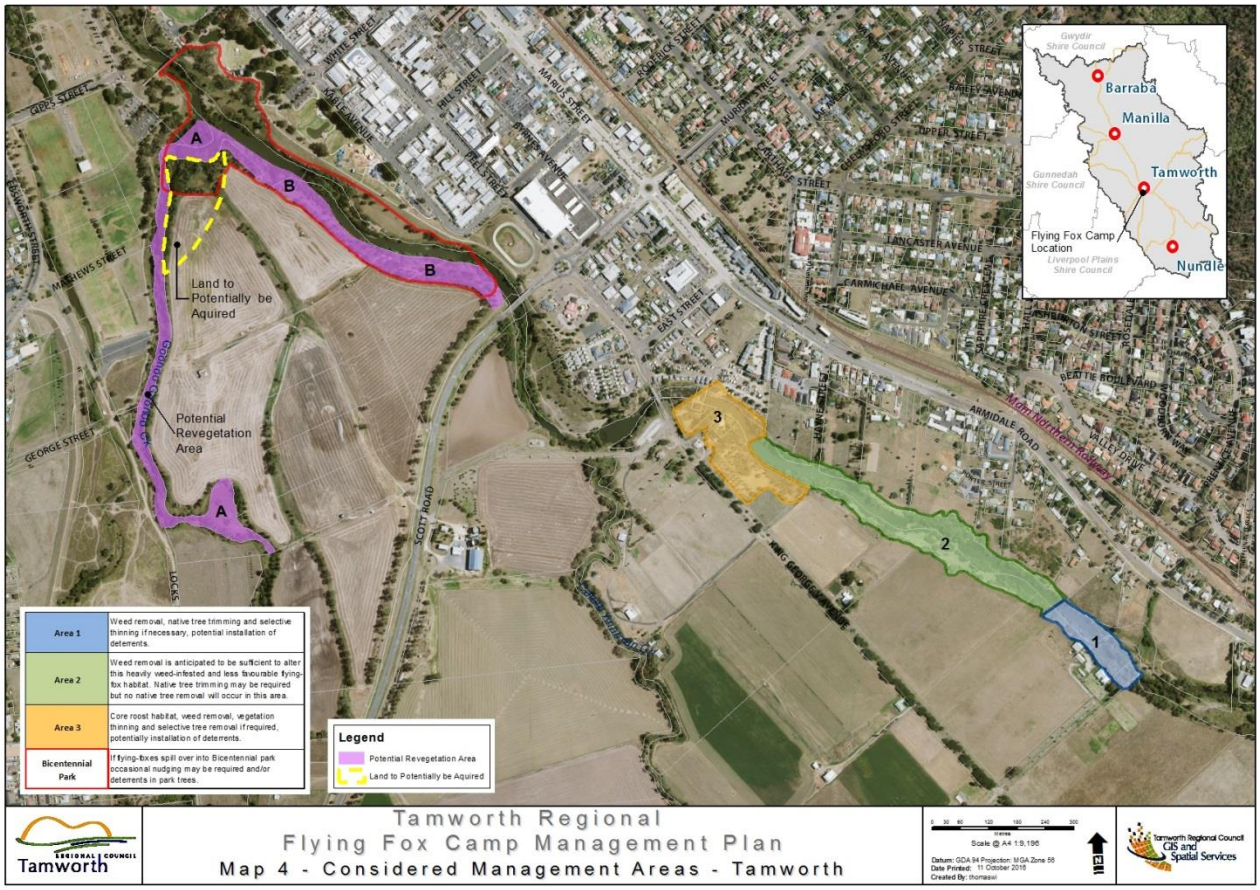
Map 2 – Land Tenure



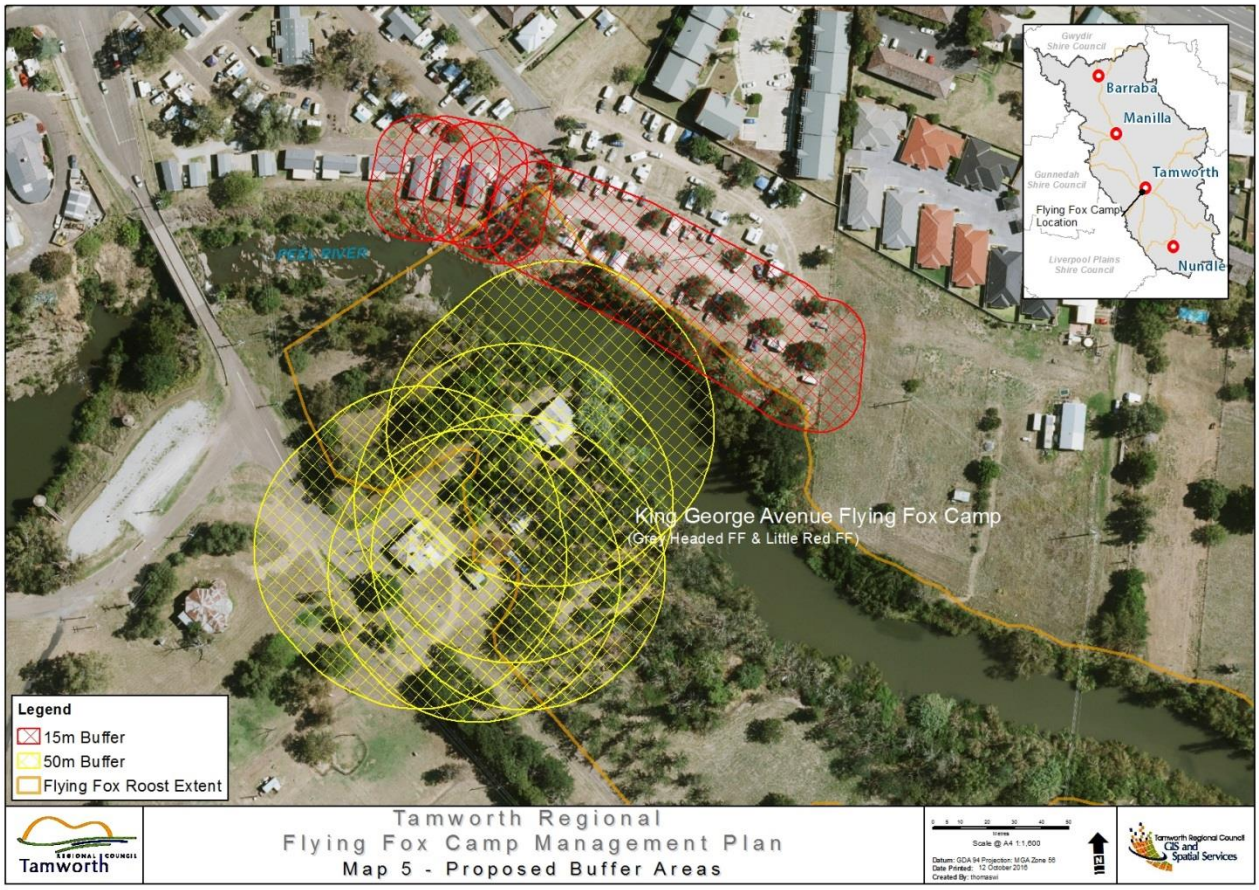
Map 3 – Potentially Affected Non-Residential Stakeholders



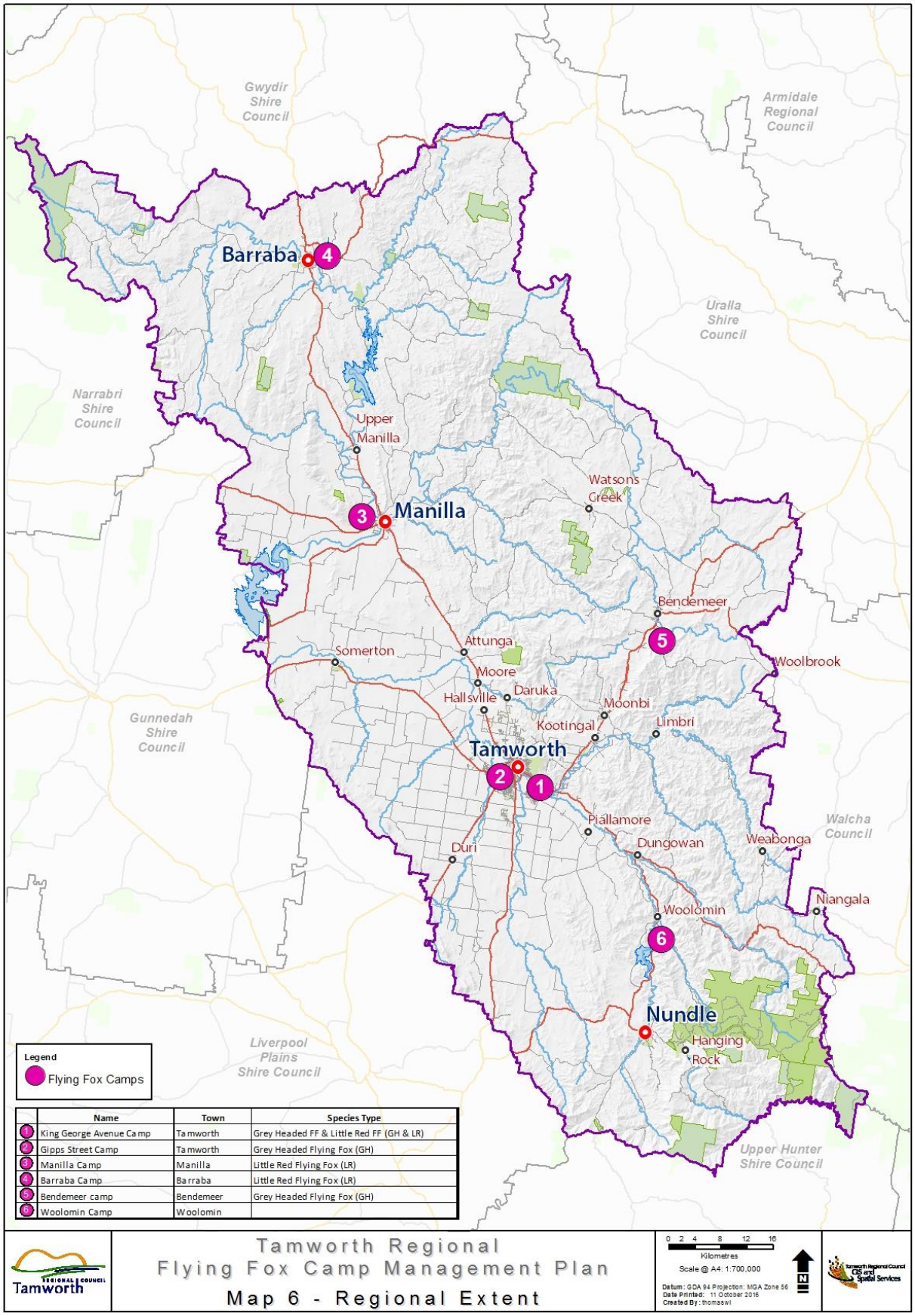
Map 4 – Considered Management Areas – Tamworth



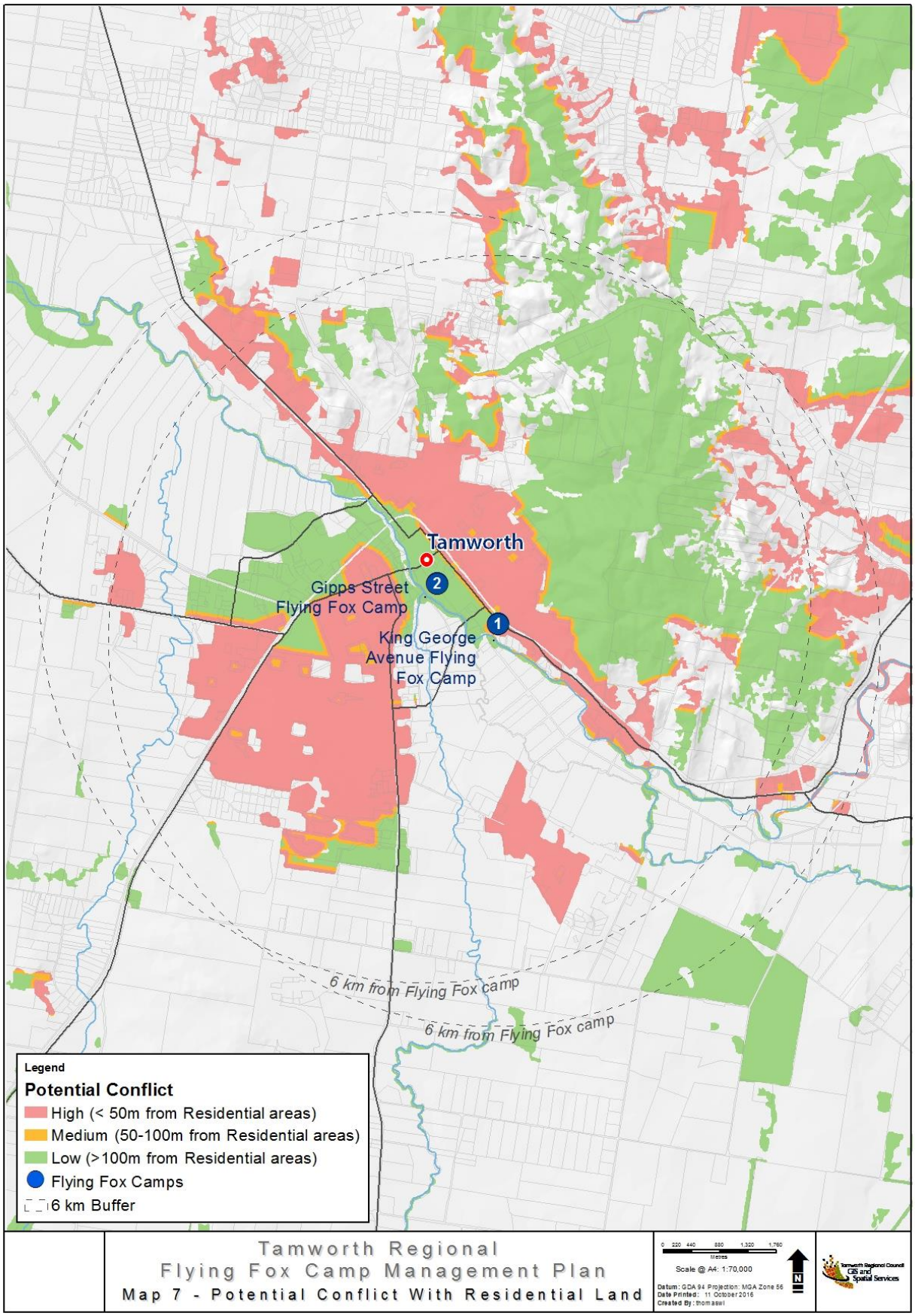
Map 5 – Proposed Buffer Areas



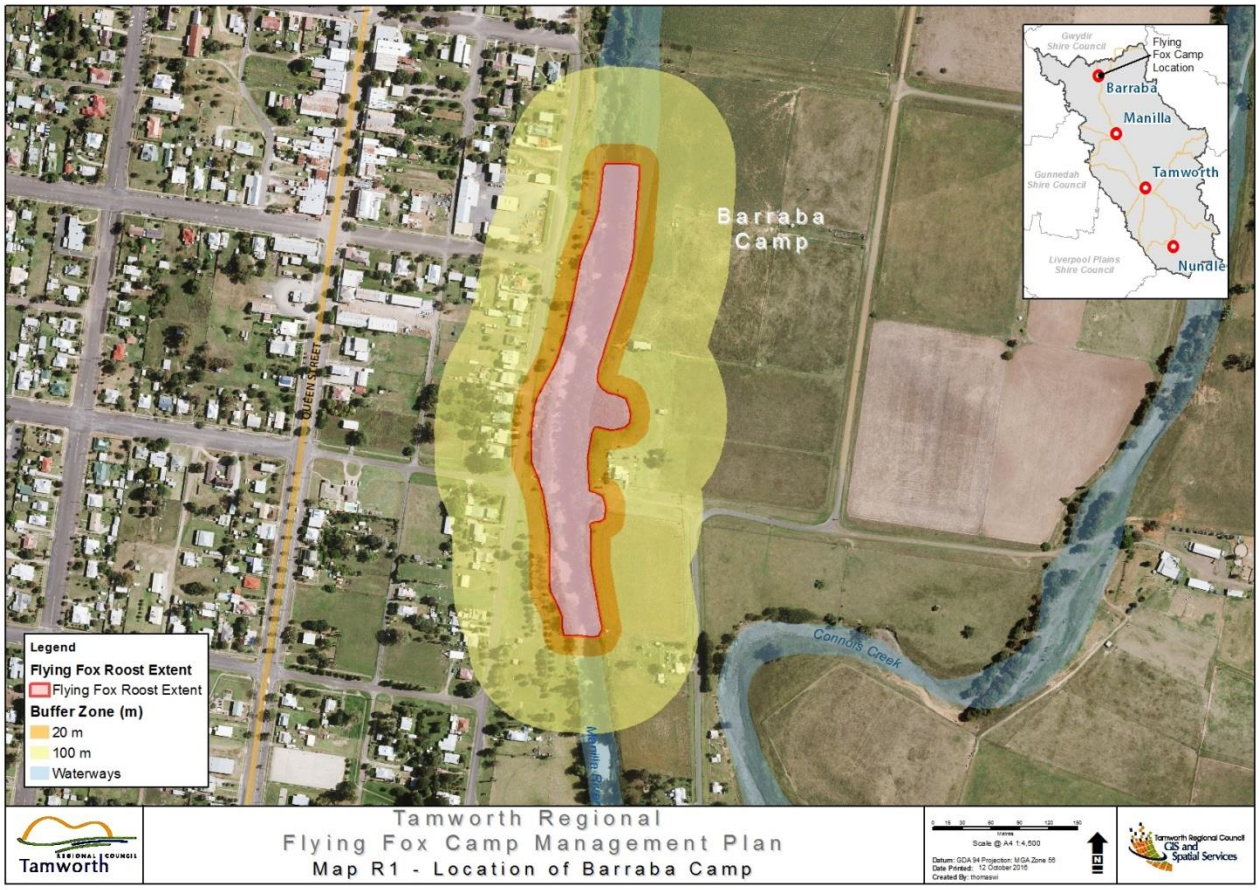
Map 6 – Regional Extent



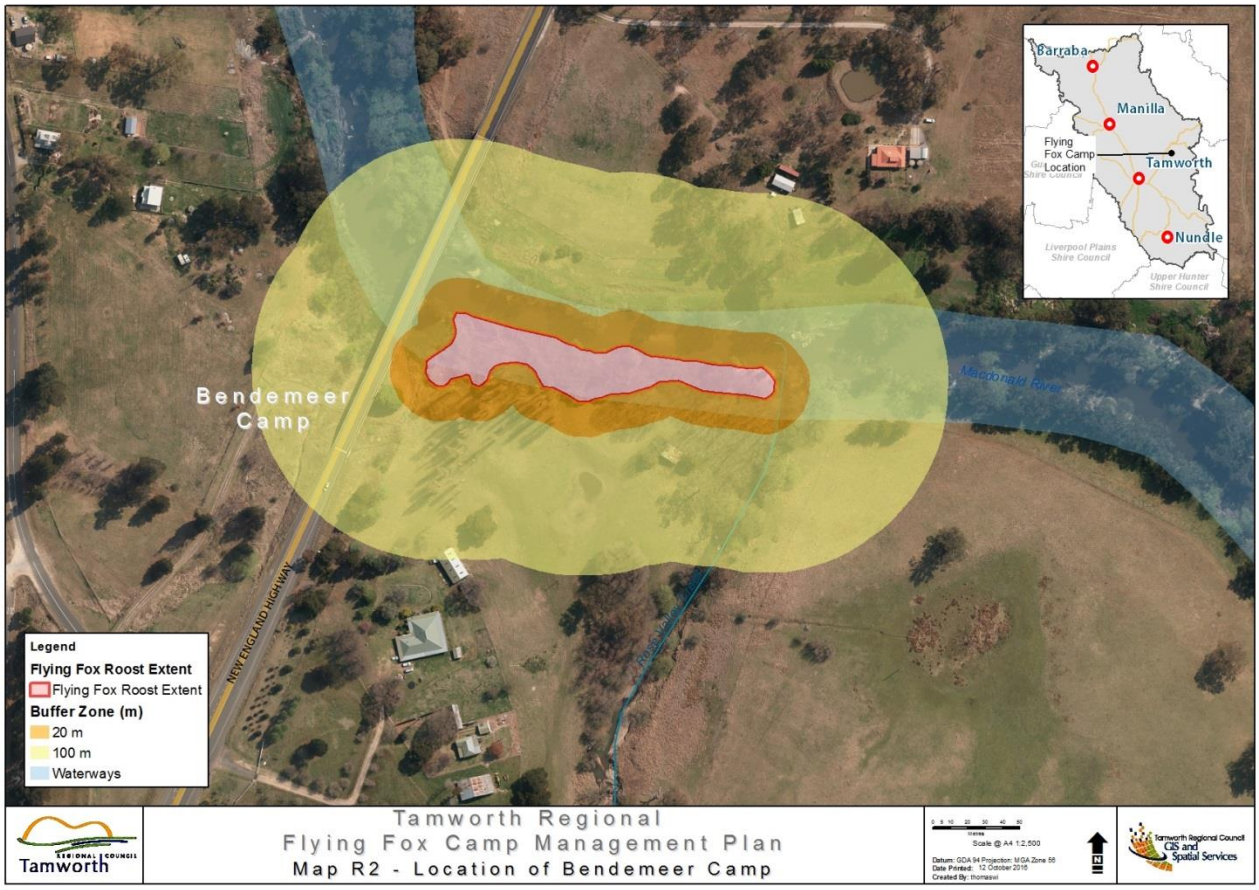
Map 7 – Potential Conflict with Residential Land



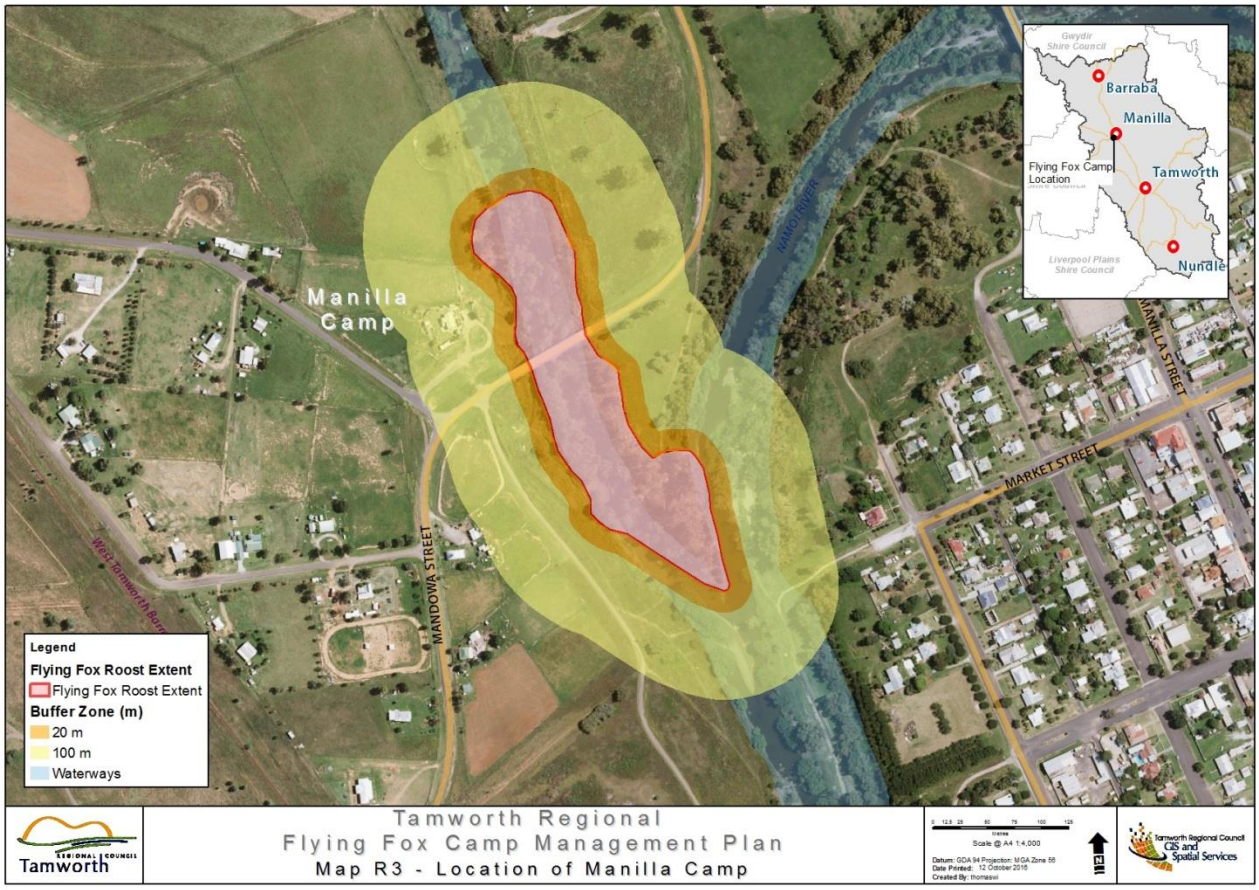
Map R1 – Location of Barraba Camp



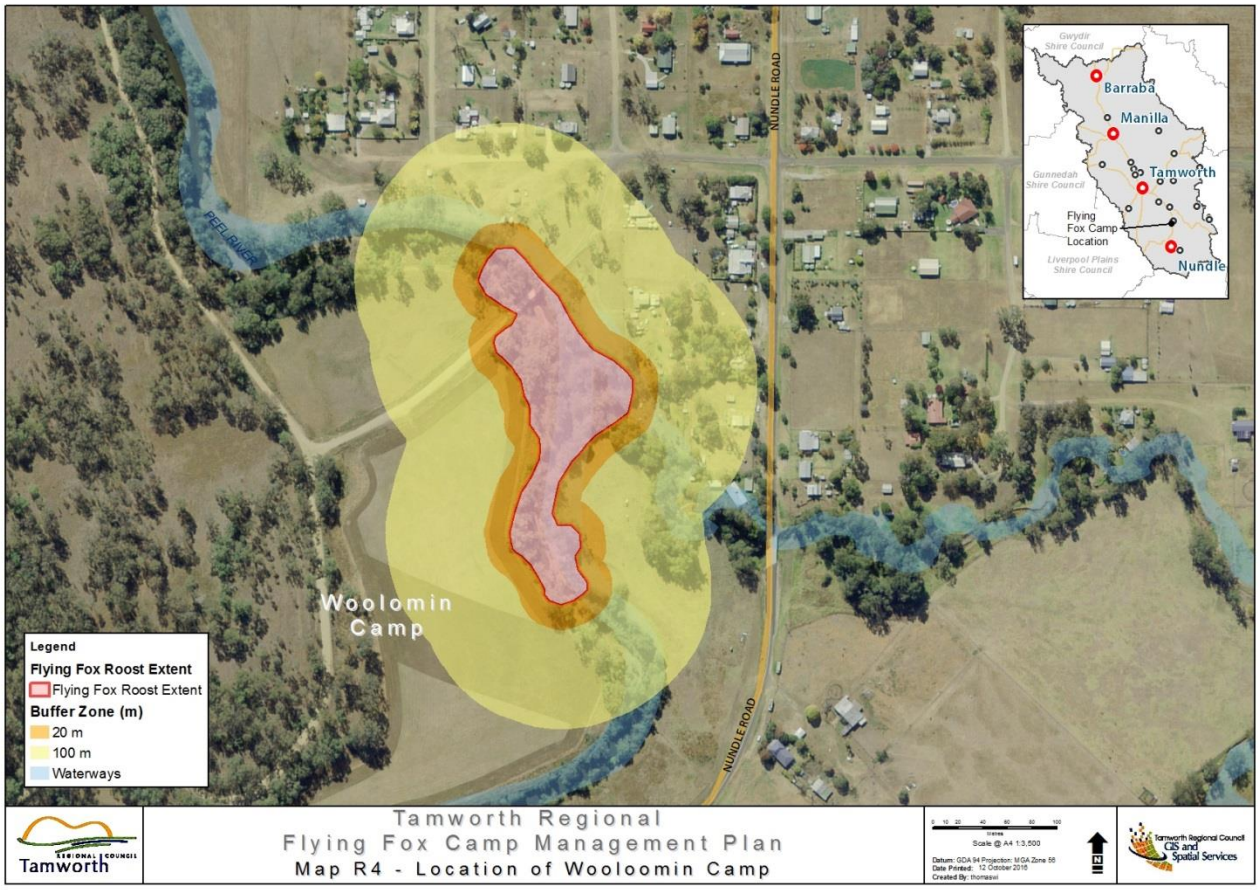
Map R2 – Location of Bendemeer Camp



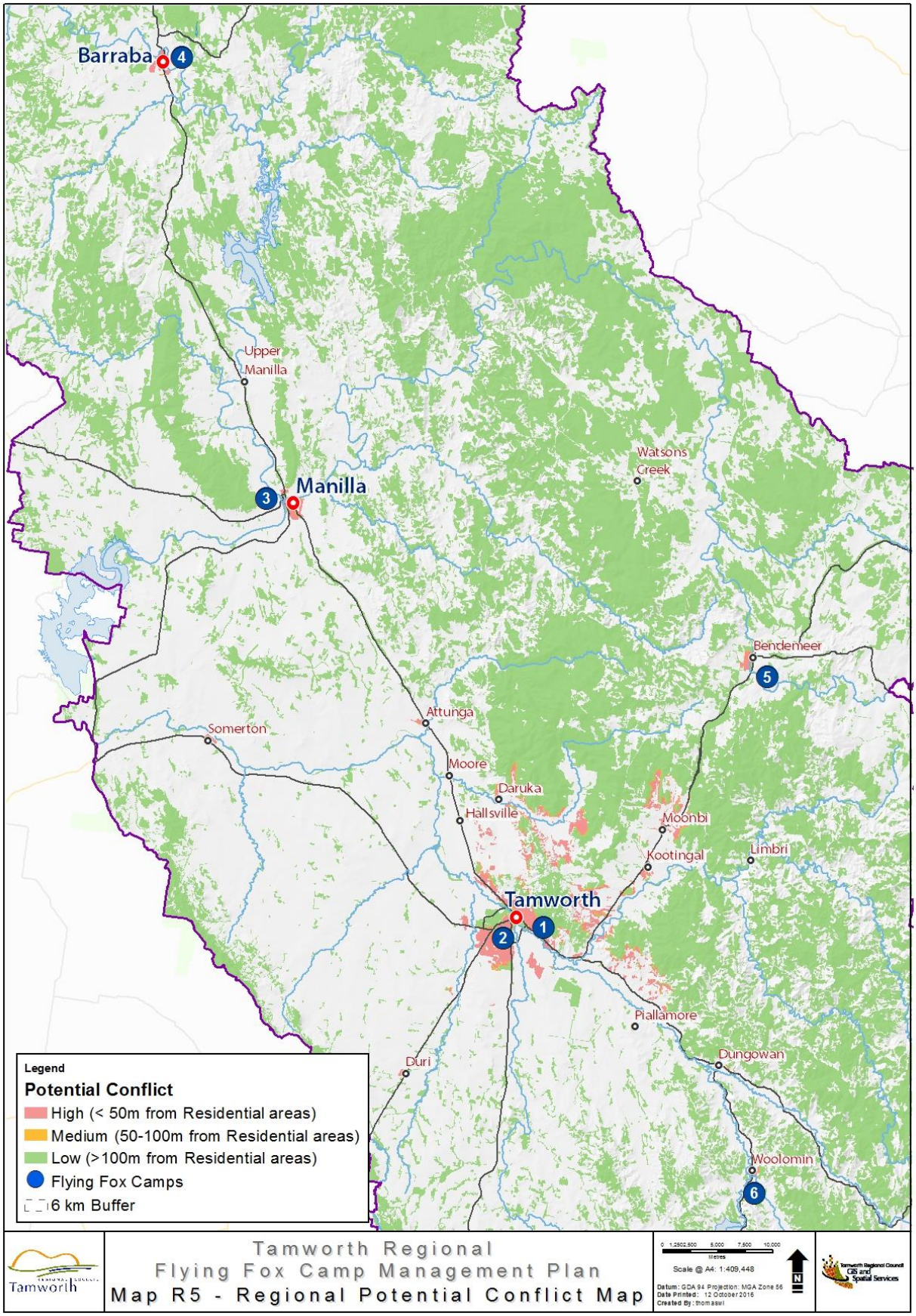
Map R3 – Location of Manilla Camp



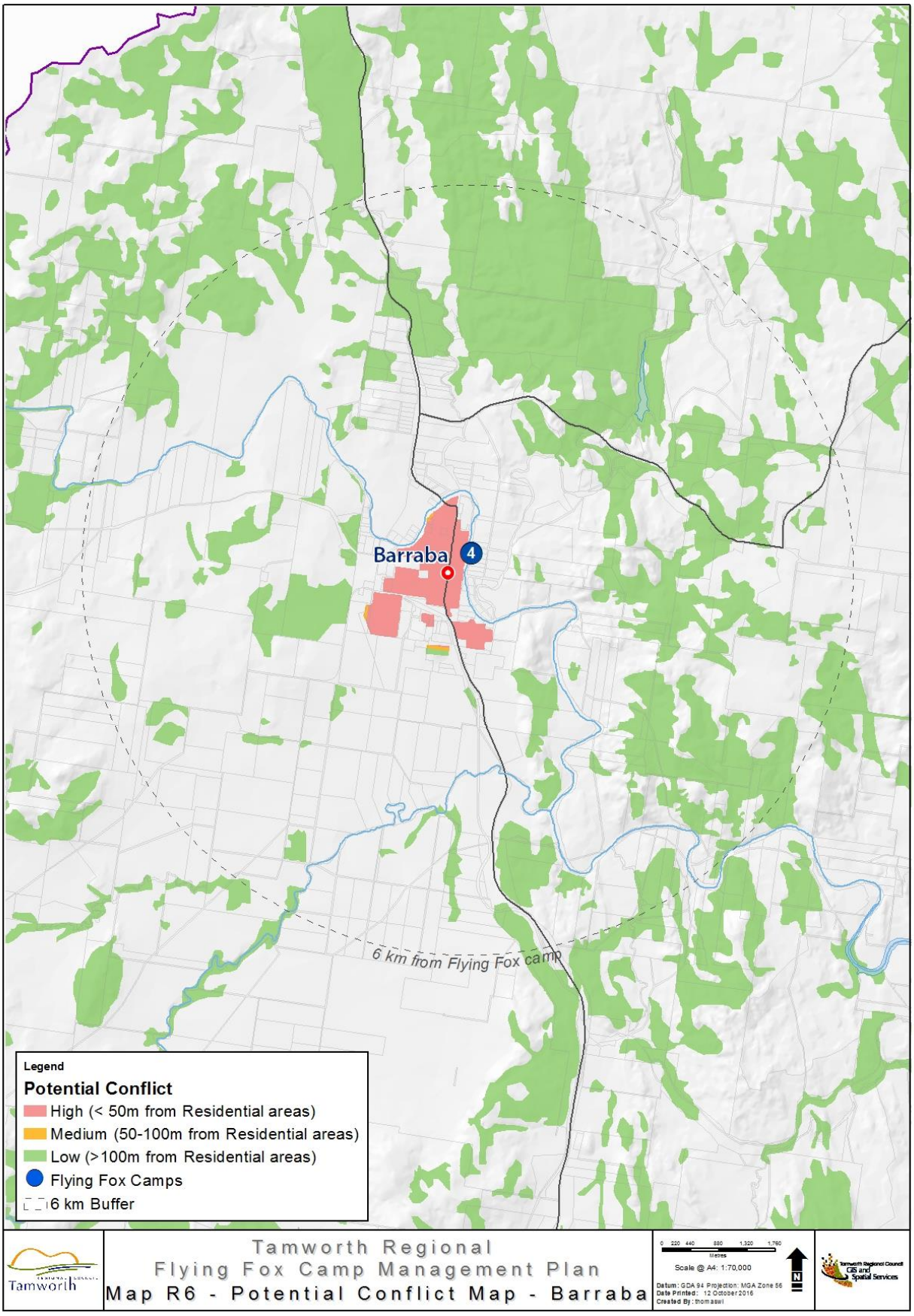
Map R4 – Location of Woolomin Camp



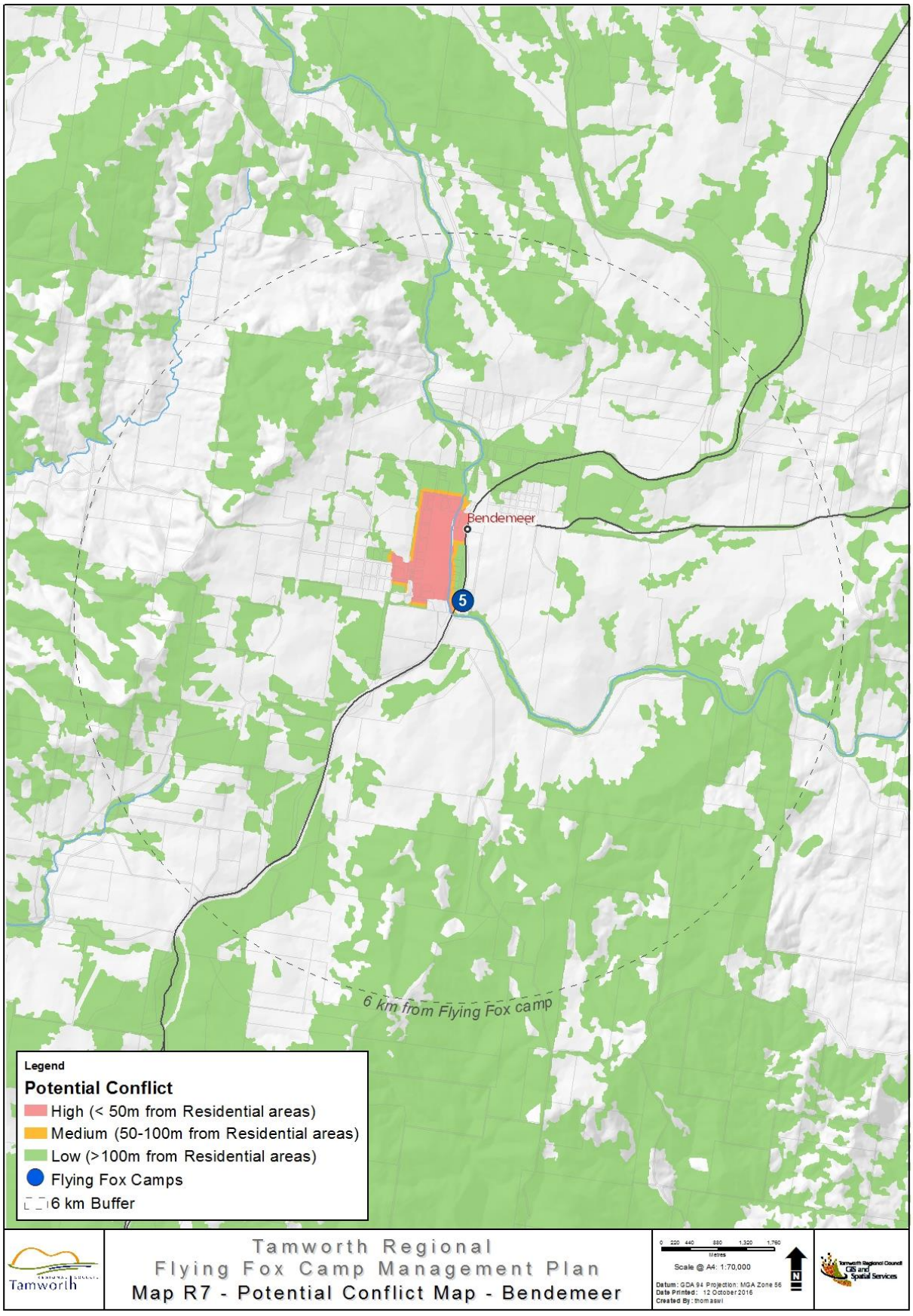
Map R5 –Regional Potential Conflict Map



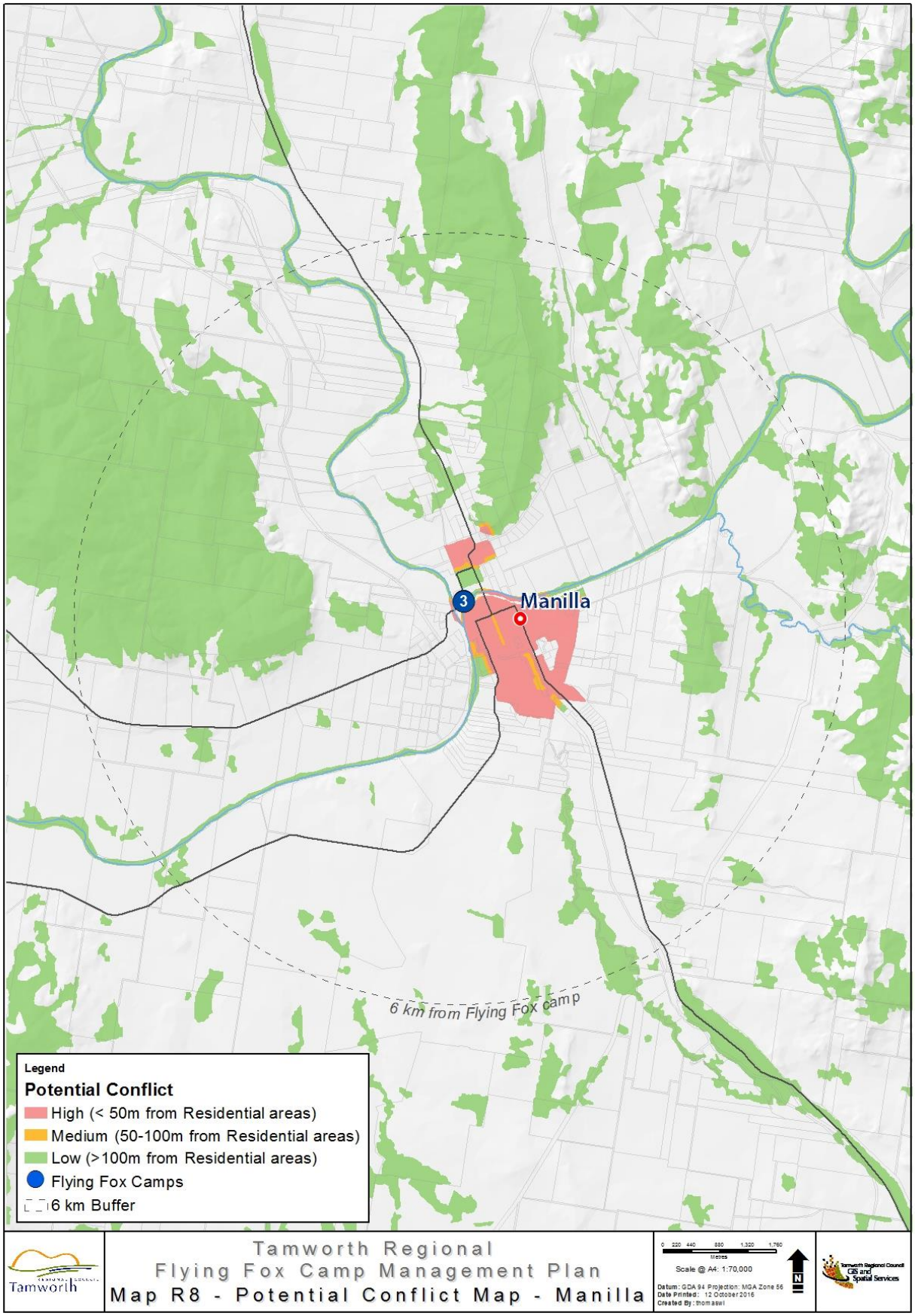
Map R6 – Potential Conflict Map - Barraba



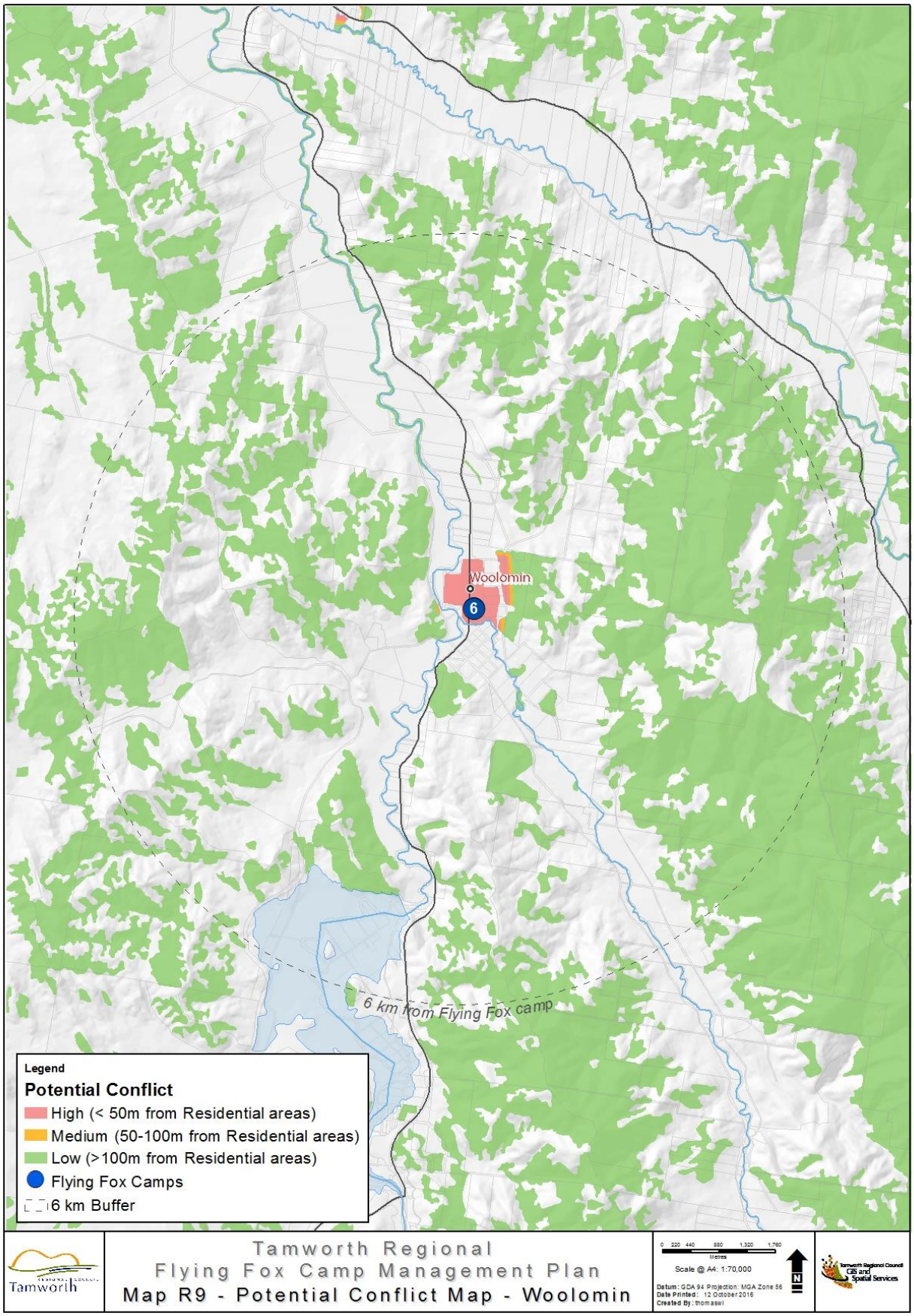
Map R7 – Potential Conflict Map - Bendemeer



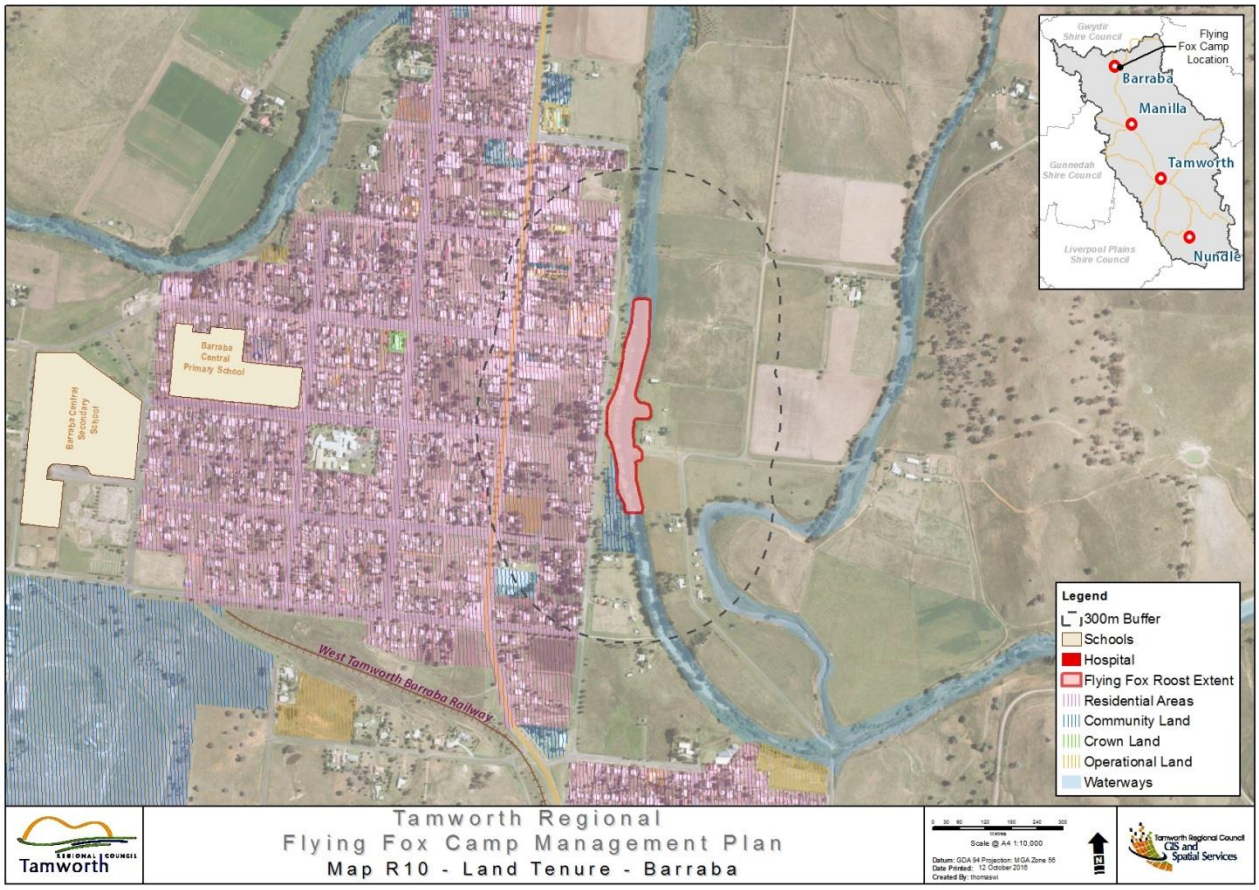
Map R8 – Potential Conflict Map – Manilla



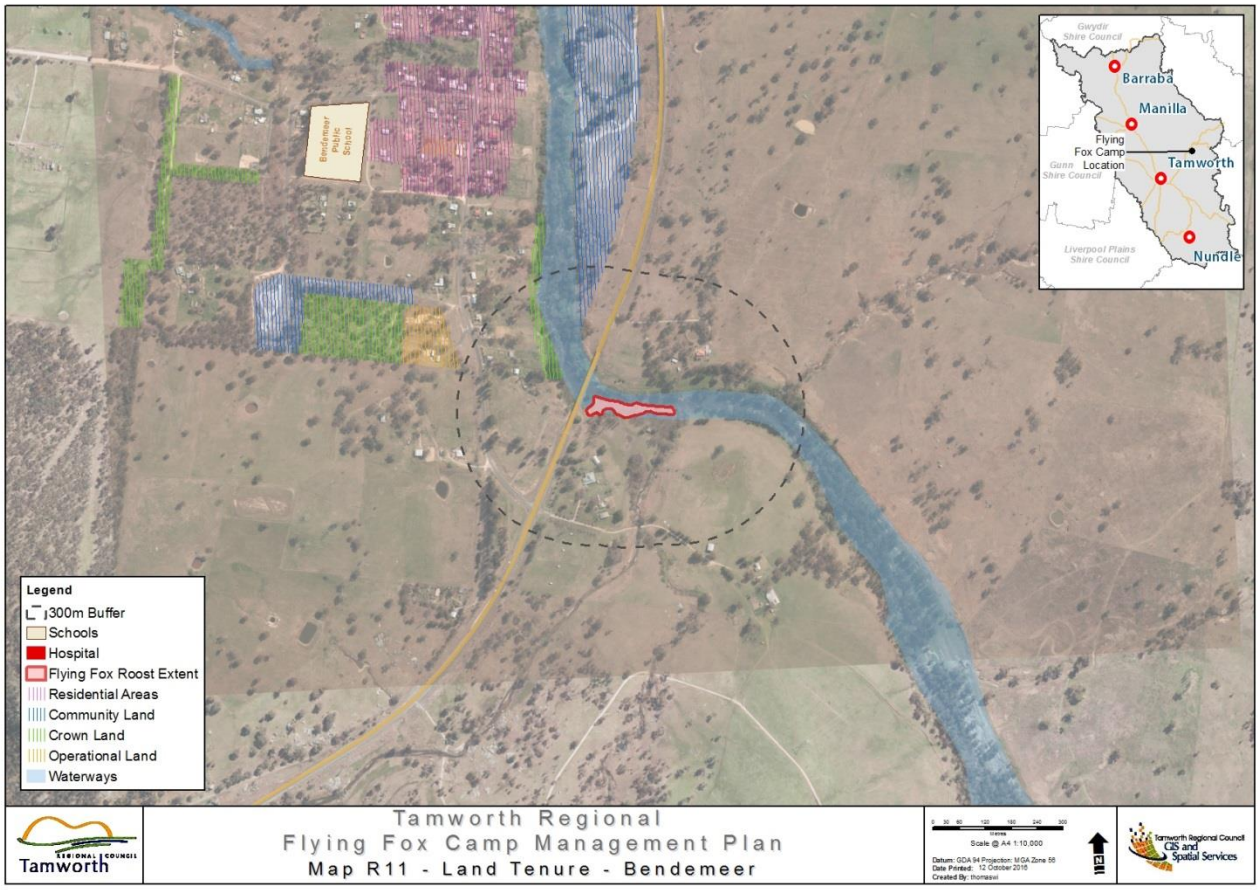
Map R9 – Potential Conflict Map - Woolomin



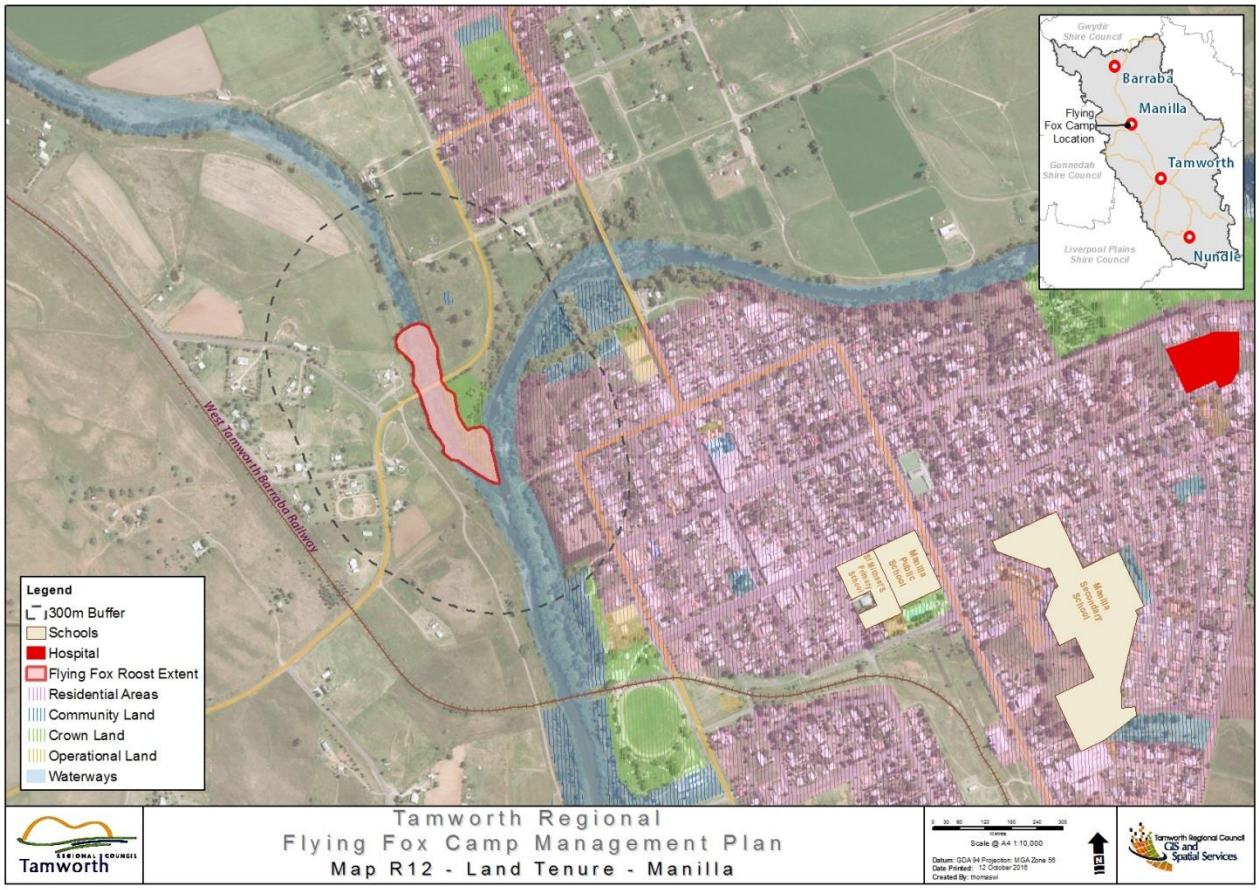
Map R10 – Land Tenure - Barraba



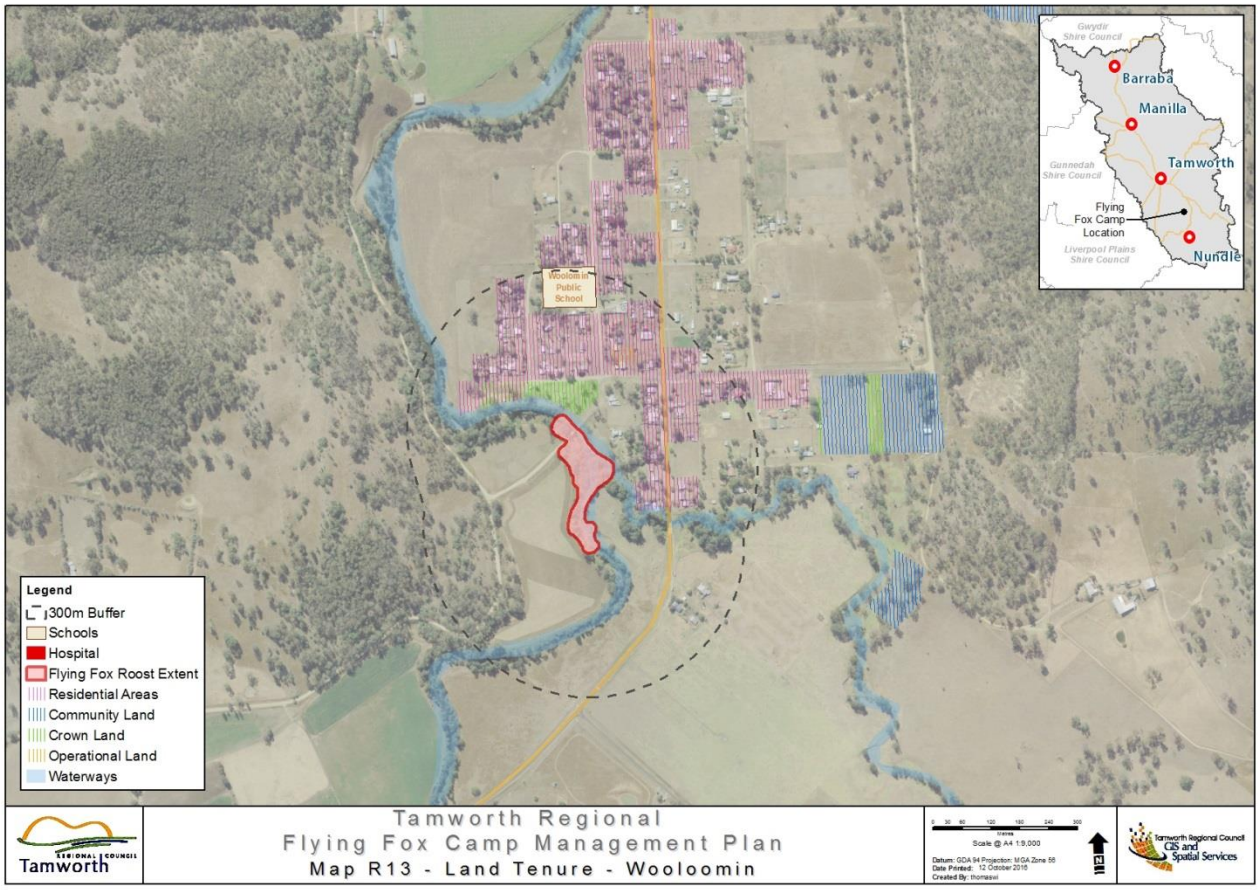
Map R11 – Land Tenure - Bendemeer



Map R12 – Land Tenure - Manilla



Map R13 – Land Tenure - Woolomin



Appendix 2 Summary of other key legislation likely to apply at some camps

Local

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

Local Environment Plans are a type of Environmental Planning Instrument which are legal documents that relate to a local government area. Other Environmental Planning Instruments, such as State Environmental Planning Policies (SEPPs), may relate to the whole or part of the State. A development control plan provides detailed planning and design guidelines to support the planning controls in a Local Environment Plan, but they are not legal documents.

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

State

Rural Fires Act 1997

The objects of this Act are to prevent, mitigate and suppress bushfires and co-ordinate bush firefighting, while protecting persons from injury or death, and reduce property damage from fire. A permit is generally required from the Rural Fire Service for any fires in the open that are lit during the local Bush Fire Danger Period as determined each year. This may be relevant for fires used to disperse flying-foxes, or for any burning associated with vegetation management.

Protection of the Environment Operations Act 1997

The main object of the *Protection of the Environment Operations Act 1997* (POEO Act) is to set out explicit protection of the environment polices (PEPs) and adopt more innovative approaches to reducing pollution.

Under Schedule 1, Part 8 of the Act ("Chemical production") may include the use of smoke as a dispersal mechanism and so this type of dispersal activity may require a licence under Chapter 3 of the POEO Act.

The POEO Act also regulates noise including "offensive noise". The *Protection of the Environment Operations Regulation 2008* (Schedule 3) provides information on the types of noise that can be "offensive" and for which the Environmental Protection Authority (EPA) can issue fines. This may include noise generated as a part of dispersal activities. It is best to discuss the types of noise makers and the sound levels and times these will be generated, along with identified noise receptors with council prior to any dispersal. Detailed advice and guidance on noise regulation can be found in EPA (2013).

Crown Lands Act 1989

The principles of Crown land management include the observation of environmental protection principles and the conservation of its natural resources, including water, soil, flora, fauna and scenic quality. Any works on

land that is held or reserved under the *Crown Lands Act 1989* (including vegetation management and dispersal activities) are an offence under the Act without prior authorisation obtained through the Department of Primary Industries (Lands).

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.

State Environmental Planning Policies

SEPPs are environmental planning instruments which address specific planning issues within NSW. These SEPPs often remove power from local councils in order to control specific types of development or development in specific areas. SEPPs often transfer decision-making from Council to the Planning Minister. While there may be others, some of the SEPPs likely to apply at some flying-fox camps are outlined below.

SEPP 14 – Coastal Wetlands

This policy provides additional protection for coastal wetlands by requiring development consent to be obtained before any clearing, draining, filling or construction of levees can occur on a mapped wetland. Camps are unlikely to fall within the bounds of a SEPP 14 wetland, but additional restrictions for vegetation management in these areas may be required if they do.

SEPP 26 – Littoral Rainforests

SEPP 26 aims to protect coastal rainforests (littoral rainforests) by requiring development consent for activities within or adjacent to mapped coastal rainforest. It is unlikely that clearing for flying-fox management would be considered significant enough to trigger this SEPP but this should be confirmed if the site is within a mapped SEPP 26 area.

SEPP 19 - Bushland in Urban Areas

The aim of this policy is to protect and preserve bushland within urban areas which are defined in Schedule 1 of the SEPP. Broadly, this covers most LGAs within the Greater Sydney Region. It does not cover;

- land reserved or dedicated under the National Parks and Wildlife Act 1974
- state forests, flora reserves or timber reserves under the Forestry Act 1916
- land to which SEPP (Western Sydney Parklands) 2009 applies.

Bushland within the designated LGAs may not be disturbed without the consent of the council unless the disturbance is for: bushfire hazard reduction, facilitating recreational use of the bushland in accordance with a plan of management referred to in clause 8 of the policy and essential infrastructure such as electricity, sewerage, gas or main roads. If the land owned by the proponent is zoned as SEPP 19 bushland, council approval would be required under this SEPP. Council should be contacted to discuss any potential disturbance associated with camp management.

Appendix 3 Desktop ecological assessment guideline

Buffer

Desktop assessments should include the camp and a suitable buffer area. The suggested buffer for ecological assessments is 10 km, however this may be reviewed on a case by case basis.

Sources of information for database searches

Depending on the location and extent of the project, the following databases may provide information on flora and fauna species and ecological communities for the site and surrounds (see table below).

Sources of ecological information

Source	Description	Links
Atlas of Living Australia	Biodiversity knowledge contributed by Australia's academic, scientific, environmental and general communities	http://www.ala.org.au/, page provides a link to a mapping and analysis page where you can view records within an area of interest
Protected Matters Search Tool	Used to generate a list of matters of national environment significance within an area of interest	https://www.environment.gov.au/epbc/protected-matters-search-tool
BioNet	Contains government-held information about plants and animals in NSW. The following organisations provide data: Office of Environment and Heritage; National Parks and Wildlife; Royal Botanic Gardens and Domain Trust; Department of Primary Industries; Forests NSW; Australian Museum. Users can register for a log-in version which provides additional detail and functionality.	http://www.bionet.nsw.gov.au/
Critical Habitat Register – Office of Environment and Heritage	Declarations of declared critical habitat and maps of these sites for species listed under the TSC Act	http://www.environment.nsw.gov.au/criticalhabitat/criticalhabitatprotectionbydoctype.htm
Vegetation Information System: Maps	State-wide regional scale vegetation map, and for some areas, a local fine-scale map	http://www.environment.nsw.gov.au/research/PlantCommunityIDsoftware.htm
OEH – Spatial data portal.	Spatial datasets available for download, supplied in GDA	http://data.nsw.gov.au/data/dataset/nsw-oeh-spatial-data-portal
SIX maps	Provides maps showing cadastral and topographic information	https://six.nsw.gov.au/wps/portal/
Threatened Species Profile Database	Provides a search tool for NSW threatened species including description and indicative distribution	http://www.environment.nsw.gov.au/threatenedspecies/
SEPP 14 & 26	Available on the OEH spatial data portal	http://data.nsw.gov.au/data/dataset/nsw-oeh-spatial-data-portal

Other sources of data

Depending on the type of project and location, the local Council, or National Parks and Wildlife Service may hold more detailed vegetation mapping than publicly available. The relevant authority should be contacted to confirm if the most detailed mapping and data records have been obtained.

Appendix 4 Additional human and animal health information

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 do not pose a risk of exposure to ABLV, nor do 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 your 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 been yet 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.

Menangle virus

Menangle virus (also known as bat paramyxovirus no.2) was first isolated from stillborn piglets from a NSW piggery in 1997. Little is known about the epidemiology of this virus, except that it has been recorded in flying-foxes, pigs and humans (AVA 2015). The virus caused reproductive failure in pigs and severe febrile (flu-like) illness in two piggery workers employed at the same Menangle piggery where the virus was recorded (AVA 2015). The virus is thought to have been transmitted to the pigs from flying-foxes via an oral-faecal matter route (AVA 2015). Flying-foxes had been recorded flying over the pig yards prior to the occurrence of disease symptoms. The two infected piggery workers made a full recovery and this has been the only case of Menangle recorded in Australia.

General health considerations

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

Contamination of water supplies by any animal excreta (birds, amphibians and mammals such as flying-foxes) poses a health risk to humans. Household tanks should be designed to minimise potential contamination, such as using first flush diverters to divert contaminants before they enter water tanks. Trimming vegetation overhanging the catchment area (e.g. the roof of a house) will also reduce wildlife activity and associated potential contamination. Tanks should also be appropriately maintained and flushed, and catchment areas regularly cleaned to remove potential contaminants.

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

Appendix 5 Dispersal results summary

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

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

Ecosure, in collaboration with a Griffith University Industry Affiliates Program student, researched outcomes of management in Queensland between November 2013 and November 2014 (the first year since the current Queensland state flying-fox management framework was adopted on 29th November 2013). An overview of findings[7] is summarised below.

1. There were attempts to disperse 25 separate roosts in Queensland (compared with nine roosts between 1990 and June 2013 analysed in Roberts and Eby (2013)). Compared with the historical average (less than 0.4 roosts/year) the number of roosts dispersed in the year since the Code was introduced has increased by 6,250%.
2. Dispersal methods included fog[8], birdfrite, lights, noise, physical deterrents, smoke, extensive vegetation modification, water (including cannons), paintball guns and helicopters.
3. The most common dispersal methods were extensive vegetation modification alone and extensive vegetation modification combined with other methods.
4. In nine of the 24 roosts dispersed, dispersal actions did not reduce the number of flying-foxes in the LGA.
5. In all cases it was not possible to predict where new roosts would form.
6. When flying-foxes were dispersed, they did not move further than 6 km away.
7. As at November 2014 repeat actions had already been required in 18 cases.
8. Conflict for the council and community was resolved in 60% of cases, but with many councils stating that they feel this resolution is only temporary.
9. The financial costs of all dispersal attempts, regardless of methods used were considerable ranging from $7,500 to more than $400,000 (with costs ongoing).

[6] Local area is defined as the area within a 20 km radius of the original site = typical feeding area of a flying-fox.

[7] This was based on responses to questionnaires sent to councils: some did not respond and some omitted responses to some questions

[8] Fog refers to artificial smoke or vapours generated by smoke/fog machines. Many chemical substances used to generate smoke/fog in these machines is considered toxic.

Appendix 6 Section 91 licence application form

At the time the Plan is submitted to OEH for approval, it should include a completed section 91 licence application form. The form can include information already contained in the Plan. Alternatively, the land manager should inform OEH that the proposed works are to be assessed under Part 5 of the EP&A Act and will not require a licence application under the TSC Act.

Note that OEH is obliged to place licence application forms on its website, and the application, accompanying documentation and approval form part of the public register for the *Threatened Species Conservation Act 1995.* The licence application is available at:

www.environment.nsw.gov.au/resources/nature/S91ApplicationForm.pdf.

Appendix 7 Example flying-fox rescue protocol

Reference documents:

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

OEH 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 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 2 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 animals' saliva or excreta through the eyes, nose or mouth.

Equipment

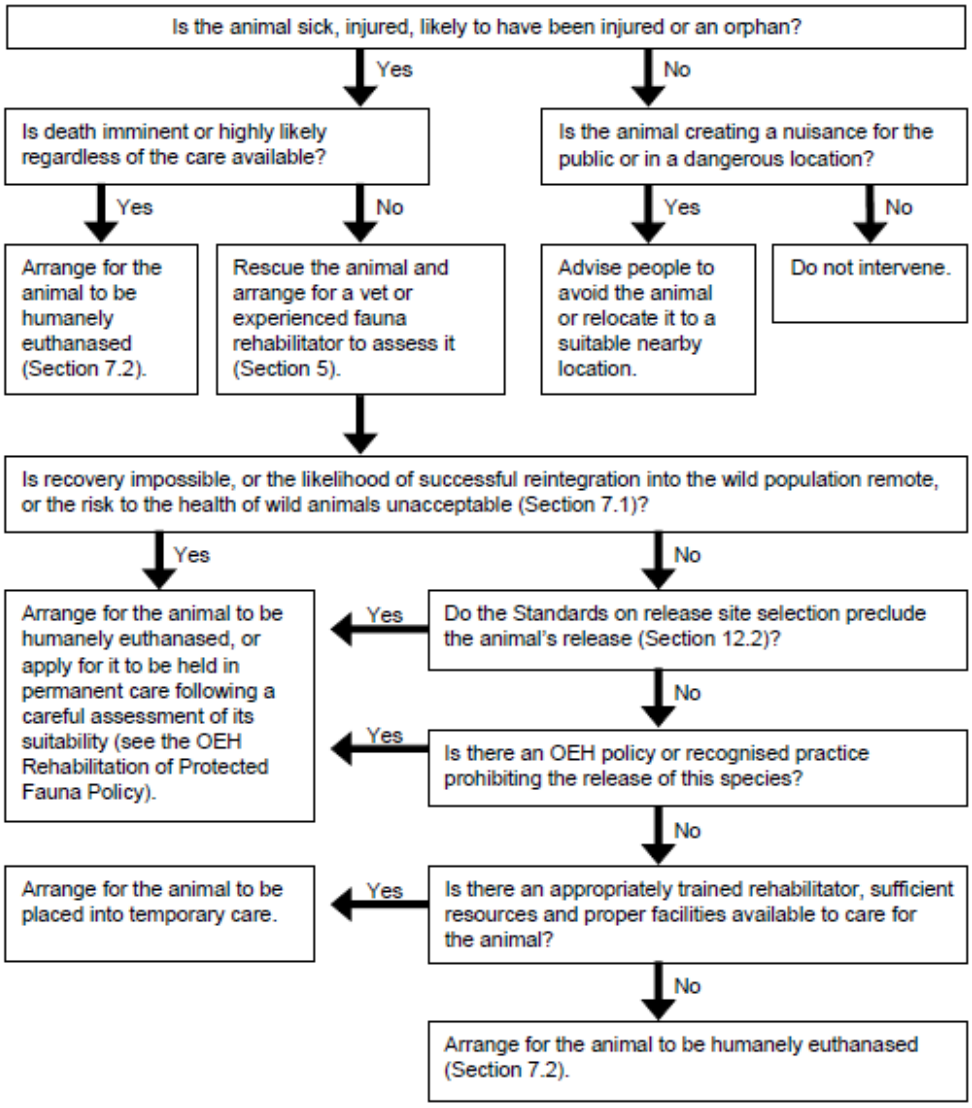
- lidded plastic carry basket or 'pet-pack' with bedding (juveniles) / transport container with hanging perch, tall enough for bat to hang without hitting its head (in accordance with Section 5.1 of the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012)
- warm water bottle / 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:
   - 2 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

f) 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.

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

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

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

j) 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.