ecosure

Tweed Flying-fox Camp Management Plan

March 2018

TWEED SHIRE COUNCIL

ecology / vegetation / wildlife / aquatic ecology / GIS

Acknowledgements

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Acronyms

ABLV	Australian bat lyssavirus
ALA	Atlas of Living Australia
APZ	asset protection zone
ASAP	as soon as possible
BC Act	*Biodiversity Conservation Act 2016*
BFF	black flying-fox (*Pteropus alecto*)
CE	critically endangered
DCP	development control plan
DoEE	Department of Environment and Energy (Federal)
E	Endangered
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environment Planning and Assessment Act 1979*
GHFF	grey-headed flying-fox (*Pteropus poliocephalus*)
ha	hectares
HeV	Hendra virus
KMA	koala management area
KPoM	Tweed Coast Comprehensive Koala Plan of Management
LRFF	little red flying-fox (*Pteropus scapulatus*)
MNES	matters of national environmental significance
MSES	matters of state environmental significance
NFFMP	National Flying-fox Monitoring Program
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
OEH	Office of Environment and Heritage (NSW)
SEPP 14	State Environmental Planning Provision No. 14 – Coastal Wetlands
SPRAT	Species Profiles and Threats (database)
the plan	Tweed Flying-fox Camp Management Plan (this document)
the Shire	Tweed Shire Council local government area
TSC Act	*Threatened Species Conservation Act 1995*
Council	Tweed Shire Council
V	Vulnerable

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1 Overview

Flying-foxes are keystone species, and Australia's only long-distance pollinator, making them essential to the persistence of natural areas. Long-distance pollination and seed dispersal by flying-foxes are critical to our sustainable orchard species and hardwood production, and this is even more important in the increasingly fragmented landscape created through development and urban sprawl.

Across their range, flying-foxes are known to establish camps in close proximity to human settlements. This results from a range of factors, including correlation of flying-foxes pre-European settlement use of the landscape with current human settlement patterns, loss of natural habitat, availability of suitable camp sites in the urban landscape, reduced pressure from natural predators and availability of reliable year-round food resources within residential and public lands.

There are currently 16 known flying-fox camps in the Tweed Shire (the Shire). All are seasonally variable in relation to species present, number of animals present, area occupied and time of the year occupied. Several of these camps have been the source of community complaints.

This flying-fox management plan (the plan) provides Tweed Shire Council (Council) with a framework that aims to reduce potential human/flying-fox conflict and help conserve flying-foxes and their habitat in the Shire. The plan will consider human health, economic and amenity impacts, along with the beneficial ecological roles flying-foxes provide.

Shire-wide or regional plans are preferred over reactive and individual camp management actions, giving consideration in a holistic and proactive manner to the landscape scale movement of individual flying-foxes, seasonal variation in flying-fox locations and implications for the community.

The three species of flying-foxes that camp and forage within the Shire are:

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

All are protected under New South Wales (NSW) legislation. The GHFF is also vulnerable to extinction, and is protected under Commonwealth legislation.

1.1 Objectives

The plan has been prepared in accordance with the NSW Flying-fox Camp Management Policy (administered by the New South Wales [NSW] Office of Environment and Heritage [OEH]), to facilitate efficient and timely response to manage community impacts from flying-fox camps where appropriate.

The key objectives of this plan are to:

- support Council's ability to respond to community concern regarding flying-foxes
- ensure positive conservation outcomes for flying-foxes in the Shire
- enhance community awareness and understanding of flying-fox ecology and behaviour
- facilitate streamlined camp management approvals and actions where appropriate.

Council will only manage flying-fox camps on Council-owned or managed land, and this plan does not constitute approval for camp management on land which is not Council-owned or managed. Other landholders wishing to manage a flying-fox camp on their land must refer to the *Flying-fox Camp Management Policy 2015* for an outline of when and how appropriate levels of management can be applied.

1.2 Context

This plan has been developed for the 16 active flying-fox camps in the Shire. There are a number of other historic camps that are not currently considered active and may have only been short term. Since regular monitoring began in 2012, it is estimated that at each census, between 1,500 and 30,000 (average 10,500) flying-foxes have occupied the 16 camps identified within this plan. The majority of camps (8), when occupied, support an average of 100-1,000 flying-foxes. Six camps support an average of between 1,000 and 5,000 flying-foxes and two camps contain an average of fewer than 100. The location of all known camps is included on Figure 1, however only active sites have been assessed and detailed in the plan. Should the abandoned/sporadic camps re-establish they will be evaluated using the framework provided in this plan.

1.3 Background

Tweed Shire Council resolved in November 2016 to prepare a shire-wide flying-fox management plan that would provide a policy position in relation to flying-fox camp management and to improve transparency, certainty and availability of information for the community, including those affected by flying-fox camps. Consultants Ecosure were engaged to prepare the draft plan in accordance with the NSW Flying-fox Camp Management Policy. Preparation of the draft plan involved an initial community consultation phase.

The draft plan was also placed on exhibition, inviting submissions from the public and other stakeholders during October and November 2017. Amendments to the plan were made in response to submissions received, and Council resolved to adopt the plan in March 2018.

Figure 1: Flying-fox camp locations

Tweed Shire Council

Flying-fox Camp Management Plan

Tweed local government area

Maximum known camp extent

Abandoned flying-fox camps

Job number: PR2365
Revision: 0
Author: DB
Date: 16/06/2017

0 1 2 4
Kilometers

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

PR2365_MP1_CampLocations
A4

2 Community engagement

2.1 Stakeholders

There is a range of stakeholders who are directly or indirectly affected by flying-fox camps, or who are interested in camp management. Stakeholders may include:

- residents
- business owners
- recreation and sports clubs
- schools
- airport and helipad operators and users
- hospitals
- wildlife carers and conservation groups
- equine industry
- indigenous groups
- land managers
- tourists
- all levels of government.

2.2 Engagement methods

In addition to Council's ongoing engagement with internal Council land managers, NSW Health and OEH, targeted engagement was completed to assist preparation of this plan. This engagement sought to ensure that people with a specific interest in flying-fox camps in the Shire were consulted. The engagement provided an opportunity to:

- seek ideas and feedback about possible future management options
- understand the issues directly and indirectly affecting the community around each of the camps
- allow the community to share their attitudes and experiences with flying-foxes.

The types of engagement that were undertaken during development of the plan include:

- promotion of the contact details of responsible officers
- telephone conversations to record issues and complaints
- face-to-face meetings and telephone calls with adjacent residents
- media release
- radio interview (ABC North Coast & Gold Coast)
- Tweed Link article to promote engagement activities.

2.3 Community feedback

A summary of the main feedback received during the plan development stage is as follows:

- 9 submissions were made during community engagement interview sessions
- 3 submissions were made via phone interview
- 4 submissions were made via email.

Table 1 summarises the comments received during community engagement.

Table 1 Sample of concerns or issues received during community engagement

Stakeholder	Interest/reported impacts
Residents	· affected primarily by noise, smell, faecal drop and some concerns regarding disease · do not want the flying-foxes harmed · understand the need for flying-foxes and that flying-foxes need somewhere to live · increase education and public awareness · increase knowledge and research of flying-fox ecology and movements · how heat stress being managed in flying-fox camps · unable to use park when flying-fox are there · mindful of making situation worse for themselves or other residents through inappropriate management actions · need to use air-conditioning a lot more because windows need to be shut due to smell · unable to use washing line · education around water tanks, water treatment plant and swimming near camps · need more information on health risks and disease · concern for property values
School	· students are studying flying-foxes and know the different species. · need to close one of the playgrounds when flying-foxes are there
Horse Riding Club	· understand flying-foxes are important to environment · consideration of Hendra virus and maintenance of colonies near equine facilities and trails
Business owners	· businesses and camping ground report reduced patronage due to amenity impacts associated with flying-fox camp
Tweed Valley Wildlife Carers	· wildlife carers and conservation organisations have an interest in flying-fox welfare and conservation of flying-foxes and their habit

2.3.1 Management options

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

- reduce the impact of noise and odour on nearby residents and businesses
- reduce the impact of flying-fox excrement
- would be unlikely to risk moving the camp or impacts to other areas that may also be near residents or businesses

- would be unlikely to have a negative impact on the flying-foxes
- would not change the natural or ecological values of the site
- would not impact on the visual appeal or on recreational opportunities currently undertaken at the site
- were of low financial cost to local ratepayers
- provide a long-term solution.

2.3.2 Ongoing consultation

Community input will be actively sought during development of the education and engagement strategy (see Section 9). Consultation will also be a key ongoing component of plan implementation, around existing camps and in the event of a new camp establishing (see Sections 7-11).

3 Flying-fox ecology and behaviour

3.1 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).

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

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

Flying-foxes are considered ‘keystone’ species given their contribution to the health, longevity and diversity among and between vegetation communities. These ecological services ultimately protect the long-term health and biodiversity of Australia’s bushland and wetlands. In turn, native forests act as carbon sinks, provide habitat for other fauna and flora, stabilise river systems and catchments, add value to production of hardwood timber, honey and fruit (e.g. bananas and mangoes; Fujita 1991), and provide recreational and tourism opportunities worth millions of dollars each year (EHP 2012; ELW&P 2015).

3.2 Flying-foxes in urban areas

Flying-foxes appear to be roosting and foraging in urban areas more frequently. There are many possible drivers for this, as summarised by Tait et al. (2014):

- loss of native habitat and urban expansion
- opportunities presented by year-round food availability from native and exotic species found in expanding urban areas

- disturbance events such as drought, fires, cyclones
- human disturbance or culling at non-urban camps or orchards
- urban effects on local climate
- refuge from predation
- movement advantages, e.g. ease of manoeuvring in flight due to the open nature of the habitat or ease of navigation due to landmarks and lighting.

3.3 Flying-foxes and aircraft

Collisions between wildlife and aircraft in flight (wildlife strikes) are common aviation safety occurrences (McKee et al. 2016) and cost Australian civil aviation an estimated AUD$50M per year. Strikes to aircraft involving large birds or bats and those involving more than one animal (multiple strikes) can be serious, potentially disabling aircraft and resulting in major accidents.

Flying-foxes are large animals that transit in very large flocks at relatively low altitudes. Consequently, in terminal airspace, where aircraft are also operating at low altitudes they may present a significant risk to air safety. Currently, in Australia, flying-foxes are the most common species struck by aircraft and, depending on aircraft type, 13-20% of these collisions cause damage to the aircraft (ATSB 2017).

More specifically, at Gold Coast Airport, flying-foxes frequently transit critical airspace and consequently are rated in the top seven collision-risk species and the most significant cause of nocturnal strikes. Flying-fox strike numbers at Gold Coast Airport have increased by 300% over the last five years. Over that time they have caused several damaging strikes including a serious engine failure after take-off in a corporate jet. A flying-fox detection and notification program has been implemented at the airport to help reduce the safety risk.

For any strike reduction program to be effective it is imperative that wildlife congregations in the vicinity of the aerodrome are identified, monitored and managed. Under international (ICAO Annex 14) and national legislation (NASAF-C) airport operators are required to identify potential wildlife hazards in the vicinity and convene a local stakeholder group to help reduce the risk of strike associated with those hazards. National guidelines (NASAF-C) identify a 13 km radius from airports within which strike risk should be jointly managed by land holders and airport managers.

3.4 Under threat

Flying-foxes roosting and foraging in urban areas more frequently can give the impression that their populations are increasing; however, the GHFF is in decline across its range and in 2001 was listed as vulnerable by the NSW Government through the TSC Act, and is currently listed as vulnerable under the BC Act.

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%. It was also estimated that the population would continue to decrease by at least 20% in the next three generations given the continuation of the current rate of habitat loss and culling.

The main threat to GHFF in NSW is clearing or modification of native vegetation. This threatening process removes appropriate roosting and foraging 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 & Martin 2002).

3.5 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 kilometre 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 for 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 camp in vegetation with at least some of the following general characteristics (SEQ Catchments 2012):

- closed canopy >5 metres high
- dense vegetation with complex structure (upper, mid- and understorey layers)
- within 500 metres of permanent water source
- within 50 kilometres of the coastline or at an elevation <65 metres above sea level

- level topography (<5° incline)
- greater than one hectare to accommodate and sustain large numbers of flying-foxes.

Optimal 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).

3.6 Species profiles

Figure 2 Black flying-fox indicative species distribution, adapted from OEH 2015a

3.6.1 Black flying-fox

The black flying-fox (BFF) (Figure 2) has traditionally occurred throughout coastal areas from Shark Bay in Western Australia, across Northern Australia, down through Queensland and into NSW (Churchill 2008; OEH 2015a). Since it was first described there has been a substantial southerly shift by the BFF (Webb & Tidemann 1995). This shift has consequently led to an increase in indirect competition with the threatened GHFF, which appears to be favouring the BFF (DoE 2016a).

They forage on the fruit and blossoms of native and introduced plants (Churchill 2008; OEH 2015a), including orchard species at times. 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 kilometres of the camp site (Markus & Hall 2004).

BFF usually camp 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.

3.6.2 Grey-headed flying-fox

Figure 3 Grey-headed flying-fox indicative species distribution, adapted from OEH 2015a

The grey-headed flying-fox (GHFF) (Figure 3) is found throughout eastern Australia, generally within 200 kilometres of the coast, from Finch Hatton in Queensland to Melbourne, Victoria (OEH 2015d). This species now ranges into South Australia and has been observed in Tasmania (DoE 2016a). It requires foraging resources and camp sites within rainforests, open forests, closed and open woodlands (including melaleuca swamps and banksia woodlands). This species is also found throughout urban and agricultural areas where food trees exist and will raid orchards at times, especially when other food is scarce (OEH 2015a).

All the GHFF in Australia are regarded as one population that moves around freely within its entire national range (Webb & Tidemann 1996; DoE 2015). GHFF may travel up to 100 kilometres in a single night with a foraging radius of up to 50 kilometres from their camp (McConkey et al. 2012). They have been recorded travelling over 500 kilometres over 48 hours when moving from one camp to another (Roberts et al. 2012). GHFF generally show a high level of fidelity to camp sites, returning year after year to the same site, and have been recorded returning to the same branch of a particular tree (SEQ Catchments 2012). This may be one of the reasons flying-foxes continue to return to small urban bushland blocks that may be remnants of historically-used larger tracts of vegetation.

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

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

2000; Richards 2000 cited in OEH 2011a). There is a wide range of ongoing threats to the survival of the GHFF, including habitat loss and degradation, deliberate destruction associated with the commercial horticulture industry, conflict with humans, infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.) and competition and hybridisation with the BFF (DECCW 2009). For these reasons, it is listed as vulnerable to extinction under NSW and federal legislation (see Section 5).

3.6.3 Little red flying-fox

Figure 4 Little red flying-fox indicative species distribution, adapted from OEH 2015a

The little red flying-fox (LRFF) (Figure 4) 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 camp 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 areas of south-east Queensland and NSW during the summer months, however rarely visit the Tweed Shire area. Outside these periods LRFF undertake regular movements from north to south during winter–spring (July–October) (Milne & Pavey 2011).

3.7 Reproduction

Black and grey-headed flying-foxes

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

Young are highly dependent on their mother for food and thermoregulation. Young are suckled and carried by the mother until approximately four weeks of age (Markus & Blackshaw 2002). At this time they are left at the camp during the night in a crèche until they begin foraging with their mother in January and February (Churchill 2008) and are usually weaned by six months of age around March. Sexual maturity is reached at two years of age with a life expectancy up to 20 years in the wild (Pierson & Rainey 1992). As such, the critical reproductive period for GHFF 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 5).

Little red flying-fox

The LRFF breeds approximately six months out of phase with the other flying-foxes. Peak conception occurs around October to November, with young born between March and June (McGuckin & Blackshaw 1991; Churchill 2008) (Figure 5). Young are carried by their mother for approximately one month then left at the camp while she forages (Churchill 2008). Suckling occurs for several months while young are learning how to forage. LRFF generally birth and rear young in temperate areas (rarely in NSW).

Figure 5 Indicative flying-fox reproductive cycle.

4 Human and animal health

Flying-foxes, like all animals, carry pathogens that may pose human health risks. Many of these do not produce symptoms in flying-foxes but have the potential to cause significant disease in people or other animals. In Australia, flying-foxes are known to carry Australian bat lyssavirus (ABLV), Hendra virus (HeV) and Menangle virus. Specific information on these viruses is provided in Appendix 1.

Except for those people whose occupations include close contact with bats or potentially infected domestic animals (such as wildlife carers and vets) human exposure to disease is extremely rare. There are also simple preventative measures available, including vaccination, and the overall public health risk is judged to be low (Qld Health 2016).

4.1 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 ongoing disturbance and harassment and its effect on HeV infection were not within the scope of the study and are therefore unknown.

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

Furthermore, management actions or natural environmental changes may increase disease risk by:

- forcing flying-foxes into closer proximity to one another, increasing the probability of disease transfer between individuals and within the population
- resulting in abortions and/or dropped young if inappropriate 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.

5 Legislation and policy

5.1 Local

Tweed Shire has three Local Environmental Plans:

- Tweed City Centre LEP 2012
- Tweed Local Environmental Plan 2014
- Tweed LEP 2000.

5.1.1 Draft Biodiversity and Habitat Management DCP

The Draft Biodiversity and Habitat Management Development Control Plan (DCP) includes controls that apply to development in the Tweed so that planning and design of new development maintains or improves ecological values. Flying-fox camps and habitat is a key biodiversity theme of the DCP which and is to be considered in appropriate development design, which may include buffers or setbacks from flying-fox camps.

5.1.2 Tweed Coast Comprehensive Koala Plan of Management

Council developed the Tweed Coast Comprehensive Koala Plan of Management (January 2015) (KPoM) to address the decline in Koala population across the region. The KPoM divides the Tweed Coast into northern (Tweed Heads) and southern (Tweed Coast) Koala Management Areas (KMAs). Vegetation management conducted within KMAs must align with the actions detailed in the KPoM for the preservation and recovery of Koala populations.

5.1.3 Draft Aboriginal Cultural Heritage Management Plan

The Draft Aboriginal Cultural Heritage Management Plan seeks to achieve greater awareness, understanding and respect of the cultural heritage significance of the Tweed Shire on matters of Aboriginal history, culture and heritage. The Plan aims to build stronger relationships with the Tweed Aboriginal community and effective systems and policy framework for the protection, conservation and management of Aboriginal cultural heritage.

5.2 State

Note that at the time of plan development a reform to conservation and land management legislation in NSW was underway. This included repeal of the *Threatened Species Conservation Act 1995* and parts of the *National Parks and Wildlife Act 1974*, which were replaced by the consolidated *Biodiversity Conservation Act 2016*.

5.2.1 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. The Policy outlines a hierarchical approach to management, where low impact management options (Level 1 followed by Level 2) should be implemented before more invasive measures are considered (Level 3) (see Section 6).

5.2.2 *National Parks and Wildlife Act 1974*

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

5.2.3 *Biodiversity Conservation Act 2016*

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

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

It is an offense, under Part 2 Division 1 of the BC Act, to harm animals or the habitat of threatened species.

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

a. harm or attempted harm to any animal that is of a threatened species or is part of threatened ecological community
b. harm or attempted harm, dealing in, or liberating a protected animal
c. the picking of any plant that is of a threatened species or is part of threatened ecological community
d. picking or dealing in protected plants
e. damage to declared areas of outstanding biodiversity value
f. damage to any habitat of a threatened species or threatened ecological community.

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

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

the plan.

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

5.2.4 *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.

5.2.5 *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 adherence with this Act.

5.2.6 *Environmental Planning and Assessment Act 1979*

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

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

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

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

flying-foxes.

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

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

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

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

Proponents will need to consider whether the State Environmental Planning Policy (Vegetation in Non-Rural Areas) applies to their proposal, and if any approvals are required under the BC Act.

5.3 Commonwealth

5.3.1 *Environment Protection and Conservation Biodiversity 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 DoEE 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 an MNES. It is also considered to have a single national

population. DoEE 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 one that has either:

- contained ≥10,000 GHFF in more than one year in the last 10 years, or
- been occupied by more than 2500 GHFF permanently or seasonally every year for the last 10 years.

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

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

Mitigation standards

- The action must not occur if the camp contains females that are in the late stages of pregnancy or have dependent young that cannot fly on their own.
- The action must not occur during or immediately after climatic extremes (heat stress event[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.

[1] spectacled flying-fox (*P. conspicillatus*)

[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.

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.

6 Camp management options

A suite of commonly used management options, categorised as Level 1, 2 or 3 in accordance with the NSW Flying-fox Camp Management Policy 2015 are provided below. Management actions chosen for each flying-fox camp are determined through risk assessment (Section 7) and site assessment (Section 10). Some management options, for example education and awareness programs, may be applicable Shire-wide and are presented in Section 9; other actions may be pertinent to a specific camp site only and are presented in Section 10.

6.1 Level 1 actions: routine camp management

6.1.1 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, and information about flying-fox numbers and flying-fox behaviour at the camp.

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

Collecting and providing information should always be the first response to community concerns in an attempt to alleviate issues without the need to actively manage flying-foxes or their habitat. Where it is determined that management is required, education should similarly be a key component of any approach, and should be guided by a community engagement plan. An education program may include components shown in Figure 6.

Figure 6 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.

6.1.2 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 5 for further information):

- Create visual/sound/smell barriers with fencing or hedges. To avoid attracting flying-foxes, species selected for hedging should not produce edible fruit or nectar-exuding flowers, should grow in dense formation between two and five metres (Roberts 2006) (or be maintained at less than 5 metres). Vegetation that produces fragrant flowers can assist in 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 guidelines provided at the NSW Department of Primary Industries Hendra virus web page (DPI 2015a).
- Include suitable buffers and other provisions (e.g. covered car parks) in planning of new developments.
- Consider removable covers for swimming pools and ensure working filter and regular chlorine treatment.
- Appropriately manage rainwater tanks, including installing first-flush systems, and as a general hygiene measure avoid use for consumption.
- 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.

6.1.3 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.

6.1.4 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. Eligibility and timeframes will also need to be determined for subsidy programs, which will be reflective of variable resource availability.

6.1.5 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 chainsaws, whipper-snippers, using generators and testing alarms or sirens.

6.1.6 Revegetation and land management to create alternative habitat

This management option involves revegetating and managing land to create alternative flying-fox camp habitat away from high conflict locations.

Attempting to attract flying-foxes to new sites has had limited success in the past. Regardless of the level of restoration or fabrication there remains a high level of uncertainty as to whether flying-foxes will use a site that they have not selected themselves. As such, it is generally preferable to improve known camp sites in a manner that reduces conflict (e.g. providing additional habitat in lower conflict areas of the existing camp) and provides for long-term camp sustainability.

Despite current limitations in creating new camp sites, where sufficient camp habitat is not available in low conflict locations, alternative habitat should be improved or created based on known flying-fox camp preferences (Section 3.5). This approach should continue to be informed by findings of ongoing research.

Similarly, foraging habitat should be created and conserved to limit the reliance flying-foxes appear to have on urban food sources at certain times, which is likely influencing the urbanising trend seen across their population ranges.

6.1.7 Provision of artificial camp habitat

This management option involves constructing artificial structures to augment camp habitat in current camp sites or to provide new camp 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 camp habitat. It is thought that the structure of the vegetation below and around the ropes is important.

6.1.8 Protocols to manage incidents

This management option involves developing and implementing protocols to manage incidents or situations specific to particular camps including how to respond to emergency or arising or rapidly escalating camp issues. Such protocols may include monitoring at susceptible nearby sites (e.g. child care facilities), management of land uses to ensure compatibility (e.g. fencing in off-lead dog areas) or response to heat stress events (when the camp is subjected to extremely high temperatures which can lead to flying-fox behaviour change and mortality). Contingency planning should include Council's immediate response, levels of consultation, administrative process, and consent requirements.

6.1.9 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.

6.1.10 Appropriate land-use planning

Land-use planning instruments should be used to ensure adequate distances are maintained between future residential developments and existing or historical flying-fox

camps. While this management option will not assist in the resolution of existing land-use conflict, it provides a critical and unique opportunity to prevent future issues, conflict and cost. Physical separation between humans and flying-foxes is a key strategy for mitigating conflict (SEQ Catchments 2012).

SEQ Catchments (2012), identifies an ideal separation distance of 300 m between human habitation and a flying-fox camp. Distances of less than 50 m are unlikely to be sufficient (OEH 2015c) and conflict is commonly reported for distances between 50-100 m (Ecosure personal experience, TSC unpublished data).

6.1.11 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 may be less costly in the long term.

6.1.12 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.

6.2 Level 2 actions: in-situ management

6.2.1 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 metres are likely to be required to fully mitigate amenity impacts (SEQ Catchments 2012). The usefulness of a buffer to mitigate odour and noise impacts generally declines if the camp is within 50 metres of human habitation (SEQ Catchments 2012), however any buffer will assist reducing impacts.

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.

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

Suitable experts (Appendix 2) 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 camp trees have shown to have localised effects, with flying-foxes deterred from roosting within 1–10 metres of the deterrents. The type and placement of visual deterrents would need to be varied regularly to avoid habituation.
- 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.

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 in rubbish in the natural environment.

6.2.2 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.

6.3 Level 3 actions: disturbance or dispersal

6.3.1 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).

6.3.2 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 3 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 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 5.3.1) 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.

Active dispersal through disturbance

Active dispersal involves disturbing flying-foxes at the camp as they attempt to return from nightly foraging. This is done using noise, visual disturbance and smoke between 0300 and 0700. Given the timing and nature of activities, active dispersal is disruptive to residents and noise-phobic animals. Flying-foxes remaining at the camp during the day are also usually noisier and odour is more prominent due to the disturbance.

Flying-foxes commonly abandon a camp after one-two weeks of daily dispersal, moving to nearby camps or often creating one or several new camps very nearby (within 600m). Despite this, flying-foxes have a very high level of fidelity to their camp sites, and attempts to re-establish the camp will continue, often for many years. For example, the successful flying-fox dispersal from the Sydney Botanic Gardens required dispersal (teams of up to 20 people) every morning for the first 12 months, several days per week in Year 2, and at least monthly in Year 3. The dispersal has cost in excess of $1M to date, and some level of continued dispersal effort is anticipated to be required.

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. Assessment of any new camp will consider the potential proximity and risk to sensitive receptors and potential camp extent when determining whether or not early dispersal is an appropriate management option.

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 10.3).

6.4 Unlawful activities

6.4.1 Culling

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

6.4.2 Unlicenced dispersal and vegetation management

Council and private land owners/managers are not permitted to alter or remove any camp vegetation, or disperse flying-foxes without an appropriate licence issued by OEH (Refer Section 5.2.3). Significant fines may apply.

7 Management framework

This plan takes a risk-based approach to management, where camp intervention is generally only considered where there is actual risk that cannot be otherwise managed.

The level of risk associated with a nearby flying-fox camp was assigned to each sensitive receptor based on land use type and proximity to the camp. 'Risk' is defined as actual risk to human/animal health, safety or economic loss. Risk assignment was based on the following:

- Very low risk = Negligible risk associated with the camp.
- Low risk = Flying-fox camp unlikely to influence risk.
- Moderate risk = Flying-fox camp may create some level of risk.
- High risk = Flying-fox camp causes significant risk.

Categories have been assigned as per the table below.

Table 2 Risk assignment

Sensitive receptor	Proximity	Risk level	Applicable management level
Residential, aged care, school / child care, hospital, equine centres	<5m (overhanging)	High	Level 1 actions required, Level 2 actions likely required (and in extreme cases, Level 3 actions considered).
	5-100m	Moderate	Level 1 actions required, Level 2 actions potentially required.
	100-300m	Low	Level 1 actions may be required
	>300m	Very low	Level 1 actions beneficial but no action required.
Public park or access	<50m	Low	Level 1 actions may be required
	>50m	Very low	Level 1 actions beneficial but no action required.
Aerodromes	<3km	High	Level 1 actions required, Level 2 likely required (and in extreme cases, Level 3 actions considered).
	3-8km	Moderate	Level 1 actions required, Level 2 actions potentially required.
	8-13km	Low	Level 1 actions may be required
	>13km	Very low	Level 1 actions beneficial but no action required.

A flow chart outlining the approach to assessing and managing camps is outlined in Figure 7.

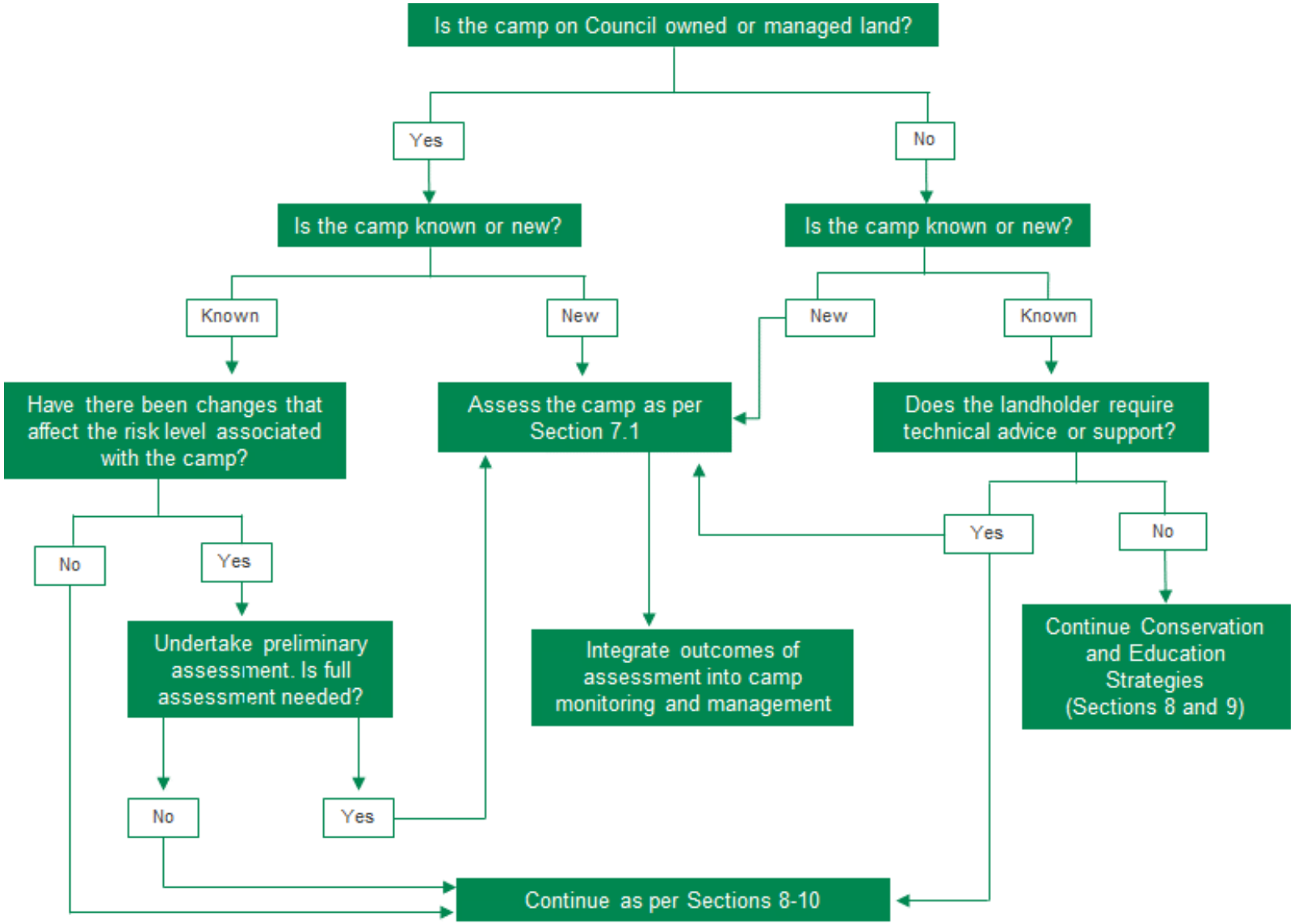


Figure 7 Flow chart of camp assessment process

7.1 Camp assessment

The following outlines a general procedure to assess any new flying-fox camp in the Shire. Note these guidelines will also be applied to reassess any camp that significantly changes or expands (as per Figure 7).

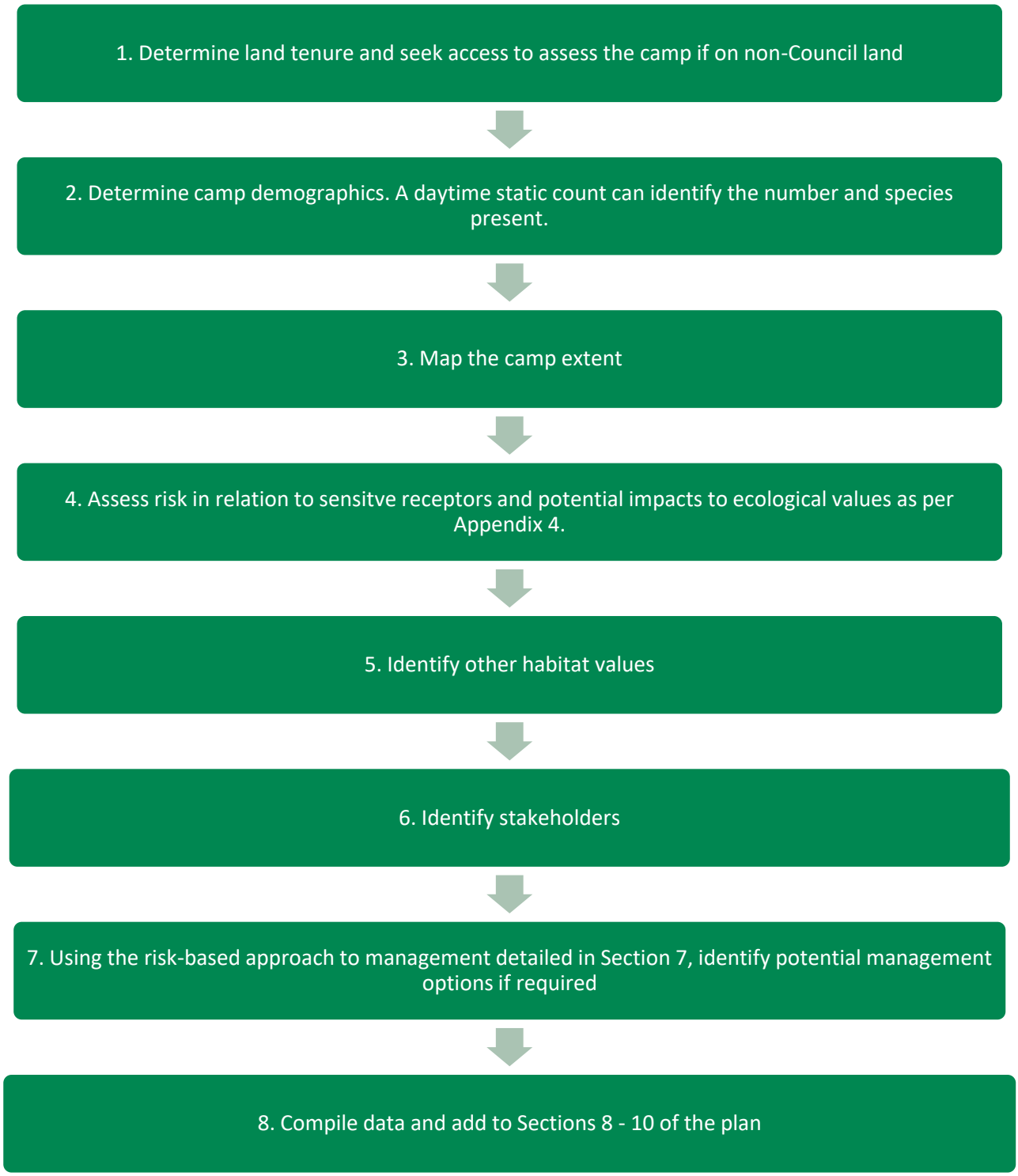
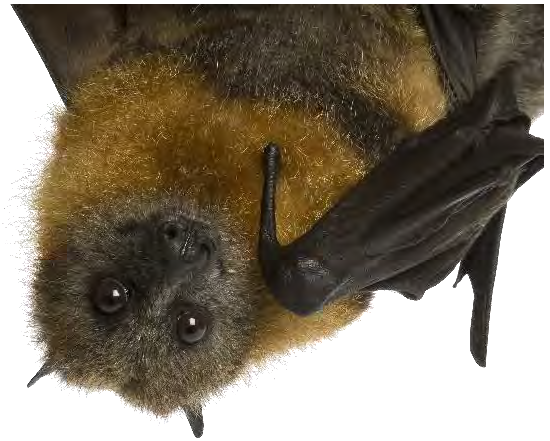


Figure 8 Assessment of new camps

8 Conservation strategy



Conservation of flying-foxes within the Tweed is a key objective of the plan, and should ultimately underpin all management decisions.

Table 3 outlines broad strategies and actions considered important for flying-fox conservation. Council will assess actions during the evaluation and review process (Section 11).

Mapping of suitable camp habitat was identified as a priority conservation action, and is provided in Section 8.1.

Table 3 Conservation strategy actions

Strategy	Action	Timeframe	Measure
General	Integrate actions from this plan into any Council or regional conservation strategies.	ASAP and ongoing	Actions integrated into relevant conservation strategies.
Education	Implement the Education and Engagement Strategy (Section 9)	ASAP and ongoing	As per measures in Table 4.
Monitoring	Ensure regular (at least seasonal) monitoring of all active flying-fox camps within the Shire as part of the National Flying-fox Monitoring Program (NFFMP), including maintaining a database and sharing information.	Ongoing	Regular monitoring undertaken at all Tweed camps and data publically available.
	Ensure monitoring at appropriate temporal and spatial scales around any camp management.	Prior to, during and following camp management	Evaluation of management includes monitoring outcomes, which can be used to inform future works.
	In collaboration with wildlife rescue and care organisations, monitor for potential heat stress events during predicted hot weather using the online heat stress forecaster http://www.animalecologylab.org/ff-heat-stress-forecaster.html.	Every summer	Likely heat stress events identified in advance to allow proactive management where possible.
	Collaborate with wildlife rescue and care organisations to monitor heat stress events, and complete the online data form for input into the national database (located at http://www.animalecologylab.org/heat-stress-data-form.html).	Every summer	Heat stress event data entered into the national database.

Strategy	Action	Timeframe	Measure
Habitat protection	Map potential camp habitat within the Shire based on known flying-fox camp preferences.	Short-term	Maps included within the plan.
	Restore and improve suitable flying-fox habitat (known and potential) to increase net available habitat (roost and foraging), offset habitat loss (especially associated with camp management) and encourage flying-foxes to suitable locations.	Medium-term	Restoration plans complete for key sites.
	Ensure all management at camps is sympathetic to flying-fox habitat requirements (including mid-storey for protection during extreme weather), and welfare requirements (e.g. appropriate mowing regimes during pup rearing season).	Ongoing	All camps have mid-storey for protection during heat stress, and flying-fox welfare is prioritised during management.
	Include, where appropriate (e.g. in low conflict locations), flying-fox roost and foraging species when revegetating Council space. There is a particular need to increase the availability of winter-flowering and fruiting foraging species (see Eby 2016 and Eby 1995 for further information).	Ongoing	Flying-fox habitat species included in revegetation guidelines where appropriate.
	Consider habitat protection measures (e.g. appropriate zoning) for flying-fox roost and foraging habitat.	Short-term	Report on potential options and commit to protecting important habitat.
	Ensure suitable biodiversity and fire management strategies are in place for all active flying-fox camps within the Shire.	Long-term	Strategies in place.
	Consider temporary/permanent exclusion measures if flying-foxes are being disturbed by public access (especially during birthing and rearing).	Ongoing	Minimal camp disturbance associated with public access.
Disaster management	Encourage wildlife groups to adopt industry-recognised best practice management during heat stress response.	Before summer 2018	Heat stress response plan in place.
	Support wildlife carers assisting flying-foxes where possible during extreme weather events.	Ongoing	Support wildlife carer efforts during extreme weather events.
Reduce urban mortality	Avoid planting low-growing foraging species (e.g. grevillea) in centre medians and road edges. Replace with tall foraging species (e.g. eucalypts) or non-foraging species.	Ongoing	Minimal vehicle-related mortality.
	Identify known hotspots and implement, where possible, known practical measures, to reduce mortality due to entanglement and electrocution.	Ongoing	Reduction in mortality at hotspots.

Strategy	Action	Timeframe	Measure
Support flying-fox rescuers and carers	Advertise grants within relevant networks so that wildlife carers are aware grant funding may be available.	Ongoing	Wildlife carers are aware that funding assistance through grants may be available.
	Encourage regular two-way communication between Council and wildlife groups to share data and other information.	Ongoing	Data and information is regularly shared between Council and wildlife groups.
Suitable land use planning	Include suitable controls to manage design of new development in the Biodiversity and Habitat Management DCP in order to avoid conflict.	Ongoing	Planning controls implemented in accordance with DCP.

8.1 Potentially suitable camp habitat

While it is recognised that flying-fox camp selection is difficult to predict, known favoured characteristics (as outlined in Section 3.5) were modelled to provide potentially suitable camp habitat within the Shire (Figures 9-13). Detailed methods for this modelling are provided in Appendix 4.

Identifying potentially suitable habitat may provide for habitat allocation, restoration, improvement and protection. Potentially suitable camp habitat will be further queried by Council to ensure the general location is suitable. It must be noted that while this assessment was based on known camp preferences, it does not mean that flying-foxes will use these areas, or that camps will not form in habitat not identified in Figures 9-13.

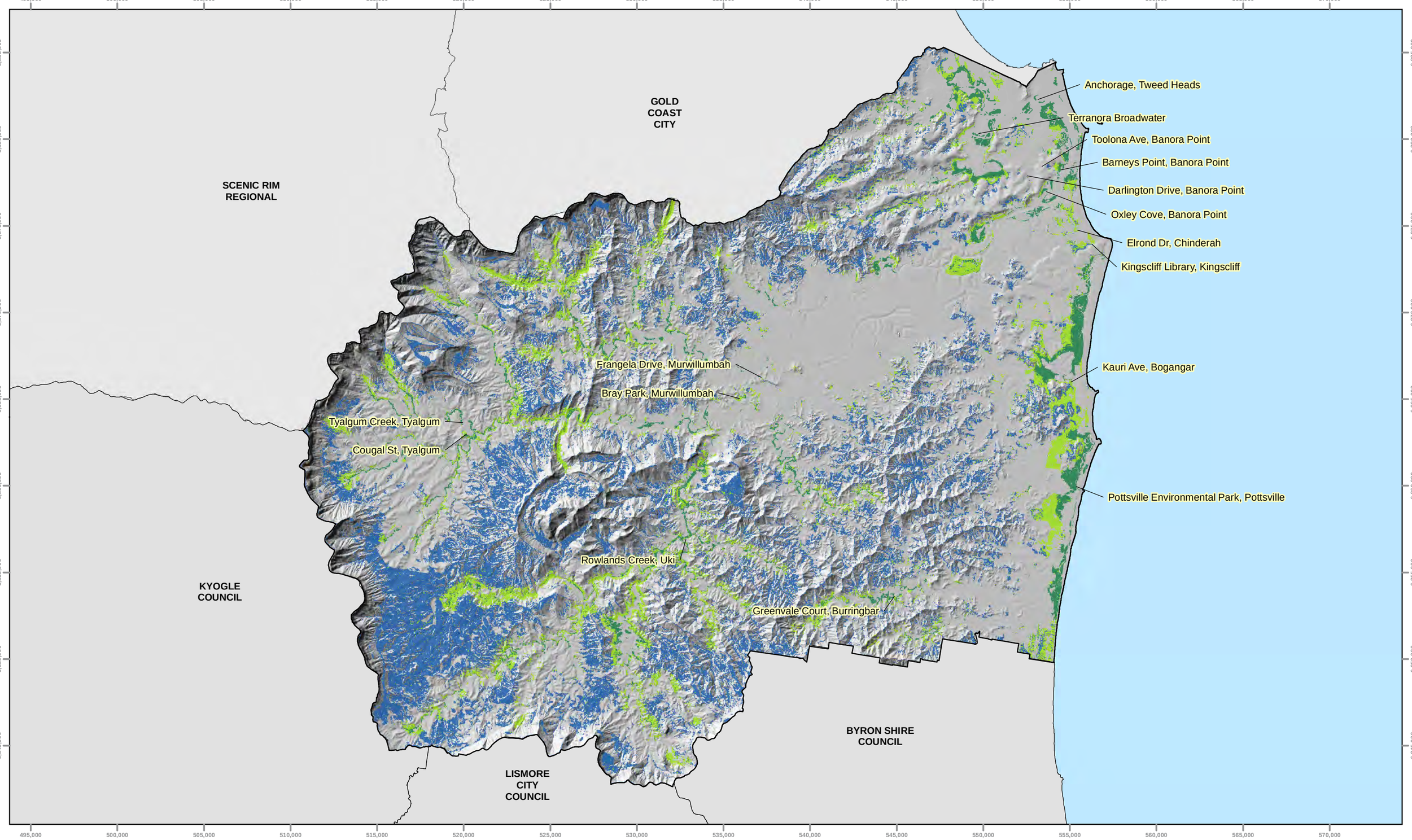
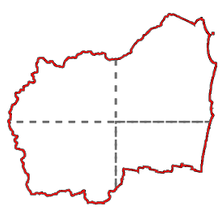


Figure 9: Potential flying-fox habitat within Tweed Shire Council Map 1 of 5

Tweed Shire Council

Flying-fox Camp Management Plan



Tweed local government area

Less preferred

Preferred

Most preferred

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 1 2 4
Kilometers

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

500,000 505,000 510,000 515,000 520,000 525,000 530,000 535,000 540,000 545,000

6,880,000 6,875,000 6,870,000 6,865,000 6,860,000

GOLD COAST CITY

SCENIC RIM REGIONAL

KYOGLE COUNCIL

Frangela Drive, Murwillumbah

Bray Park, Murwillumbah

Tyalgum Creek, Tyalgum

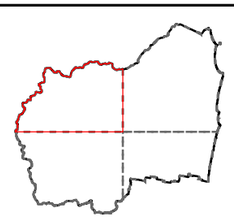
Cougal St, Tyalgum

Uki

Figure 13: Potential flying-fox habitat within Tweed Shire Council Map 2 of 5

Tweed Shire Council

Flying-fox Camp Management Plan



Tweed local government area

Less preferred

Preferred

Most preferred

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 1 2 4
Kilometers

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

525,000 530,000 535,000 540,000 545,000 550,000 555,000 560,000 565,000

6,885,000 6,880,000 6,875,000 6,870,000 6,865,000 6,860,000

GOLD COAST CITY

Anchorage, Tweed Heads

Terranora Broadwater

Toolona Ave, Banora Point

Barneys Point, Banora Point

Darlington Drive, Banora Point

Oxley Cove, Banora Point

Elrond Dr, Chinderah

Kingscliff Library, Kingscliff

Kauri Ave, Bogangar

Frangela Drive, Murwillumbah

Bray Park, Murwillumbah

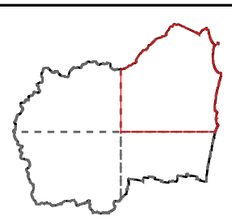
525,000 530,000 535,000 540,000 545,000 550,000 555,000 560,000 565,000

Figure 10: Potential flying-fox habitat within Tweed Shire Council Map 3 of 5

Tweed Shire Council

Flying-fox Camp Management Plan

ecosure



Tweed local government area

Less preferred

Preferred

Most preferred

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 1 2 4
Kilometers

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

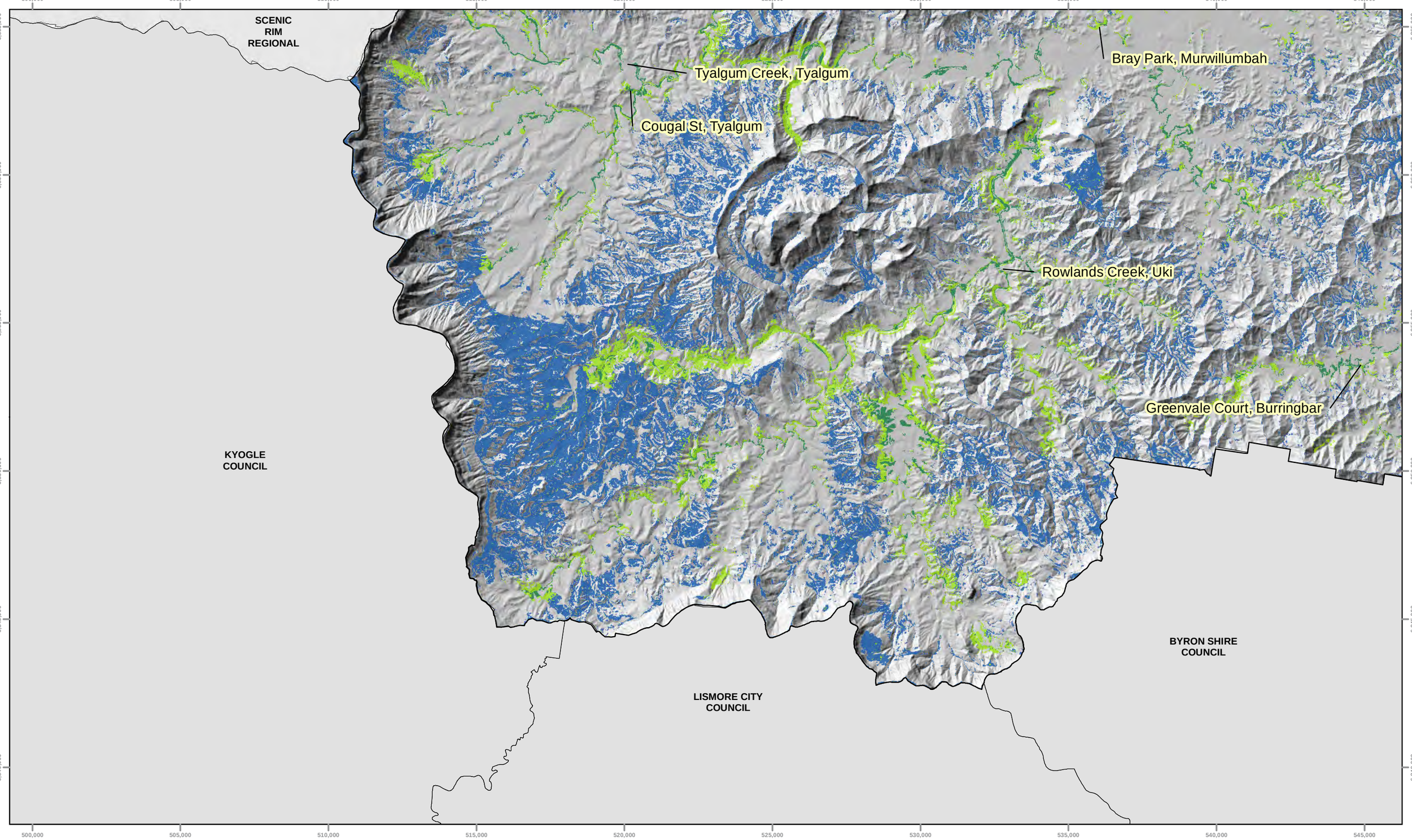
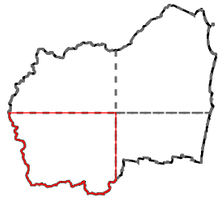


Figure 11: Potential flying-fox habitat within Tweed Shire Council Map 4 of 5

Tweed Shire Council

Flying-fox Camp Management Plan



Tweed local government area

Less preferred

Preferred

Most preferred

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 1 2 4
Kilometers

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

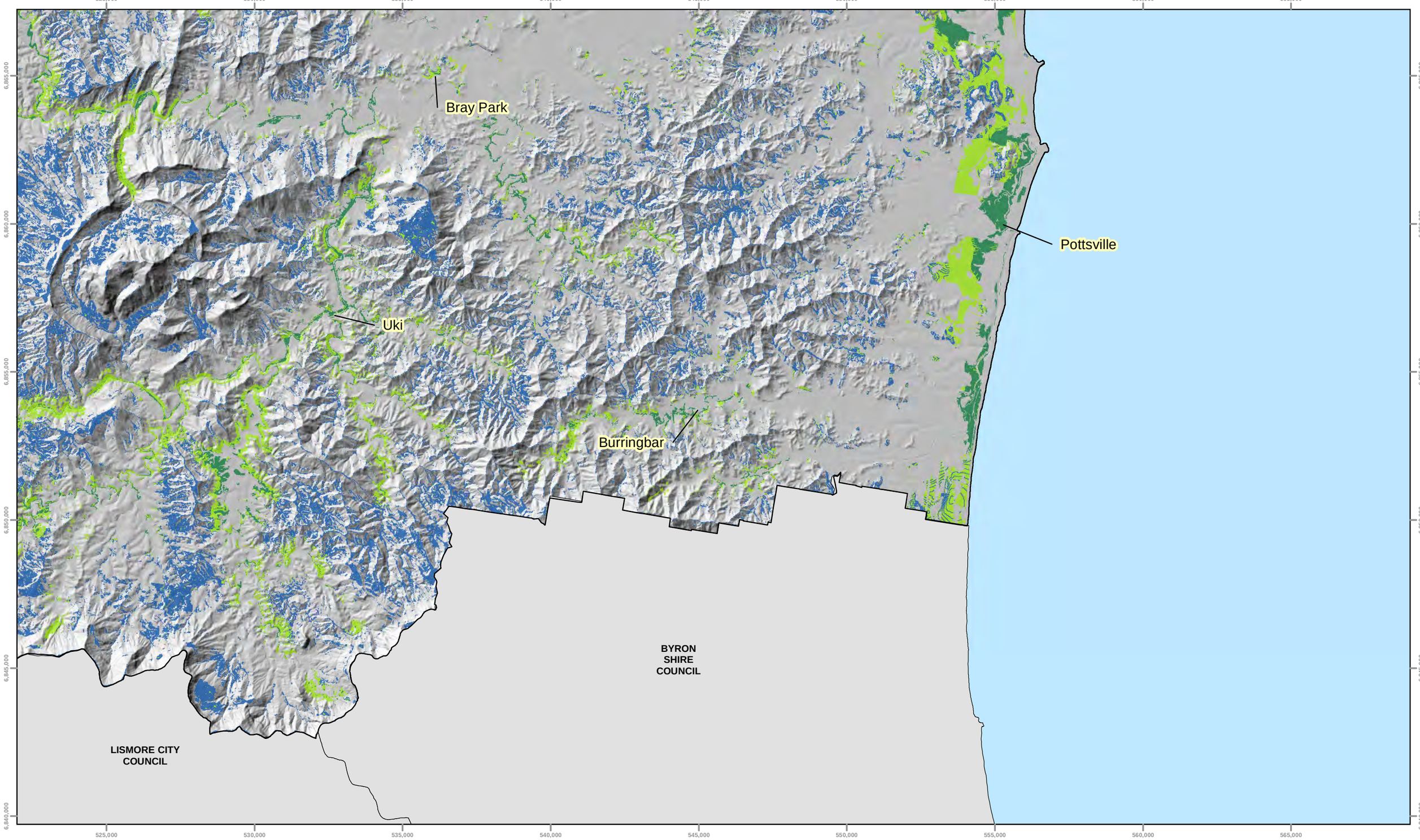
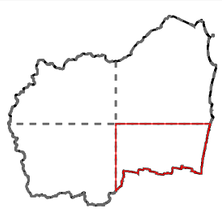


Figure 12: Potential flying-fox habitat within Tweed Shire Council Map 5 of 5

Tweed Shire Council

Flying-fox Camp Management Plan

ecosure



Tweed local government area

Less preferred

Preferred

Most preferred

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 1 2 4
Kilometers

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

9 Education and engagement strategy

It is recognised that currently there is limited requirement or scope for on-ground management actions at flying-fox camps within the Shire. Education and engagement are therefore the principal strategies that are available to achieve the plan's objectives. Working with the community to build the education and engagement strategy and to identify and develop the most appropriate actions will result in the best outcomes for conflict reduction and flying-fox conservation. The two overarching actions include:

1) Undertake priority actions

2) Facilitate one or more representative stakeholder community working groups to focus on co-design of draft actions to enhance community flying-fox awareness.

Actions that form this strategy are outlined in Table 4.

Table 4 Education and awareness strategy.

Location	Action	Timeframe	Measure
Priority actions			
Shire-wide	Continue to develop and implement an education strategy to increase public knowledge regarding health risks and ecological importance of flying-foxes.	Ongoing	Education program ongoing.
Shire-wide	Produce a fact sheet summarising the Plan and camp management approach for publication on Council's website and distribution as required.	ASAP	Fact sheet readily available.
Shire-wide	Identify, through consulting the ACHP and liaison with Tweed Byron Local Aboriginal Land Council, any known or potential aboriginal heritage significance associated with each flying-fox camp.	ASAP	Relevant matters identified and considered prior to any camp management and incorporated into the first revision of the plan where appropriate.
Airfields and hospital helipads	Ensure airport managers are aware of the location of flying-fox camps in the Shire, consult with airport managers if any camp management is planned which	ASAP and ongoing	Two way communication with aerodrome managers.

Location	Action	Timeframe	Measure
	may alter flying-fox movement patterns, and support a coordinated approach to strike risk management where possible.		
Locations where stakeholders have expressed concern about a camp	Conduct a letterbox drop within 100 m of the camp to promote awareness of flying-fox issues. Material to include flying-fox rescue organisation contact details, public health information and tips for living with flying-foxes.	ASAP	Educational pamphlets designed and distributed.
Tyalgum Creek	· local information sessions · assist with positive publicity · liaise with Tyalgum District Community Association · provide campground with a list of aromatic non-flying-fox attracting plants for planting · interpretive information including general health and water quality for Camping Ground	ASAP	Community engagement underway to promote awareness and understanding of flying-foxes, and inform of any planned management at the Tyalgum Creek camp.
Terranora Broadwater	Liaise with businesses that use estuary (e.g. tour groups).	ASAP	Boats maintain appropriate speeds and distances from islands that are occupied by flying-fox.
Anchorage, Darlington Drive, Bray Park, Pottsville, Uki	Install interpretive signage to promote awareness and understanding of flying-foxes. Where relevant, signage to include flying-fox rescue organisation contact details.	Year 1-2 of the plan	New signage designed and installed.
Draft actions to be finalised through community consultation			
Shire-wide	Encourage positive media coverage (including a social media campaign).	Ongoing	Increase in positive media.
Shire-wide	Consult with community groups and conservation organisations (e.g. Australasian Bat Society) to encourage educational bat evenings/'meet-a-bat' events to promote awareness.	At least annually	At least one event annually.
Shire-wide	Promote ecotourism opportunities. For example, since 1984 Batty Boat Cruises have been run regularly for tourists to watch flying-foxes leave their camps from the Brisbane River; one of the top-rated attractions in Texas is to watch 1.5 million Mexican free-tail bats fly-out from their roost - the Radisson Hotel offers special bat packages from viewing bedrooms (Kerr and Thiret 2016).	At least annually	Potential ecotourism opportunities promoted annually.

Location	Action	Timeframe	Measure
Shire-wide	Encourage removal of non-native foraging trees that negatively impact on flying-foxes and the environment (e.g. Cocos palms).	Ongoing	Removal of harmful vegetation and included in community educational material.
Shire-wide	Raise awareness about replacing or substituting infrastructure known to cause flying-fox mortality e.g. barbed wire, overhead powerlines.	Long-term	Minimal infrastructure-related flying-fox mortality.
Shire-wide	Support and encourage flying-fox research, and make information readily available to the community and other land managers.	Ongoing	Council attends flying-fox forums and has a network of researchers.
Shire-wide	Recommend horses residing around flying-fox roosts are HeV vaccinated and where necessary excluded from tree drip lines of foraging and roosting trees.	Ongoing	Council staff aware of best practice for horses around camps and Councils website provides links to NSW DPI.
Shire-wide	Develop and conduct relevant training for all staff/community involved in any flying-fox management action and those who will be dealing with complaints/inquiries.	Prior to implementation of management actions.	Training developed and completion register maintained.

10 Camp assessment and management

Camp context, history, ecological values, risks/potential impacts and management options are provided for each active flying-fox camp within the Shire. All site-specific risks, management options and mitigation measures should be read with referral to Sections 5 and 8.

Camps have been separated according to tenure:

- Council-managed land (12 camps) (Section 10.1)
- non Council-managed land or mixed tenure (4 camps) (Section 10.2).

Methods for camp assessment and explanation of chart annotations are provided in Appendix 4.

10.1 Council-managed land

10.1.1 Anchorage, Tweed Heads

Context

Anchorage camp is located in Keith Curran Reserve between Island Drive and Harbour Drive, Tweed Heads (Figure 14). The maximum known camp extent is shown in Figure 15 and covers 0.72 hectares (ha). Camp vegetation is mapped as a mix of swamp she-oak closed forest to woodland and banksia dry sclerophyll open forest to shrubland. This was ground-truthed during site assessment and is consistent with the vegetation communities on site. There are also other flora present, including favoured flying-fox foraging species such as figs (*Ficus* spp) and mango trees.

Table 5 Anchorage camp context

Criteria	Attribute
Location	-28.184514,153.541194
Lot and plan	2//DP820682
Tenure	Crown-owned, Council-managed
Current land use	Reserve
Aspect / slope	West / mostly flat
Maximum confirmed camp extent	0.72 ha
Potential for camp expansion	Moderate

553,000

MARINERS DRIVE WEST

MARINERS DRIVE EAST

HARBOUR DRIVE

ISLAND DRIVE

553,000

Figure 14: Anchorage, Tweed Heads camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 6 Anchorage camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP (DoEE 2017)	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Ukerebagh Island Nature Reserve	The reserve is 400 m to the south east of camp
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (critically endangered; CE) Subtropical and Temperate Coastal Saltmarsh (vulnerable; V)	May occur within area Likely to occur within area
		Threatened species	15 threatened species or species habitat are known to occur within area (SPRAT data not mapped)	58 threatened species or species habitat may occur within area
State	Atlas of Living Australia (ALA) and Bionet	Threatened species	22 threatened species have been recorded within area (Figure 15)	
Local	KPoM	KMA	The camp is included within the Tweed Heads KMA	Refer to KPoM for details
	TVMS 2004	Vegetation type	Banksia Dry Sclerophyll Open Forest to Shrubland	Occurs on site

Figure 15: Anchorage, Tweed Heads ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Banksia Dry Sclerophyll Open Forest to Shrubland
- Littoral Rainforest
- Mangrove Open Forest to Woodland
- Saltmarsh Communities
- Swamp She-oak Closed Forest to Woodland

ecosure

ALA and Bionet records have been mapped. SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The first count of this camp under the National Flying-fox Monitoring Program (NFFMP) was done in May 2016 and was undertaken by Council staff, however the camp is known to have been occupied prior to then. During subsequent surveys, the camp has been occupied by BFF, with a maximum of approximately 270 recorded in November 2016.

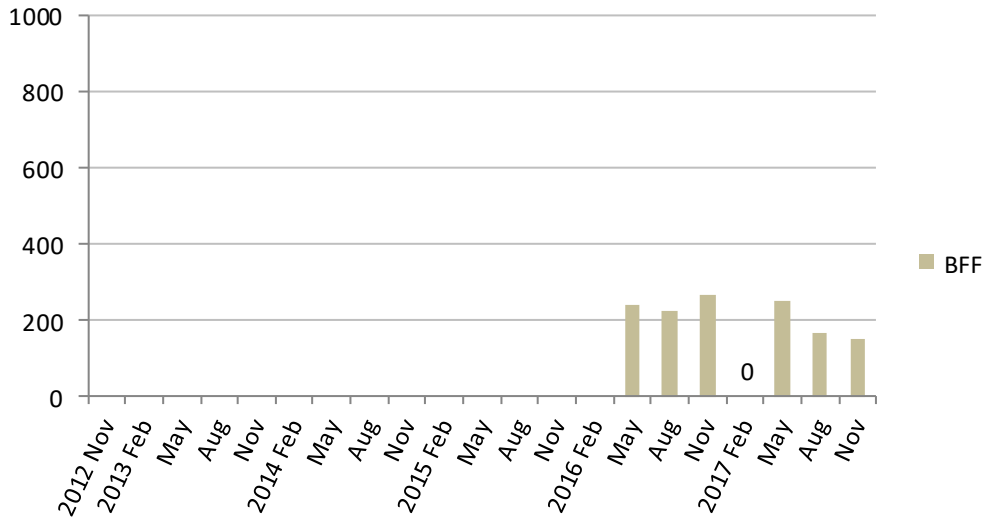


Figure 16 Anchorage camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Anchorage Camp (or within 13 km for aerodromes) are detailed in Table 7 and Figure 17. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 7 Anchorage camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Aged care	573 m	Keith Compton Drive Aged Care Facility is located to the north-east of the camp.	Very low
Airport	2,686 m	Gold Coast Airport is 2.7 km west of the camp. The risk of flying-fox strike must be appropriately managed (see Section 2.3).	High
Helipad	875 m	A helipad is located at the Tweed Hospital 875 m north of the camp. The risk of flying-fox strike must be appropriately managed (see Section 3.3).	High
Hospital	735 m	The Tweed Hospital is located 735 m north-west of the camp.	Very low
Public park or access	0 m	The camp is located within a public park that contains walking tracks and picnic tables.	Low
Residential	45 m	The closest resident is on Discovery Drive with the boundary 45 m from the confirmed camp extent.	Moderate
School / child care	673 m	The closest child care is 673 m to the north-west of the camp.	Very low

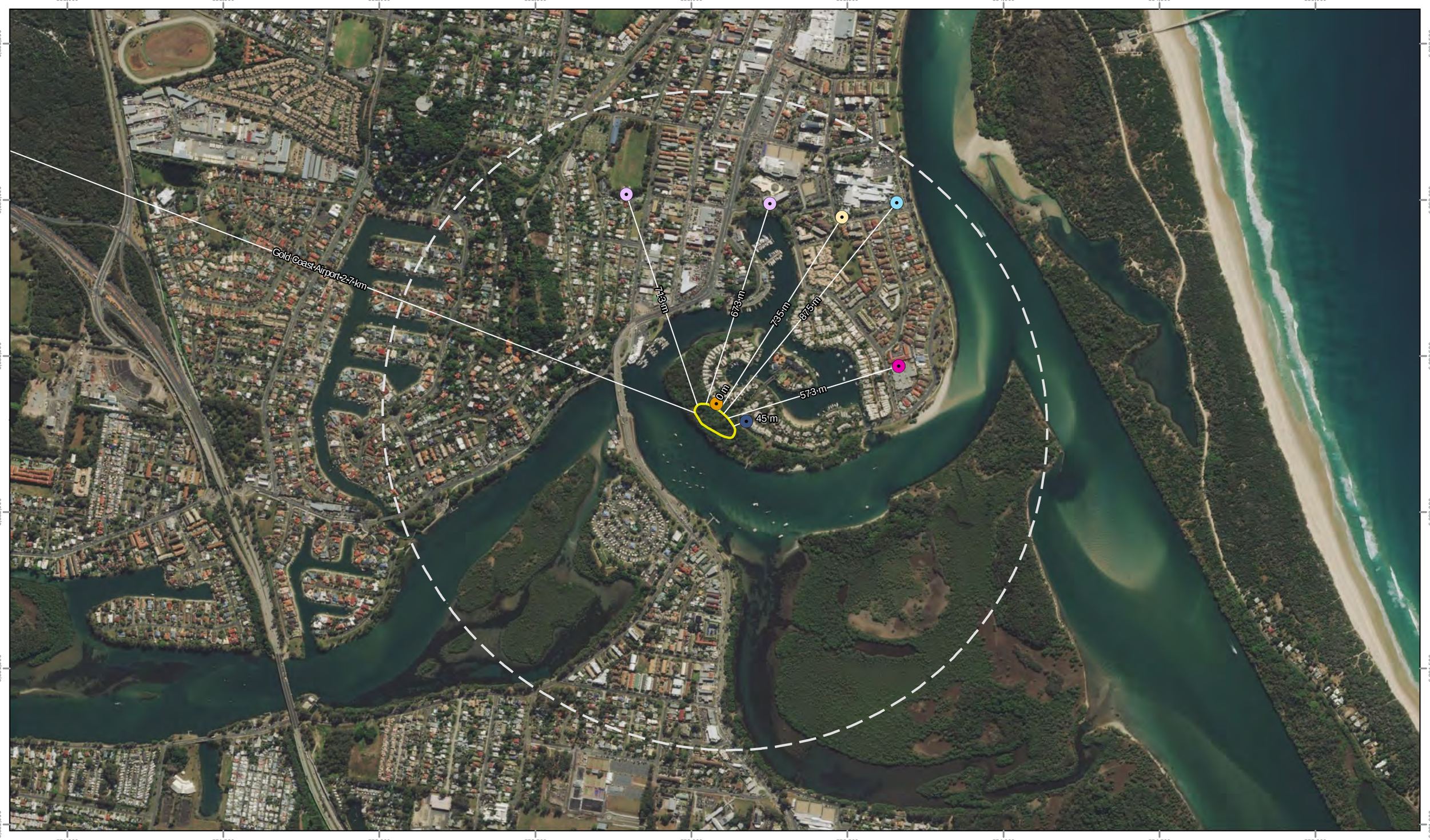


Figure 17:Anchorage, Tweed Heads sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

- Aged care
- Helipad
- Hospital
- Park
- Residential
- School

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP. Council has informally consulted with reserve users and residents in the area regarding flying-foxes at the site and no responsive management has been required to date.

Management options

Table 8 Anchorage camp management options

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	ASAP	Notify the Tweed Hospital (helipad) and Gold Coast Airport of the camp's location and population trends to allow airport personnel and land managers to appropriately manage strike risk (Section 3.3).	1	Nil
	ASAP	Regularly clean picnic tables/cover if located near camp.	1	Variable
	Year 1-2 of the Plan	Install interpretive signage in the park to promote awareness and understanding of flying-foxes.	1	$500 + maintenance
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		Re-evaluate under the management framework (Section 7). Potential management may include an increased buffer where camp meets property boundaries on Discovery Drive. Any buffer creation is to be done in accordance with an approved vegetation management plan or similar and only after any appropriate consent or licence is obtained from OEH (refer Section 5.2.3)		

10.1.2 Barney's Point, Banora Point

Context

Barney's Point camp is located in the centre of bushland situated between Bushland Drive and the Pacific Motorway, Banora Point (Figure 18). The maximum known camp extent is shown in Figure 19 and currently covers 0.84 ha. Camp vegetation is mapped as swamp she-oak closed forest and mangrove open forest to woodland. This was ground-truthed during site assessment and is consistent with vegetation type on site.

Table 9 Barney's Point camp context

Criteria	Attribute
Location	-28.21931, 153.553639
Lot and plan	7010//DP1069421, 23//1211517
Tenure	State Crown Land, Roads and Maritime Services
Current land use	Bushland
Aspect / slope	North / 1-3° incline
Maximum confirmed camp extent	0.84 ha
Potential for camp expansion	High

554,000

554,500

SEXTON HILL DRIVE

PACIFIC HIGHWAY

SOMERSET AVENUE

ECHUCA CRESCENT

SUMMIT DRIVE

BARNEYS POINT ROAD

JAMES COOK DRIVE

FINGAL ROAD

6,878,000

554,000

554,500

6,878,000

Figure 18: Barneys Point, Banora Point camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Unconfirmed flying-fox camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 10 Barney's Point camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Threatened species	15 species or species habitat known to occur within area (SPRAT data not mapped)	65 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	In addition to the GHFF, 24 threatened species have been recorded within area (Figure 19)	
	SEPP 14	Coastal Wetlands	State significant wetland	Occurs on site
Local	KPoM	KMA	The camp is included within the Tweed Heads KMA	Refer to KPoM
	Vegetation 2011 Update	Vegetation type	Lowland Rainforest on Floodplain (Endangered TSC) Mangrove Open Forest to Woodland Swamp She-oak Closed Forest to Woodland	Occurs on site

552,000 552,500 553,000 553,500 554,000 554,500 555,000 555,500 556,000 556,500

6,879,500 6,879,000 6,878,500 6,878,000 6,877,500 6,877,000

Threatened fauna species

- Albert's Lyrebird
- Australian Pied Oystercatcher
- Bush Stone-curlew
- Torresian Kingfisher
- Comb-crested Jacana
- Flesh-footed Shearwater
- Great Knot
- Koala
- Little Tern
- Mangrove Honeyeater
- Mitchell's Rainforest Snail
- Pale-vented Bush-hen
- Sooty Oystercatcher
- Terek Sandpiper

Threatened flora species

- *Acronychia littoralis*
- *Cassia marksiana*
- *Cryptocarya foetida*
- *Grammitis stenophylla*
- *Grevillea hilliana*
- *Lepiderema pulchella*
- *Macadamia tetraphylla*
- *Randia moorei*
- *Syzygium hodgkinsoniae*
- *Syzygium moorei*

552,000 552,500 553,000 553,500 554,000 554,500 555,000 555,500 556,000 556,500

Figure 19: Barneys Point, Banora Point ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Unconfirmed flying-fox camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland
- Coastal Acacia Communities
- Early Regrowth Rainforest
- Littoral Rainforest
- Lowland Rainforest on Floodplain
- Mangrove Open Forest to Woodland
- Native Grasslands (Murray & James Yes998 Study Area Only)
- Post-mining Regeneration
- Saltmarsh Communities
- Sedgeland / Rushland (Murray & James Yes998 Study Area Only)
- Swamp She-oak Closed Forest to Woodland
- Sydney Blue Gum Open Forest

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200 Metres

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

Camp history

Council first became aware of a flying-fox camp at Barney's Point in May 2016, however no formal count was conducted until February 2017 and no flying-foxes were recorded until May 2017 when 30 GHFF and 170 BFF were recorded.

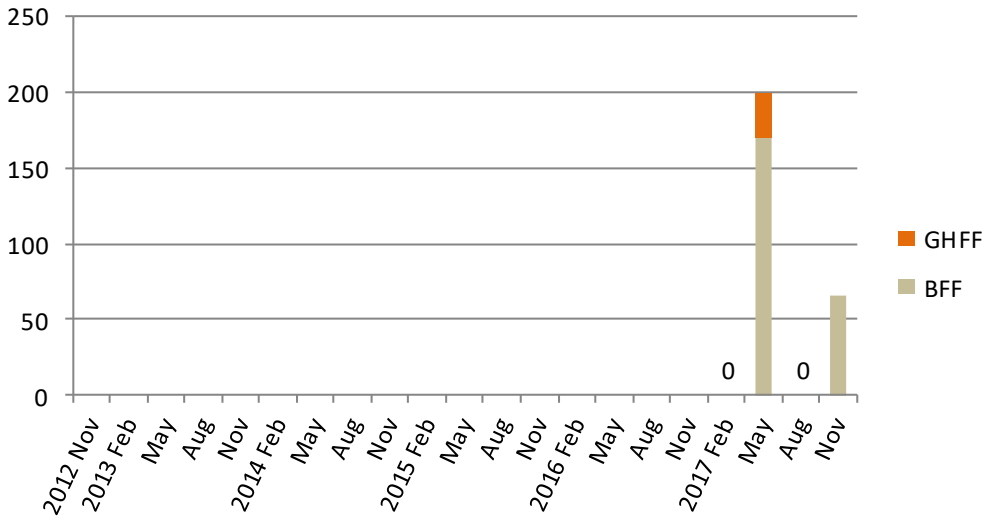


Figure 20 Barney's Point camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Barney's Point camp (or within 13 km for aerodromes) are detailed in Table 11 and Figure 21. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 11 Barney's Point camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Aged care	594 m	Freedom Aged Care Banora Point is located 594 m west of the camp.	Very low
Airport	6,223 m	Gold Coast Airport is 6.2 km north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Moderate
Helipad	4,768 m	A helipad is located at the Tweed Hospital, 4.8 km north of the camp. The risk of flying-fox strike at this distance must be jointly managed by aviation personnel and land managers (see Section 3.3).	Moderate
Public park or access	836 m	A public park is located 836 m north of the camp.	Very low
Residential	48 m	The Tweed Waters Caravan Park is located 48 m east of the camp and is separated from the park by a vegetation buffer and APZ.	Moderate
School / child care	897 m	Banora Point Primary School is located to the west of the camp.	Very low

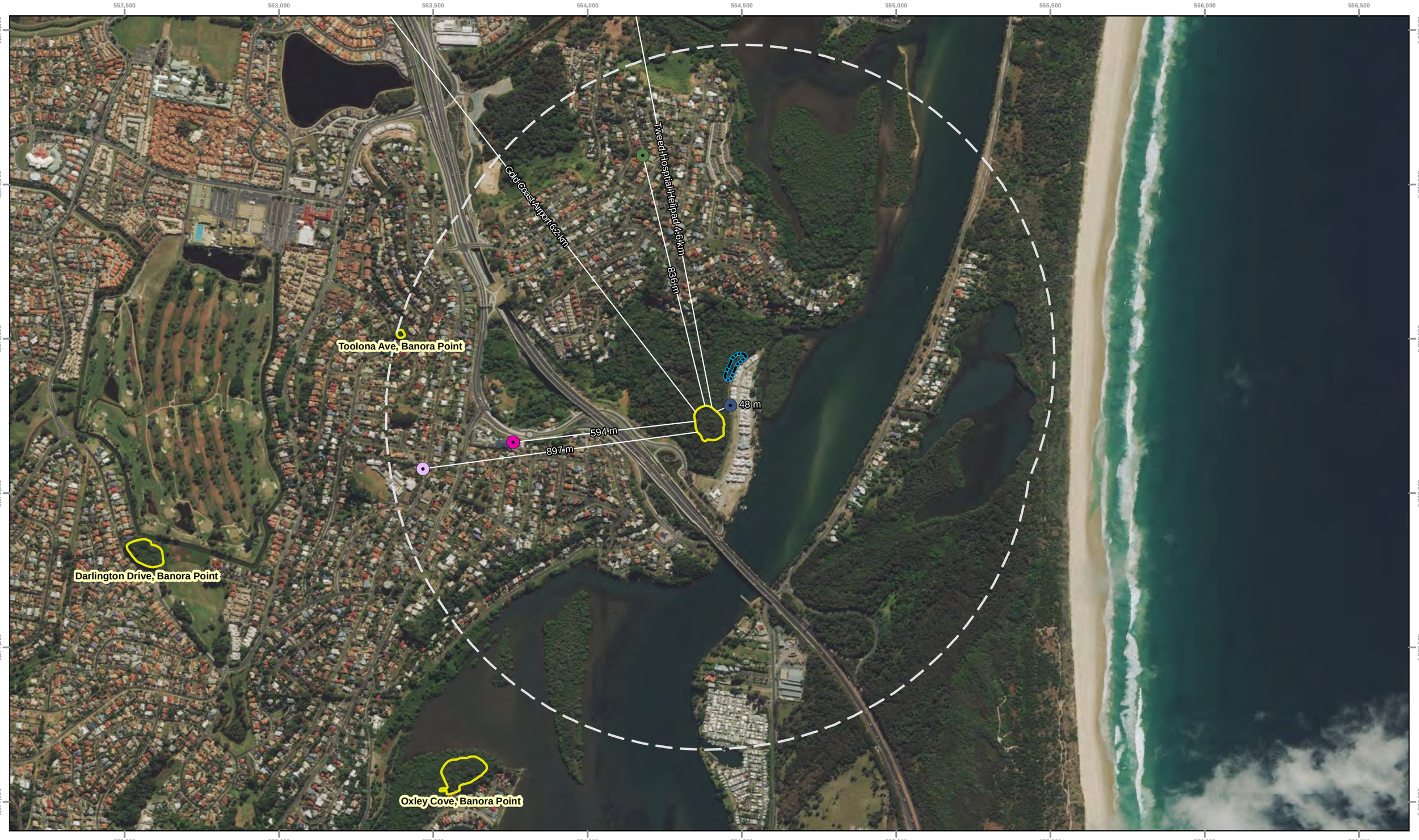


Figure 21:Barneys Point, Banora Point sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

- Residential
- Aged care
- School
- Park / Public access
- Unconfirmed flying-fox camp extent

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

PR2365_MP4_SensitiveReceptors
A4

Management to date

The camp has only recently been confirmed and will be monitored as part of the NFFMP. This camp is difficult to locate and sufficient vegetative buffers means no management has been required.

Management options

Table 12 Management options for Barney's Point camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	ASAP	Notify the Tweed Hospital and Gold Coast Airport of the camp's location and average yearly population to allow aircraft managers to jointly manage strike risk with land managers.	1	Nil
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		Potential management options include: · ensure APZ is being maintained accordingly · consider deterrents to increase buffer (e.g. canopy-sprinklers). Ensure appropriate licences are obtained from OEH (Refer Section 5.2.3)		
	Future development in the vicinity of the camp	Land use planning decisions to be made in accordance with the relevant controls of Council's Biodiversity and Habitat Management DCP and the provisions of this plan (Section 6.1.10).		

10.1.3 Bray Park, Murwillumbah

Context

Bray Park camp is located in a peri-urban environment, between Park Avenue, Riveroak Drive and Old Lismore Road, Bray Park (Figure 22). The maximum known camp extent is shown in Figure 23 and covers 4.37 ha. Camp vegetation is mapped as broad-leaved paperbark closed forest to woodland. This was ground-truthed during site assessment and is consistent with vegetation type on site.

Table 13 Bray Park camp context

Criteria	Attribute
Location	-28.3392, 153.37
Lot and plan (each lot and plan corresponds with the same numbered tenure below)	1. 1//DP1133087 2. SP 34198 3. 49//DP830595
Tenure	1. Operational 2. Private 3. Community
Current land use	Residential
Aspect / Slope	Variable / 1-5^0 incline
Maximum confirmed camp extent	4.37 ha
Potential for camp expansion	Moderate

536,000

6,865,000

OLD LISMORE ROAD

MATHESON WAY

OAKBANK TERRACE

RIVEROAK DRIVE

TULIPWOOD COURT

RIVERGUM COURT

536,000

Figure 22: Bray Park, Murwillumbah camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 14 Bray Park camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Site meets criteria.
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Threatened species	7 species or species habitat known to occur within area (SPRAT data not mapped)	58 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened Species	15 threatened species have been recorded within area (Figure 23)	
Local	KPoM	KMA	The camp is not on the Tweed Coast and therefore not included within the KPoM	
	TVMS 2004	Vegetation type	Broad-leaved Paperbark Closed Forest to Woodland Brush Box Open Forest	Occurs on site

Figure 23: Bray Park, Murwillumbah ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Broad-leaved Paperbark Closed Forest to Woodland
- Brush Box Open Forest
- Camphor Laurel Dominant Closed to Open Forest
- Exotic Plantation
- Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex
- Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates
- Tallowwood Open Forest
- Unspecified Plantation
- Urban Bushland

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The Bray Park camp is believed to have established in 2007 as a result of unauthorised clearing of vegetation at nearby flying-fox camps. During 2007 and 2008, flying-fox numbers varied between approximately 500 and 9,000 animals. The camp has been monitored (by Council staff) on a quarterly basis since November 2012 as part of the NFFMP. It is occupied by BFF and GHFF most of the time. The maximum total number of flying-foxes recorded at the camp during NFFMP monitoring was in February 2015, when 5,106 BFF and 24,376 GHFF were recorded, though it is thought that this may have been an overestimate. The peak number of BFF (11,157) was recorded in November 2012. One LRFF was recorded at Bray Park in May 2015.

There have been a number of complaints and concerns shared with Council regarding the impacts of the camp on nearby residents, including through the initial consultation phase during development of this Plan.

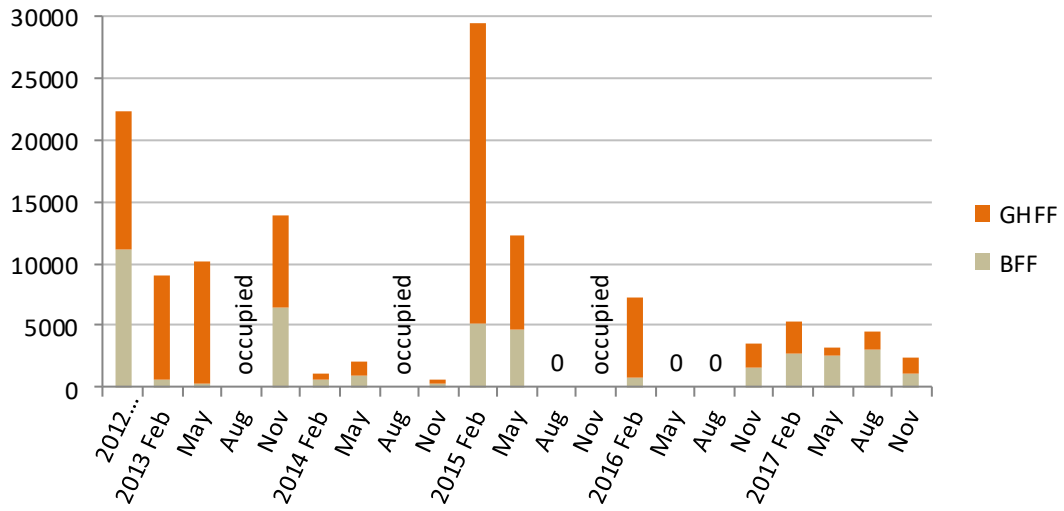


Figure 24 Bray Park camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Bray Park camp (or within 13 km for aerodromes) are detailed in Table 15 and Figure 25. Where multiple sites of the same category are mapped (e.g. schools) detail is provided for the closest, or whichever is likely to be impacted (e.g. within 300 m of the camp).

Table 15 Bray Park camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Aged care	34 m	Opal Aged Care Facility and Aveo Mountain View Retirement Community are located north of the camp. The current minimum distance between the camp and a residence is 34 m, however this is based on the maximum known camp extent and is liable to change with fluctuations in camp numbers.	Moderate

Category	Proximity to camp	Details	Risk of direct impact from camp
Airfield	4,948 m	Bob Whittle Murwillumbah Airfield is 4.9 km west-north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Moderate
Public park or access	0 m	The camp is located within a public access area.	Low
Residential	22 m	The camp shares its southern boundary with approximately 20 residences along Riveroak Drive, however there is an APZ which is currently unsuitable for roosting which provides a buffer.	Moderate
School / child care	116 m	Murwillumbah Kids, a childcare centre, is located 116 m south of the camp.	Moderate

Figure 25:Bray Park, Murwillumbah sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

- Aged care
- Park / Public access
- Residential
- School

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP. Management to date has focused on community engagement and education.

Management options

Table 16 Management options for Bray Park camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	ASAP	Notify Bob Whittle Murwillumbah Airfield of the camp's location and population trends to allow airport personnel and land managers to appropriately manage strike risk (Section 3.3).	1	Nil
	Year 1 of the Plan	Install interpretive signage at all entrance points to the park to promote awareness and understanding of flying-foxes.	1	$1,000 + maintenance
	Year 1 of the Plan	Investigate options to secure funding to provide assistance to affected residents through a services subsidy program.	1	Variable
	Year 1 of the Plan	Maintain Asset Protection Zone.	1	Variable
	Year 1-2 of the Plan	Assess the suitability and function of existing buffer vegetation at the western camp extent. Implement staged replacement if required using appropriate species. Develop a succession planting plan to remove camphor laurel and other non-native trees at the residential boundary, and replace with appropriate native screening species. Exotic or other inappropriate vegetation should only be removed once plantings have reached a sufficient screening height.	2	$5,000
	Year 1-2 of the Plan	Develop a vegetation management plan for the replacement of camphor laurels and other non-native trees with appropriate native species at the eastern camp extent. Exotic vegetation should only be removed once plantings have reached a sufficient screening height. Appropriate consent or licence is to be obtained from OEH prior to work (refer Section 5.2.3)	2	$5,000
	Year 1-2 of the Plan	Investigate use of canopy mounted sprinkler system to provide opportunity to increase the buffer between houses and occupied areas of the camp.	2	Nil
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Bob Whittle Murwillumbah Airfield manager to ensure they are aware of possible changes in flying-fox activity.		
		Ensure appropriate licences are obtained from OEH prior to any planned works (Refer Section 5.2.3)		

10.1.4 Darlington Drive, Banora Point

Context

Darlington Drive camp is located to the south of Club Banora Golf Course off Darlington Drive, Banora Point. The maximum known camp extent is shown in Figure 27 and covers approximately 0.73 ha. Camp vegetation is mapped as lowland rainforest on floodplain. This was ground-truthed during site assessment and is consistent with the vegetation type on site.

Table 17 Darlington Drive camp context

Criteria	Attribute
Location	-28.224535, 153.535769
Lot and plan	306//DP710432
Tenure	Community
Current land use	Reserve
Aspect /slope	North-east to east / mostly flat
Maximum confirmed camp extent	0.73 ha
Potential for camp expansion	Moderate

552,500

DARLINGTON DRIVE

WHITE FIG COURT

COMENARA CRESCENT

GRASSMERE COURT

552,500

Figure 26: Darlington Drive, Banora Point camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 18 Darlington Drive camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Threatened species	14 species or species habitat known to occur within area (SPRAT data not mapped)	63 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	4 threatened species have been recorded within area (Figure 27)	
Local	KPoM	KMA	The camp is included within the Tweed Heads KMA	Refer to KPoM
	TVMS 2004	Vegetation type	Lowland Rainforest on Floodplain (Endangered TSC,)	Occurs on site

Figure 27: Darlington Drive, Banora Point ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Brush Box Open Forest
- Camphor Laurel Dominant Closed to Open Forest
- Lowland Rainforest on Floodplain
- Mangrove Open Forest to Woodland
- Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The camp has only recently been included in Council's quarterly monitoring under the NFFMP. The first count was carried out in November 2016 when approximately 220 BFF were recorded. On the following occasion (February 2017) there were no flying-foxes recorded at the camp. This remains the maximum to date at this camp. It is unknown when the camp first established. No complaints have been received about this camp.

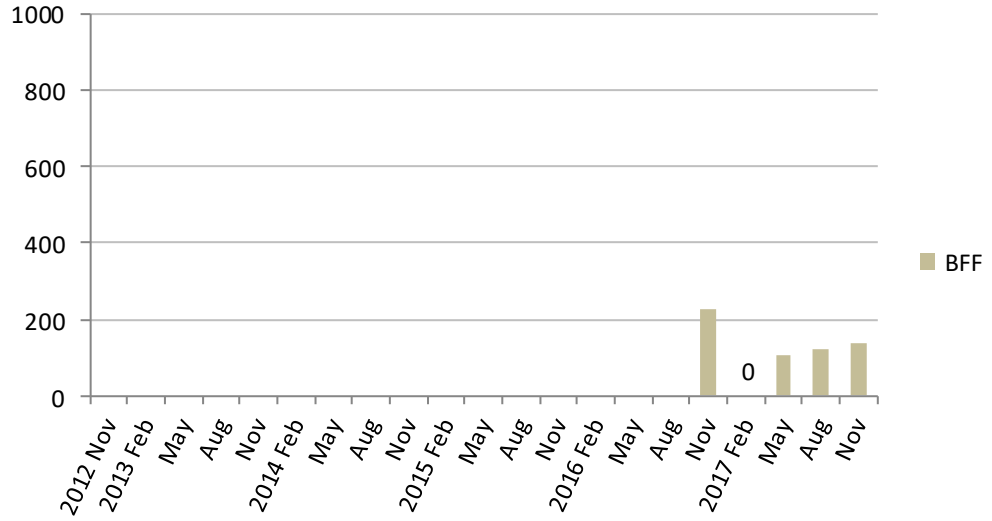


Figure 28 Darlington Drive camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Darlington Drive Camp (or within 13 km for aerodromes) are detailed in Table 19 and Figure 29. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 19 Darlington Drive camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Airport	5,712 m	Gold Coast Airport is 5.7 km north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Low
Helipad	5,300 m	A helipad is located at the Tweed Hospital 5.3 km north of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Low
Public park or access	0 m	The camp is located within a public park, adjacent to soccer fields and 30 m from Banora Club Golf Club.	Low
Residential	8 m	A residence on Darlington Drive is located directly north of the camp	Moderate
School / child care	707 m	Banora Point Primary School is east of the camp.	Very Low

Figure 29:Darlington Drive, Banora Point sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

School

Park / Public access

Residential

Unconfirmed flying-fox camp extent

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP. No management actions have been required or implemented at this site to date.

Management options

Table 20 Management options for Darlington Drive camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	ASAP	Notify the Tweed Hospital and Gold Coast Airport of the camp's location and average yearly population to allow aircraft managers and land managers to mitigate strike risk.	1	Nil
	Year 1-2 of the Plan	Install interpretive signage in the park to promote awareness and understanding of flying-foxes.	1	$500 + maintenance
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		Re-evaluate under the management framework (Section 7). Potential management options include: If flying-foxes roost in trees overhanging footpaths · trim lower branches of foraging attractants away from path · remove fiddlewood on roadside If flying-foxes roost immediately next to residences create a buffer by: · trimming native vegetation · installing deterrents (e.g. canopy-sprinklers). Any vegetation modification is to be done in accordance with an approved vegetation management plan or similar and only after any appropriate consent or licence is obtained from OEH (Refer Section 5.2.3)		

10.1.5 Elrond Drive, Chinderah

Context

Elrond Drive camp is located just outside an urban environment, to the west of Elrond Drive, Chinderah (Figure 30). The maximum known camp extent is shown in Figure 31 and covers 0.47 ha. Camp vegetation is mapped as swamp she-oak closed forest to woodland, nearby to open water. This was ground-truthed during site assessment and is consistent with vegetation type on site.

Table 21 Elrond Drive camp context

Criteria	Attribute
Location	-28.2524, 153.5649
Lot and plan	128//DP1039348
Tenure	Operational
Current land use	Bushland
Aspect / Slope	Nil / flat
Confirmed maximum camp extent	0.47 ha
Potential for camp expansion	Moderate

555,500

CHANNEL PLACE

ELROND DRIVE

555,500

Figure 30: Elrond Dr, Chinderah camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

PR2365_MP2_Extent
A4

Ecological values

Table 22 Elrond Drive camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Nil present	
		Threatened species	10 species or species habitat known to occur within area (SPRAT data not mapped)	68 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	24 threatened species have been recorded within area (Figure 31)	
Local	KPoM	KMA	The camp is included within the Southern Tweed Coast KMA	Refer to KPoM
	TVMS 2004	Vegetation type	Swamp She-oak Closed Forest to Woodland	Occurs on site

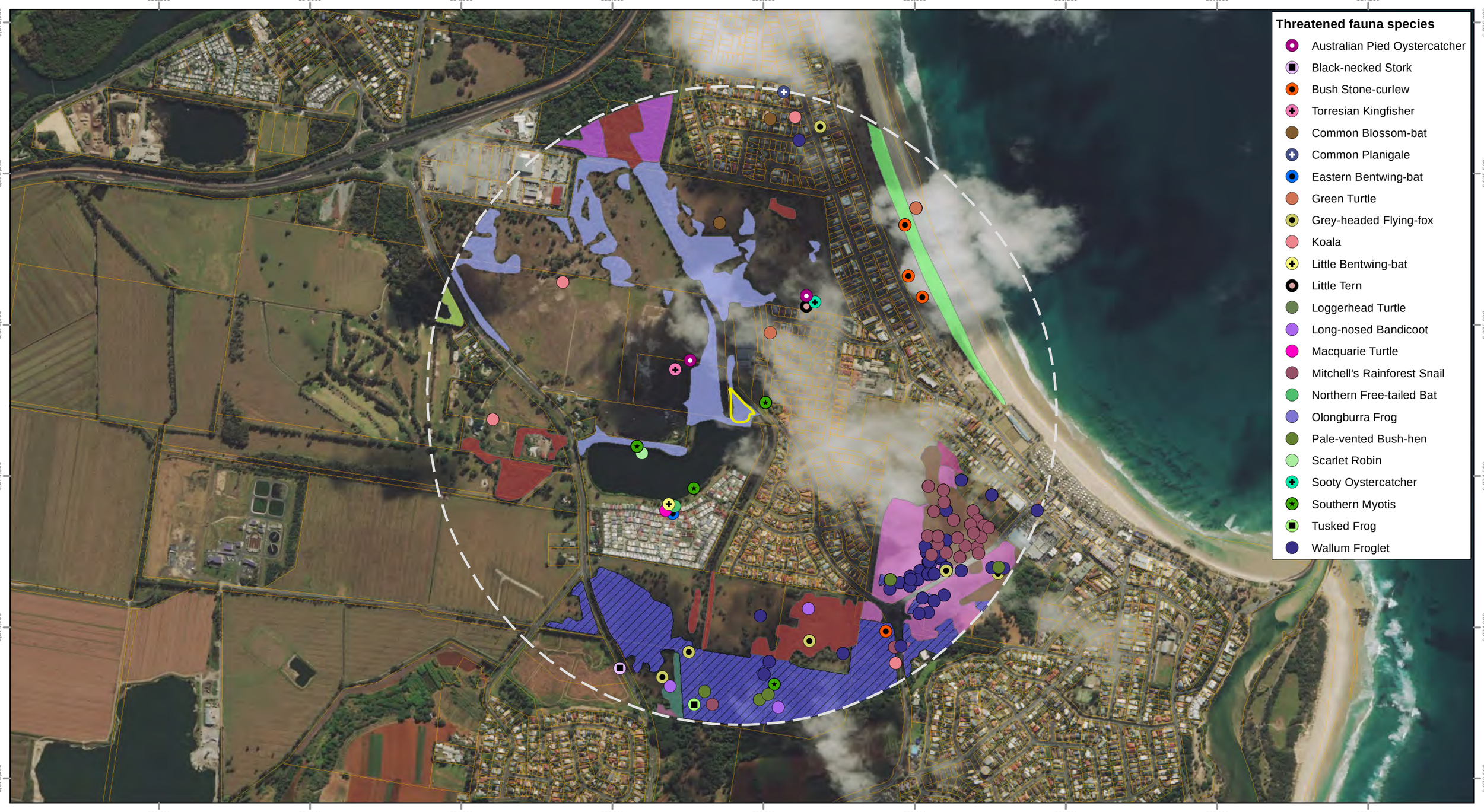


Figure 31: Elrond Dr, Chinderah ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland
- Broad-leaved Paperbark Closed Forest to Woodland
- Camphor Laurel Dominant Closed to Open Forest
- Coastal Acacia Communities
- Coastal Brush Box Open Forest to Woodland
- Coastal Forest Red Gum Open Forest to Woodland
- Fernland / Forbland (Murray & James Yes998 Study Area Only)
- Littoral Rainforest
- Post-mining Regeneration
- Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates
- Swamp She-oak Closed Forest to Woodland

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

PR2365_MP3_EcologicalValues
A4

Camp history

The camp established prior to 2012, and quarterly monitoring began at this site in November 2014 (with two additional counts prior in May 2013 and February 2014). The camp is regularly occupied by relatively small numbers of BFF, with the peak of approximately 440 recorded in May 2015. Grey-headed flying-fox were present at the camp in November 2017. The presence of this camp has caused some concern for nearby residents, who have lodged complaints in the past with Council.

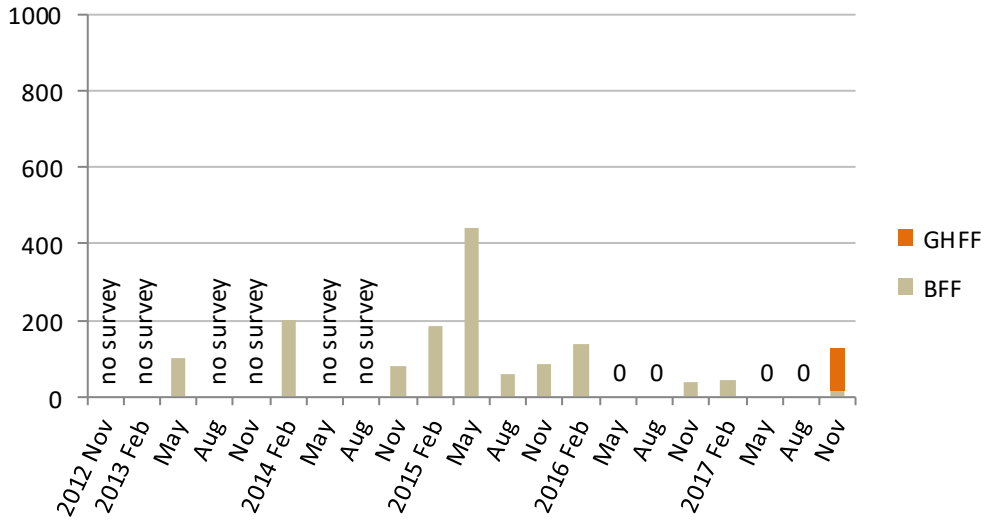


Figure 32 Elrond Drive camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Elrond Drive camp (or within 13 km for aerodromes) are detailed in Table 23 and Figure 33. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 23 Elrond Drive camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Airport	9,732 m	Gold Coast Airport is 9.7 km north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Low
Helipad	8,562 m	A helipad is located at the Tweed Hospital 8.5 km north of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Low
Public park or access	21 m	A public park is located east of the camp.	Very low
Residential	74 m	The closest residence is located on Elrond Drive, east of the camp.	Moderate
School / child care	572 m	Kingscliff Mini School is located north of the camp.	Very low

Figure 33:Elrond Dr, Chinderah sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

School

Park / Public access

Residential

Unconfirmed flying-fox camp extent

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

PR2365_MP4_SensitiveReceptors
A4

Management to date

This camp is monitored (by Council) as part of the NFFMP. Some vegetation restoration has occurred on Council land adjacent to the drainage line that borders this camp.

Management options

Table 24 Management options for Elrond Drive camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	ASAP	Notify the Tweed Hospital and Gold Coast Airport of the camp's location and average yearly population to allow airport personnel and land managers to appropriately manage strike risk (Section 3.3).	1	Nil
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		If any camp management activities are required, ensure appropriate licences are obtained from OEH (Refer Section 5.2.3)		
	Future development in the vicinity of the camp	Land use planning decisions to be made in accordance with the relevant controls of Council's Biodiversity and Habitat Management DCP and the provisions of this plan (Section 6.1.10).		

10.1.6 Frangela Drive, Murwillumbah

Context

Frangela Drive camp is located within a peri-urban environment, to the east of Frangela Drive and Kendon Avenue, Murwillumbah (Figure 34). The maximum known camp extent is shown in Figure 35 and covers 0.21 ha. Camp vegetation is mapped as camphor laurel dominant closed to open forest. This was ground-truthed during site assessment and is consistent with vegetation type on site.

Table 25 Frangela Drive camp context

Criteria	Attribute
Location	-28.329, 153.3782
Lot and plan	5//DP239140
Tenure	Operational
Current land use	Reserve
Aspect / Slope	North to north-east / mostly flat
Maximum confirmed camp extent	0.21 ha
Potential for camp expansion	Moderate

537,000

ROUS RIVER WAY

CORAL FERN CIRCUIT

KENDON AVENUE

JOSHUA STREET

FRANGELA DRIVE

537,000

Figure 34: Frangela Drive, Murwillumbah camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 26 Frangela Drive camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Threatened species	2 species known to occur within area (SPRAT data not mapped)	44 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	In addition to the GHFF, 8 threatened species have been recorded within area (Figure 35)	
Local	KPoM	KMA	The camp is not on the Tweed Coast and therefore not included within the KPoM	
	TVMS 2004	Vegetation type	Camphor Laurel Dominant Closed to Open Forest	Occurs on site

535,000 535,500 536,000 536,500 537,000 537,500 538,000 538,500 539,000

6,867,500 6,867,000 6,866,500 6,866,000 6,865,500 6,865,000

Threatened fauna species

- Comb-crested Jacana
- Koala
- Little Lorikeet

Threatened flora species

- *Cassia marksiana*
- *Diospyros mabacea*
- *Ochrosia moorei*
- *Owenia cepiodora*
- *Randia moorei*

535,000 535,500 536,000 536,500 537,000 537,500 538,000 538,500 539,000

Figure 35: Frangela Drive, Murwillumbah ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Camphor Laurel Dominant Closed to Open Forest
- Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex
- Urban Bushland

ecosure

ALA and Bionet records have been mapped. SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

Flying-foxes were first observed at the camp around August 2013, and first counted in November 2013. The camp was subsequently monitored (by Council staff) on a quarterly basis as part of the NFFMP. The camp has since been occupied by BFF and GHFF (including in November 2015 when it was occupied but not counted). Numbers of both species were highly variable and the camp was not continuously occupied since establishment. The maximum total number of flying-foxes recorded at the camp was approximately 1,330 in May 2016. The peak in BFF numbers (1,170) was recorded in May 2016 and the peak recorded GHFF was in August 2015 (330). No flying-foxes have been recorded at the camp since May 2016.

Local residents formed a committee in 2016 and campaigned for Council to manage the flying-foxes due to noise, smell and perceived health risks with using the park for picnicking and dog walking.

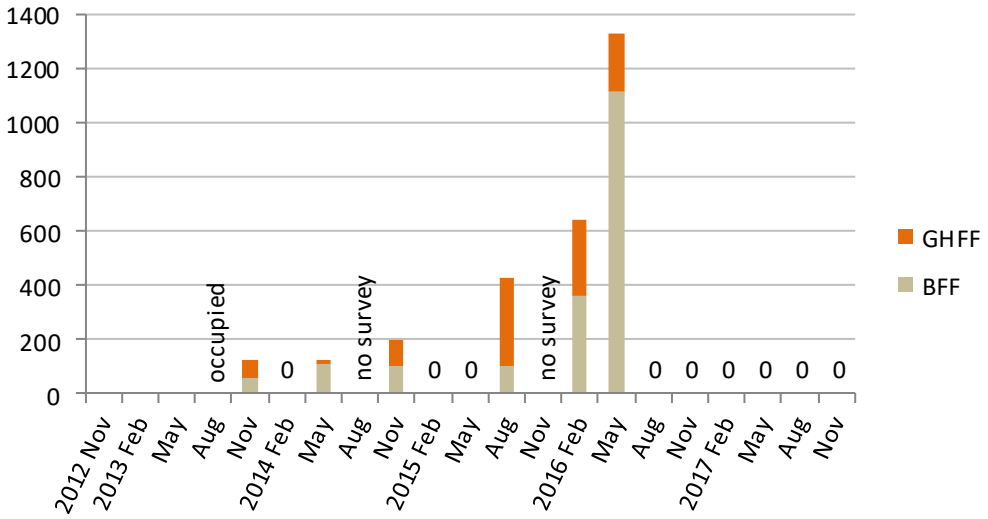


Figure 36 Frangela Drive camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Frangela Drive camp are detailed in Table 27 and Figure 37. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 27 Frangela Drive camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Aged care	509 m	Heritage Lodge Assisted Aged Care is located 509 m to the south-west of the camp.	Very low
Airfield	3,353 m	Bob Whittle Murwillumbah Airfield is 3.4 km west-north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Moderate
Public park or access	0 m	The camp is located within a public park, the Frangela Drive Reserve.	Low

Category	Proximity to camp	Details	Risk of direct impact from camp
Residential	28 m	The camp is adjacent to residences on Frangela Drive and Kendon Avenue. Buffers have been increased through camphor laurel removal to at least 28 m to residence.	Moderate
School / child care	458 m	The closest school is 458 m to the north-west of the camp.	Very low

Figure 37:Frangela Drive, Murwillumbah sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

- Aged care
- Park / Public access
- Residential
- School

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP.

In 2016, Council developed a proposal to create buffers to the closest residence through the removal of camphor laurel. A section 95 certificate was issued by NSW OEH for these works. The works were completed after flying-foxes seasonally vacated the site in August 2016. Follow-up vegetation maintenance has been undertaken to restrict weed species proliferation and restore local rainforest species. Council has also installed educational signage.

Management options

Table 28 Management options for Frangela Drive camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Notify Bob Whittle Murwillumbah Airfield of the camp's location and population trends to allow airport personnel and land managers to appropriately manage strike risk (Section 3.3).	1	Nil
	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	ASAP	Install fencing to limit access / reduce disturbance to vegetation containing Mitchells rainforest snail	2	$10,000
	ASAP	Ensure compatibility of recreational uses within park (e.g. dog off-leash area and picnic area)	1	Nil
	Ongoing	Maintain buffer to residential properties	2	$5,000/year
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Bob Whittle Murwillumbah Airfield manager to ensure they are aware of possible changes in flying-fox activity.		
		If any management actions are required, ensure appropriate licences are obtained from OEH (Refer Section 5.2.3)		
	Future development in the vicinity of the camp	Land use planning decisions to be made in accordance with the relevant controls of Council's Biodiversity and Habitat Management DCP and the provisions of this plan (Section 6.1.10).		

10.1.7 Kingscliff Library

Context

Kingscliff Library camp is located to the east of the Kingscliff Library off Cudgen Road, Kingscliff (Figure 38). The maximum known camp extent is shown in Figure 39 and covers 0.06 ha, with the potential for as much as 0.72 ha. Camp vegetation is mapped as broad-leaved paperbark closed forest to woodland. This was ground-truthed during the site assessment and is consistent with vegetation type on site.

Table 29 Kingscliff Library camp context

Criteria	Attribute
Location	-28.259399, 153.573161
Lot and plan	4//DP1179360
Tenure	Operational, road reserve
Current land use	Bushland
Aspect / Slope	Mostly north / 5-12^0 incline
Maximum confirmed camp extent	0.06 ha
Potential for camp expansion	Moderate

Figure 38: Kingscliff Library, Kingscliff camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Unconfirmed flying-fox camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 30 Kingscliff Library camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	N/A	Not present
		Threatened species	16 species or species habitat known to occur within area (SPRAT data not mapped)	69 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	22 threatened species have been recorded within area (Figure 39)	
Local	KPoM	KMA	The camp is included within the Southern Tweed Coast KMA	Refer to KPoM
	TVMS 2004	Vegetation type	Broad-leaved Paperbark Closed Forest to Woodland Fernland	Occurs on site

554,000 554,500 555,000 555,500 556,000 556,500 557,000 557,500 558,000 558,500

6,875,000 6,874,500 6,874,000 6,873,500 6,873,000

Threatened fauna species

- Albert's Lyrebird
- Australian Pied Oystercatcher
- Black-tailed Godwit
- Bush Stone-curlew
- Common Planigale
- Fairy Penguin
- Glossy Black-Cockatoo
- Great Knot
- Grey-headed Flying-fox
- Koala
- Little Tern
- Long-nosed Bandicoot
- Mitchell's Rainforest Snail
- Olongburra Frog
- Pale-vented Bush-hen
- Rose-crowned Fruit-dove
- Sooty Oystercatcher
- Southern Myotis
- Tusked Frog
- Wallum Froglet
- White-eared Monarch

Threatened flora species

- *Cryptocarya foetida*

554,000 554,500 555,000 555,500 556,000 556,500 557,000 557,500 558,000 558,500

Figure 39: Kingscliff Library, Kingscliff ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Unconfirmed flying-fox camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Banksia Dry Sclerophyll Open Forest to Shrubland
- Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland
- Broad-leaved Paperbark Closed Forest to Woodland
- Coastal Acacia Communities
- Coastal Brush Box Open Forest to Woodland
- Early Regrowth Rainforest
- Fernland / Forbland (Murray & James Yes998 Study Area Only)
- Littoral Rainforest
- Mangrove Open Forest to Woodland
- Post-mining Regeneration
- Sedgeland / Rushland (Murray & James Yes998 Study Area Only)

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The camp established prior to 2015, however the exact date is not known. Monitoring has been carried out (by Council staff) on a quarterly basis since May 2016 as part of the NFFMP. On monitoring occasions when the camp has been occupied, up to 100 BFF have been recorded. The actual number is likely to be higher, as visibility is highly limited at this camp.

Flying-foxes have been recorded during four of the seven quarterly monitoring events to date, however local residents have reported more regular occupation, generally during winter months. Nearby residents have registered concerns with Council relating to noise and amenity impact due to the camp's presence.

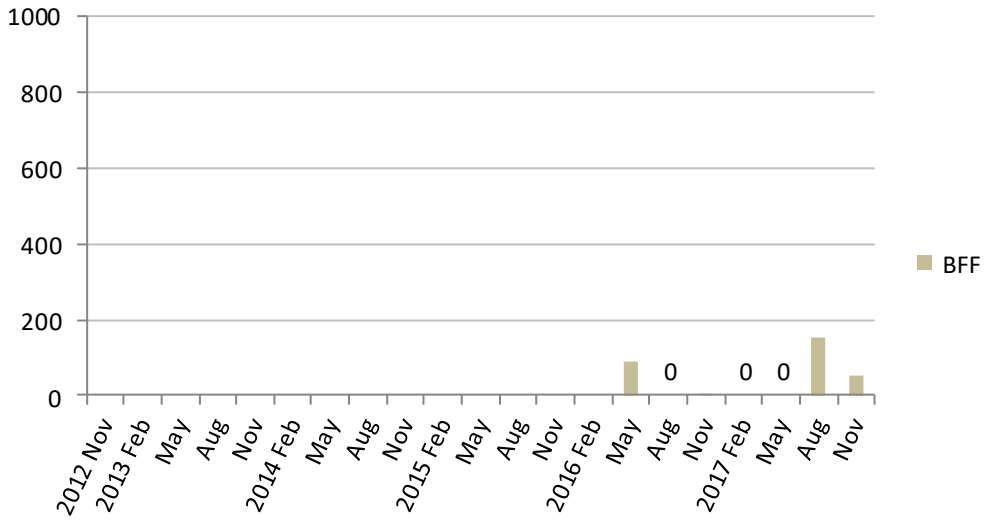


Figure 40 Kingscliff Library camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Kingscliff Library camp (or within 13 km for aerodromes) are detailed in Table 31 and Figure 41. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 31 Kingscliff Library camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Airport	10,804 m	Gold Coast Airport is 10.8 km north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Low
Hospital	223 m	Tweed Valley Respite Centre is 223 m from the camp	Low
Helipad	9,450 m	A helipad is located at the Tweed Hospital, 9.4 km north of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land manager (see Section 3.3).	Low

Category	Proximity to camp	Details	Risk of direct impact from camp
Public park or access	123 m	Kingscliff Library is located west of the camp.	Very low
Residential	46 m	Several residences on Cudgen Road occur south of the camp.	Low
School / child care	149 m	St Anthony's Catholic Primarily School is east-north-east of the camp and is the closest of several schools in the area.	Very low

554,500 555,000 555,500 556,000 556,500 557,000 557,500 558,000

6,875,000 6,874,500 6,874,000 6,873,500 6,873,000

Elrond Dr, Chinderah

Gold Coast Airport 10.9 km

Tweed Hospital Helipad 9.3 km

270 m

149 m

519 m

123 m

223 m

46 m

618 m

659 m

554,500 555,000 555,500 556,000 556,500 557,000 557,500 558,000

Figure 41:Kingscliff Library, Kingscliff sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

Hospital

Park / Public access

Residential

School

Unconfirmed flying-fox camp extent

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

PR2365_MP4_SensitiveReceptors
A4

Management to date

This camp is monitored (by Council) as part of the NFFMP. No management actions have been required or implemented at this site to date.

Management options

Table 32 Management options for Kingscliff Library camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Notify the Tweed Hospital and Gold Coast Airport of the camp's location and average yearly population to allow aircraft managers to jointly manage strike risk with land managers (Section 3.3).	1	Nil
	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	Future development in the vicinity of the camp	Land use planning decisions to be made in accordance with the relevant controls of Council's Biodiversity and Habitat Management DCP and the provisions of this plan (Section 6.1.10).		
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		If any management actions are required, ensure appropriate licences are obtained from OEH (Refer Section 5.2.3)		

10.1.8 Oxley Cove, Banora Point

Context

Oxley Cove camp is located to the west of Chinderah Bay off Bosun Boulevard, Tweed Heads (Figure 42). The maximum known camp extent occupied is shown in Figure 43 and covers 1.08 ha. Camp vegetation is mapped as swamp she-oak closed forest and mangrove open forest to woodland. This was ground-truthed during the site assessment and is consistent with vegetation type on site.

Table 33 Oxley Cove camp context

Criteria	Attribute
Location	-28.23099, 153.545844
Lot and plan	229 / DP261796
Tenure	Community, Waterway
Current land use	Bushland
Aspect / slope	East / mostly flat
Maximum confirmed camp extent	1.08 ha
Potential for camp expansion	Moderate

553,500

SEAFARER PLACE

6,877,000

553,500

Figure 42: Oxley Cove, Banora Point camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

PR2365_MP2_Extent
A4

Ecological values

Table 34 Oxley Cove camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Threatened species	15 species or species habitat known to occur within area (SPRAT data not mapped)	67 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	11 threatened species have been recorded within area (Figure 43)	
	SEPP 14	Coastal Wetlands	State significant wetlands	
Local	KPoM	Koala habitat	The camp is included within the Tweed Heads KMA	
	TVMS 2004	Vegetation type	Mangrove Open Forest to Woodland Swamp She-oak Closed Forest to Woodland	Occurs on site

Figure 43: Oxley Cove, Banora Point ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland
- Camphor Laurel Dominant Closed to Open Forest
- Littoral Rainforest
- Lowland Rainforest on Floodplain
- Mangrove Open Forest to Woodland
- Saltmarsh Communities
- Sedgeland / Rushland (Murray & James Yes998 Study Area Only)
- Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates
- Swamp She-oak Closed Forest to Woodland

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The earliest flying-fox record for this location is from 1992, it is unknown whether a camp was established at this time. A count of approximately 1000 GHFF was recorded in the NSW BioNet Atlas in 2001. The camp has been monitored (by Council staff) on a quarterly basis since November 2012 as part of the NFFMP. During this time it has been occasionally occupied by BFF and GHFF. The maximum total number of flying-foxes recorded at the camp was approximately 850 in May 2014. BFF numbers peaked at this time (250), however, GHFF numbers reached a maximum (640) in May 2013. No flying-foxes have been recorded since May 2014.

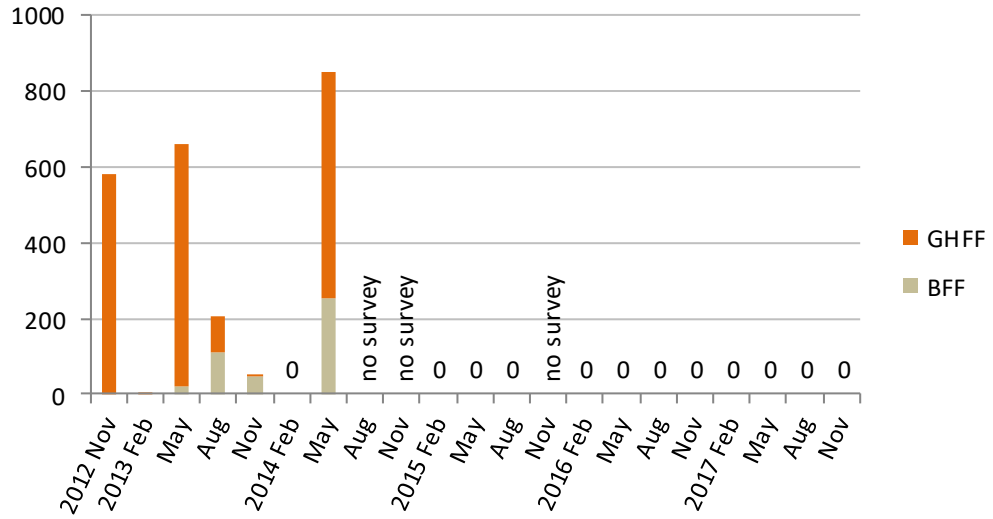


Figure 44 Oxley Cove camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Oxley Cove camp (or within 13 km for aerodromes) are detailed in Table 35 and Figure 45. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 35 Oxley Cove camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Airport	6,767 m	Gold Coast Airport is 6.8 km north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Moderate
Helipad	5,744 m	A helipad is located at the Tweed Hospital, 5.74 km north of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Moderate
Public park or access	274 m	A public park is located south-west of the camp.	Very low
Residential	2 m	The camp's southern boundary is shared with several residences on Bosun Boulevard.	High (if camp returns to the southern part of its prior extent)

Category	Proximity to camp	Details	Risk of direct impact from camp
School / child care	838 m	Banora Point Primary School is to the north-east of the camp.	Very low

Figure 45:Oxley Cove, Banora Point sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

School

Park / Public access

Residential

Unconfirmed flying-fox camp extent

ecosure

Distances measured from
measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP. No management actions have been required or implemented at this site to date.

Management options

Table 36 Management options for Oxley Cove camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Notify the Tweed Hospital and Gold Coast Airport of the camp's location and average yearly population to allow aircraft managers to jointly manage strike risk with land managers (Section 3.3).	1	Nil
	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
Adaptive	If flying-foxes return to the camp.	Remove non-native vegetation (e.g. umbrella trees) to discourage flying-foxes from roosting immediately adjacent to residences.		
	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		Potential management option may be to increase buffer where camp meets property boundaries on Seafarer Place and Bosun Boulevard. Any vegetation modification is to be done in accordance with an approved vegetation management plan or similar and only after any appropriate consent or licence is obtained from OEH (Refer Section 5.2.3)		

10.1.9 Pottsville Environmental Park, Pottsville

Context

Pottsville camp is located in Pottsville Environmental Park generally along the banks of Cudgera Creek (Figure 46). The maximum known camp extent is shown in Figure 47 and covers 3.71 ha. Camp vegetation is mapped as coastal swamp box open forest to woodland, swamp she-oak closed forest to woodland and coastal pink bloodwood open forest to woodland. This was ground-truthed during the site assessment and is consistent with vegetation type on site.

Table 37 Pottsville camp context

Criteria	Attribute
Location	-28.385717, 153.565415
Lot and plan (each lot and plan corresponds with the same numbered tenure below)	1. 4//DP1062338 2. 8208//DP755701 3. 7008//DP1056637
Tenure	1. Council Administered Crown Land 2. Waterway 3. State Crown Land
Current land use	Bushland
Aspect / slope	Variable / mostly flat
Maximum confirmed camp extent	3.71 ha
Potential for camp expansion	High

555,000

555,500

6,860,000

6,860,000

CENTENNIAL DRIVE

SURFSIDE CRESCENT

BORONIA AVENUE

TWEED COAST ROAD

SEABRAE COURT

ELANORA AVENUE

URUNGA DRIVE

SUFFOLK PARADE

BALLINA STREET

KOROORA PARKWAY

555,000

555,500

Figure 46: Pottsville Environmental Park, Pottsville camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

PR2365_MP2_Extent
A4

Ecological values

Table 38 Pottsville camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Subtropical and Temperate Coastal Saltmarsh (V)	Likely to occur within area
		Threatened species	74 threatened species or species habitat may occur within area (SPRAT data not mapped)	15 species or species habitat known to occur within area
State	ALA and Bionet	Threatened species	15 threatened species have been recorded within area (Figure 47)	
Local	KPoM	KMA	The camp is included within the Southern Tweed Coast KMA	Refer to KPoM
	TVMS 2004	Vegetation type	Coastal Swamp Box Open Forest to Woodland Swamp She-oak Closed Forest to Woodland	Occurs on site

552,500 553,000 553,500 554,000 554,500 555,000 555,500 556,000 556,500 557,000 557,500 558,000

6,861,000 6,860,500 6,860,000 6,859,500 6,859,000 6,858,500

Threatened fauna species

- Australian Pied Oystercatcher
- Black Bittern
- Black-necked Stork
- Bush Stone-curlew
- Common Planigale
- Glossy Black-Cockatoo
- Green Turtle
- Grey-headed Flying-fox
- Koala
- Little Bentwing-bat
- Loggerhead Turtle
- Sooty Oystercatcher
- Southern Myotis
- White-bellied Sea-eagle

Threatened flora species

- *Acronychia littoralis*

Figure 47: Pottsville Environmental Park, Pottsville ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Banksia Dry Sclerophyll Open Forest to Shrubland
- Black She-oak Low Open Forest to Woodland
- Blackbutt Open Forest Complex
- Broad-leaved Paperbark + Eucalyptus spp.+/- Swamp Box Closed Forest to Woodland
- Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland
- Broad-leaved Paperbark Closed Forest to Woodland
- Coastal Brush Box Open Forest to Woodland
- Coastal Forest Red Gum Open Forest to Woodland
- Coastal Pink Bloodwood Open Forest to Woodland
- Coastal Swamp Box Open Forest to Woodland
- Coastal Swamp Mahogany Open Forest to Woodland
- Exotic Plantation
- Foredune Complex
- Littoral Rainforest
- Mangrove Open Forest to Woodland
- Post-mining Regeneration
- Saltmarsh Communities
- Sedgeland / Rushland (Murray & James Yes998 Study Area Only)
- Swamp She-oak Closed Forest to Woodland

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200 Metres

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

Camp history

A flying-fox camp has been present at this location since at least 2007. The camp has been monitored (by Council staff) on a quarterly basis since November 2012 as part of the NFFMP. It has been regularly occupied by a fairly consistent number of BFF and GHFF, with an uncharacteristic influx of approximately 6,200 flying-foxes in May 2017 (5,350 GHFF and 850 BFF). Numbers are generally higher during winter months.

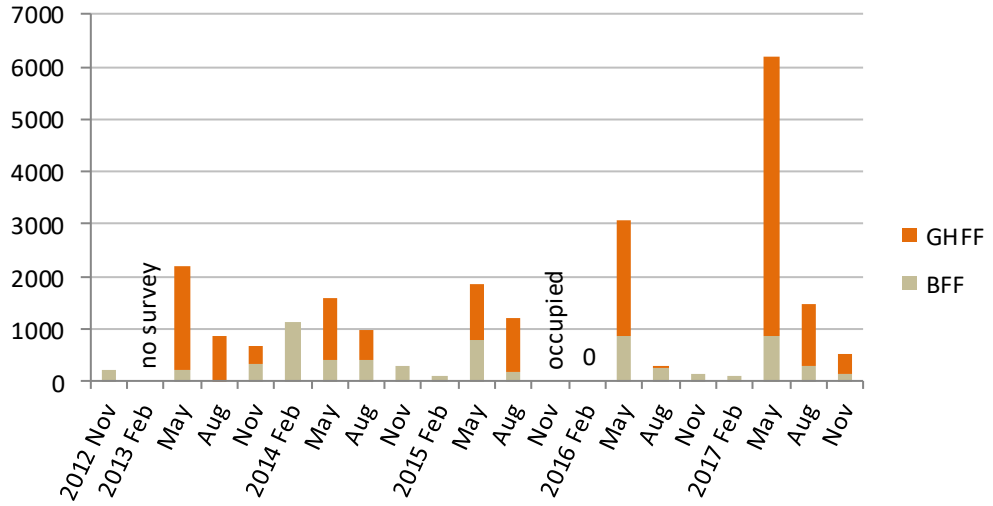


Figure 48 Pottsville camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Pottsville camp (or within 13 km for aerodromes) are detailed in Table 39 and Figure 49. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 39 Pottsville camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Aged care	887 m	Bupa Aged Care Pottsville Beach is located almost 1 km west of the camp.	Very low
Public park or access	0 m	The camp is located within a public park that contains: · walking and cycling tracks · boardwalks · viewing platforms · a camping area with kitchen and toilet/shower facilities · public barbeques · picnic tables and water fountains.	Low
Residential	40 m	The closest residence is on Tweed Coast road, 40 m east of the known camp boundary. This property and several residences north of it are separated from the camp by Cudgera Creek.	Moderate
School / child care	455 m	Pottsville Community School is the closest school, located to the south-west of the southern camp extent.	Very low

Figure 49:Pottsville Environmental Park, Pottsville sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

Aged care

Park / Public access

Residential

School

ecosure

Distances measured from
measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

PR2365_MP4_SensitiveReceptors
A4

Management to date

This camp is monitored as part of the NFFMP. No management actions have been required or implemented at this site to date.

Management options

Table 40 Management options for Pottsville camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Conduct a letterbox drop within 100 m of the camp, promoting awareness of flying-foxes that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100
	ASAP	Ensure compatibility of recreational uses within park (e.g. no horse riding / dirt bike riding)	1	Nil
	ASAP	Install interpretive signage in the park to promote awareness and understanding of flying-foxes.	1	$500 + maintenance
	Year 1-2 of the Plan	Investigate tourism or innovative methods to increase awareness and education	1	Nil
Adaptive	If stakeholders express concern about camp presence	Engage the community to promote awareness and understanding of flying-foxes, and dispel misconceptions (e.g. unwarranted fear of disease).		
	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). If any management actions are required, ensure appropriate licences are obtained from OEH (Refer Section 5.2.3)		

10.1.10 Terranora Broadwater

Context

Terranora Broadwater camp is located on an uninhabited and unnamed island within the Terranora Broadwater, Tweed Heads (Figure 50). The maximum known camp extent is shown in Figure 51 and covers 1.44 ha. Camp vegetation is mapped as mangrove open forest and swamp she-oak closed forest to woodland. This was ground-truthed during the site assessment and is consistent with vegetation type on site. A number of other islands in the estuary have been used by flying-fox in the past, including Daveys Island, Caddys Island, Tonys Island and Big Island.

Table 41 Terranora Broadwater camp context

Criteria	Attribute
Location	-28.20224, 153.50396
Lot and plan	1832//DP1188212
Tenure	State Crown Land
Aspect /slope	North / mostly flat
Current land use	Bushland
Maximum confirmed camp extent	1.44 ha
Potential for camp expansion	Moderate

Figure 50: Terranora Broadwater camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Unconfirmed flying-fox camp extent

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

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

Ecological values

Table 42 Terranora Broadwater camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	May occur within area
		Threatened species	14 species or species habitat known to occur within area (SPRAT data not mapped)	62 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	11 threatened species have been recorded within area (Figure 51)	
	SEPP 14	Coastal wetlands	State significant wetlands	
Local	KPoM	KMA	The camp is included within Tweed Heads KMA	Refer to KPoM
	TVMS 2004	Vegetation type	Mangrove Open Forest to Woodland Swamp She-oak Closed Forest to Woodland	Occurs on site

Figure 51: Terranora Broadwater ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Blackbutt Open Forest Complex
- Brush Box Open Forest
- Camphor Laurel Dominant Closed to Open Forest
- Early Regrowth Rainforest
- Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex
- Mangrove Open Forest to Woodland
- Saltmarsh Communities
- Swamp She-oak Closed Forest to Woodland
- Tallowwood Open Forest

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

Flying-fox camps have been recorded occupying a number of nearby islands since at least 2001. The camp in its current location has been monitored (by Council staff) on a quarterly basis since February 2013 as part of the NFFMP, and has been consistently occupied by BFF and GHFF since then (except in November 2016 when zero GHFF were recorded). The maximum total number of flying-foxes recorded at the camp was approximately 3,960 in May of 2013 (3,600 BFF and 360 GHFF).

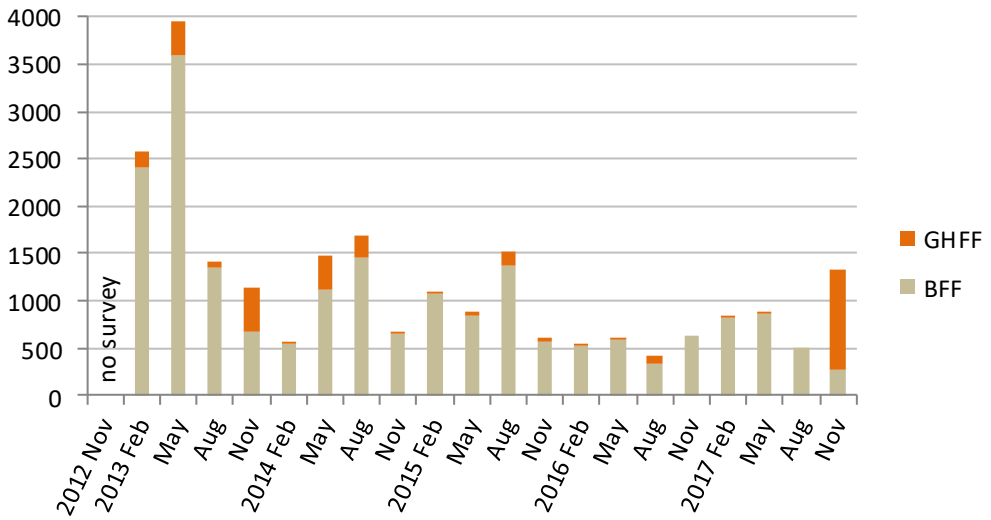


Figure 52 Terranora Broadwater flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Terranora Broadwater camp (or within 13 km for aerodromes) are detailed in Table 43 and Figure 53. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 43 Terranora Broadwater camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Airport	2,877 m	Gold Coast Airport is 2.9 km north of the camp. The risk of flying-fox strike must be jointly managed by airport personnel and land managers (see Section 3.3).	High
Helipad	4,664 m	A helipad is located at the Tweed Hospital, 4.6 km north-east of the camp. The risk of flying-fox strike must be appropriately managed by aviation personnel (see Section 3.3).	Moderate
Public park or access	113 m	A park is located east of the camp, and is separated from the camp by a water passage.	Very low
Residential	135 m	A residence is located 135 m east of the camp but is separated from the camp by a water passage.	Low

Figure 53:Terranora Broadwater sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

Park / Public access

Residential

Unconfirmed flying-fox camp extent

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored as part of the NFFMP. This camp is located on an island, sufficiently separated from sensitive receptors by water, and thus no management has been required.

Management options

Table 44 Management options for Terranora Broadwater camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Notify the Tweed Hospital and Gold Coast Airport of the camp's location and average yearly population to allow aircraft managers to jointly manage strike risk with land managers.	1	Nil
	ASAP	Liaise with businesses who use estuary (e.g. tour groups). Ensure boats maintain appropriate speeds and distances from islands that are occupied by flying-fox, particularly during breeding season.	1	Nil
Adaptive	If stakeholders express concern about camp presence	Engage the community to promote awareness and understanding of flying-foxes, and dispel misconceptions (i.e. unwarranted fear of disease).		
	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		If any management action is required, ensure appropriate licences are obtained from OEH (Refer Section 5.2.3)		

10.1.11 Toolona Avenue, Banora Point

Context

Toolona Avenue camp is located within an urban environment, on the corner of Toolona Avenue and Cominan Avenue, Banora Point (Figure 54). The maximum known camp extent is shown in Figure 55 and covers 0.05 ha. The camp site does not contain mapped vegetation and was ground-truthed during the site assessment.

Table 45 Toolona Avenue camp context

Criteria	Attribute
Location	-28.218115, 153.544159
Lot and plan	193//DP261752
Tenure	Community
Current land use	Bushland
Aspect / slope	North-west to west / flat to moderate incline
Maximum confirmed camp extent	0.05 ha
Potential for camp expansion	Low

553,500

6,878,500

TOOLONA AVENUE

ST ANDREWS WAY

COMINAN AVENUE

WIDGEE AVENUE

6,878,500

553,500

Figure 54: Toolona Ave, Banora Point camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 46 Toolona Avenue camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Threatened species	17 species or species habitat known to occur within area (SPRAT data not mapped)	66 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	15 threatened species have been recorded within area (Figure 55)	
Local	KPoM	KMA	The camp is included within the Tweed Heads KMA	Refer to KPoM
	TVMS 2004	Vegetation type	Early Regrowth Rainforest (E TSC)	Occurs on site

551,500 552,000 552,500 553,000 553,500 554,000 554,500 555,000 555,500

6,879,500 6,879,000 6,878,500 6,878,000 6,877,500

Threatened fauna species

- Albert's Lyrebird
- Australian Pied Oystercatcher
- Torresian Kingfisher
- Comb-crested Jacana
- Flesh-footed Shearwater
- Koala
- Little Tern
- Mitchell's Rainforest Snail
- Pale-vented Bush-hen

Threatened flora species

- *Grammitis stenophylla*
- *Grevillea hilliana*
- *Lepiderema pulchella*
- *Macadamia tetraphylla*
- *Randia moorei*
- *Syzygium hodgkinsoniae*

551,500 552,000 552,500 553,000 553,500 554,000 554,500 555,000 555,500

Figure 55: Toolona Ave, Banora Point ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Broad-leaved Paperbark Closed Forest to Woodland
- Coastal Acacia Communities
- Early Regrowth Rainforest
- Lowland Rainforest on Floodplain
- Mangrove Open Forest to Woodland
- Swamp She-oak Closed Forest to Woodland
- Sydney Blue Gum Open Forest

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

Monitoring began at this camp in November 2016. BFF numbers have remained low (approximately 60 in November 2016; 85 in February 2017) in this camp since monitoring began.

Council has received numerous complaints regarding this camp.

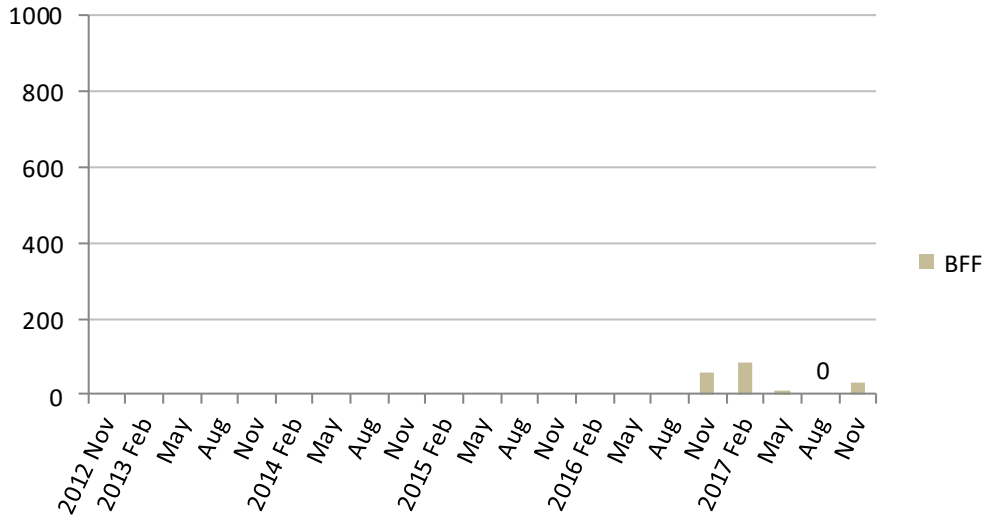


Figure 56 Toolona Avenue camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Toolona Avenue camp (or within 13 km for aerodromes) are detailed in Table 47 and Figure 57. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 47 Toolona Avenue camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Aged care	373 m	Freedom Aged Care Banora Point is 379 m south-east of the camp.	Very low
Airport	5,474 m	Gold Coast Airport is 5.5 km north-west of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel (see Section 3.3).	Low
Helipad	4,404 m	A helipad is located at the Tweed Hospital, 4.4 km north of the camp. The risk of flying-fox strike must be jointly managed by aviation personnel and land managers (see Section 3.3).	Low
Public park or access	0 m	The camp is located within a public green space.	Low
Residential	20 m	The distance between the camp and the nearest two residences is approximately 20 m.	Moderate
School / child care	406 m	Banora Point Primary School is south of the camp.	Very low

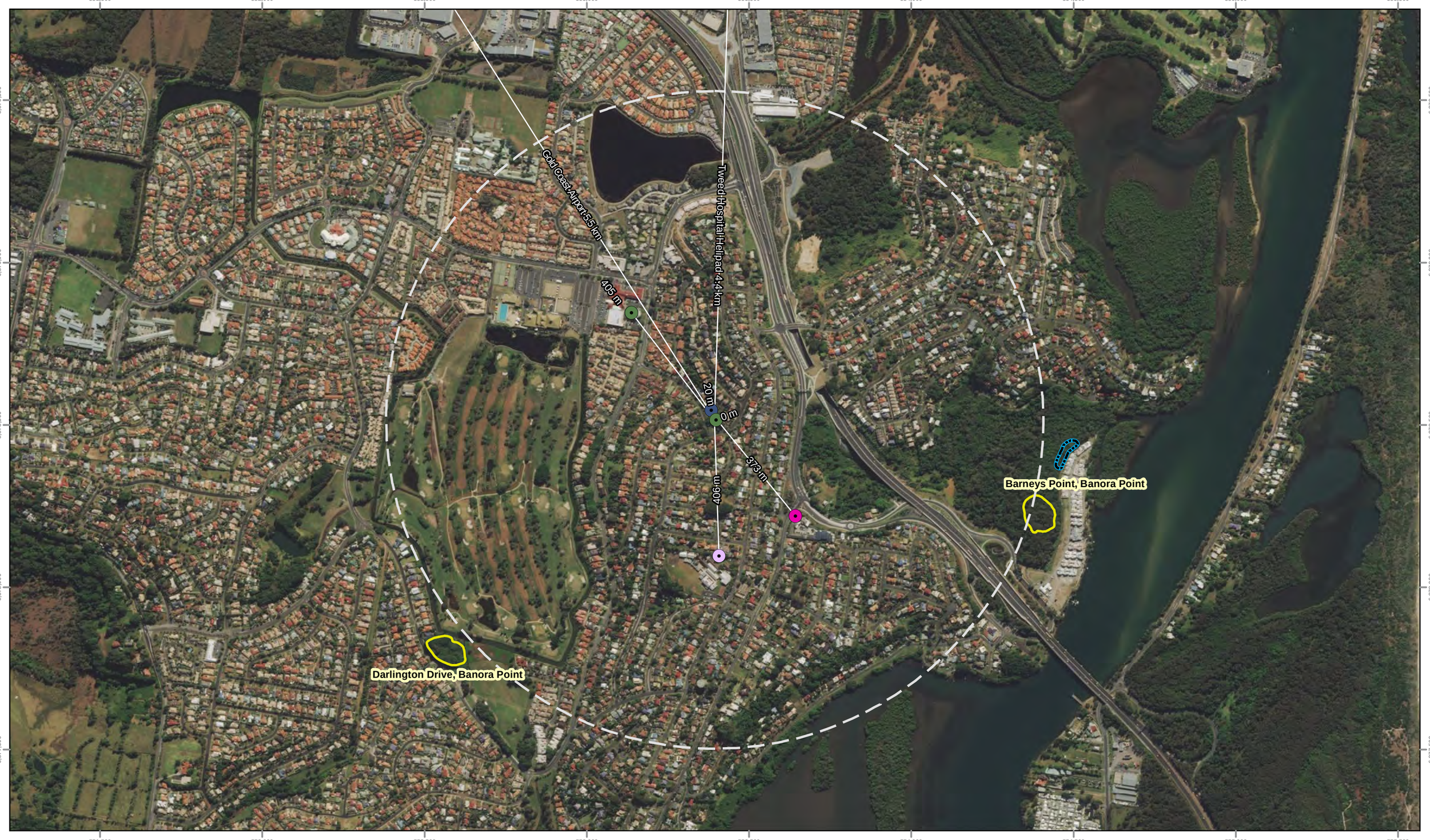


Figure 57:Toolona Ave, Banora Point sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

Aged care

Park / Public access

Residential

School

Unconfirmed flying-fox camp extent

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP. Ongoing weed control work is being undertaken.

Management options

This camp occurs in a very small park in a built up residential area. The likelihood of this site being used in the long term is considered to be low. Council will continue to monitor the camp and respond to any change in accordance with the plan's Management Framework (Section 7).

Table 48 Management options for Toolona Avenue camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Notify the Tweed Hospital and Gold Coast Airport of the camp's location allow aircraft managers to jointly manage strike risk with land managers.	1	Nil
	ASAP	Conduct a letterbox drop within 100 m of the camp to promote awareness of flying-fox issues that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.	1	<$100

10.1.12 Tyalgum Creek, Tyalgum

Context

The northern extent of the camp is located along Tyalgum Creek off Carraboi Terrace, while the southern is located adjacent to Carraboi Terrace and Tyalgum Creek Road, Tyalgum (Figure 58). The maximum known camp extent is shown in Figure 59 and covers 1.33 ha. The site contains camphor laurel dominant closed forest and casuarina within the vegetation canopy.

Table 49 Tyalgum Creek camp context

Criteria	Attribute
Location	-28.352608, 153.205409
Lot and plan (each lot and plan corresponds with the same numbered tenure below)	1. 63//DP755748 2. 64//DP755748 3. 1//607435
Tenure	1. Operational 2. Operational 3. Private
Current land use	Operational, road reserve, rural
Aspect / slope	North to north-east / mostly flat
Maximum confirmed camp extent	1.33 ha
Potential for camp expansion	Low/moderate

520,000

TYALGUM CREEK ROAD

CARRABOI TERRACE

HOBWEE STREET

COOLMAN STREET

6,863,500

520,000

6,863,500

Figure 58: Tyalgum Creek, Tyalgum camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

PR2365_MP2_Extent
A4

Ecological values

Table 50 Tyalgum Creek ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	May occur within area
		Threatened species	3 species or species habitat known to occur within area (SPRAT data not mapped)	36 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	In addition to the GHFF, 3 threatened species have been recorded within area (Figure 59)	
Local	KPoM	KMA	The camp is not on the Tweed Coast and therefore not included within the KPoM	
	TVMS 2004	Vegetation type	Camphor Laurel Dominant Closed to Open Forest	Occurs on site

517,500 518,000 518,500 519,000 519,500 520,000 520,500 521,000 521,500 522,000 522,500

6,865,000 6,864,500 6,864,000 6,863,500 6,863,000 6,862,500

Threatened fauna species

- Giant Barred Frog

Threatened flora species

- *Diospyros mabacea*
- *Endiandra hayesii*

517,500 518,000 518,500 519,000 519,500 520,000 520,500 521,000 521,500 522,000 522,500

Figure 59: Tyalgum Creek, Tyalgum ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Camphor Laurel Dominant Closed to Open Forest
- Flooded Gum Open Forest
- River She-oak Open Forest
- Tallowwood Open Forest

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The occupation of Tyalgum Creek camp was first reported to Council in November 2015. The maximum number of flying-foxes recorded at the camp was approximately 5,580 GHFF in February 2016. BFF have been recorded in February 2017 (630) and May (840). The camp has also been unoccupied on a number of occasions since monitoring commenced.

The camp is located within close range of Tyalgum Showground and Camping site and Tyalgum Public School. There have been a number of complaints and concerns submitted to Council regarding noise and odour from flying-foxes at the site and the loss of business and tourism related to the camp's proximity to the campground.

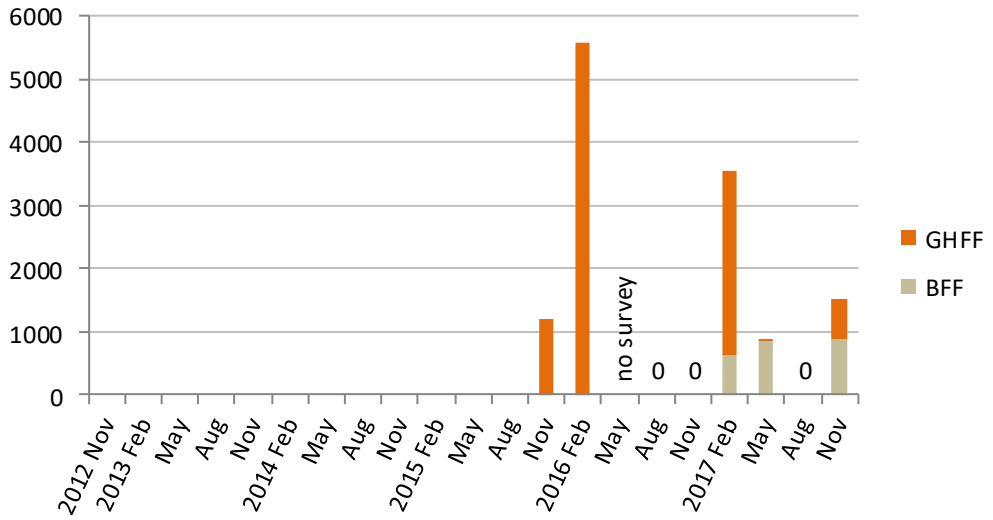


Figure 60 Tyalgum Creek camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Tyalgum Creek camp (or within 13 km for aerodromes) are detailed in Table 51 and Figure 61. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 51 Tyalgum Creek camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Public park or access	38 m	Tyalgum Showgrounds and Camping Ground is located approximately 38 m to the east of the camp.	Low
Equine	38 m	Equine events are held at the Showgrounds.	Moderate
Residential	52 m	A residence on the corner of Carraboi Terrace and Coolman Street is located 52 m from the southern boundary of the southern camp extent.	Moderate
School / child care	18 m	Several trees along the southern boundary of the southern camp extent occur on the property at Tyalgum Public School.	Moderate

518,000 518,500 519,000 519,500 520,000 520,500 521,000 521,500 522,000 522,500

6,865,000 6,864,500 6,864,000 6,863,500 6,863,000 6,862,500

38 m
38 m
18 m
52 m
Cougal St, Tyalgum

Figure 61:Tyalgum Creek, Tyalgum sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

- Equine
- Park / Public access
- Residential
- School

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP. No management has been implemented at this site to date.

Management options

Table 52 Management options for Tyalgum Creek camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Education and consultation · local information sessions · assist with positive publicity · liaise with Tyalgum District Community Association · provide list of aromatic non-flying-fox attracting plants to the managers of the nearby public reserve and campground · interpretive information for campground (e.g. brochure and signage), including general health and water quality	1	$1000
	ASAP	Planting plan a. Liaise with the TSC Water Unit to determine feasibility of additional plantings on the western side of Tyalgum Creek to establish flying-fox roost habitat away from high conflict areas. b. Prepare site plan to identify planting areas, species selection (including suitable shade species for horses) and relevant fencing and maintenance requirements c. Identify resources for site preparation, planting and maintenance. d. Implement planting.	1	$5000 (site plan, preparation and fencing). Planting and maintenance cost dependant on area planted.
	ASAP	Inform managers of the adjacent public reserve, campground of the critical importance for horses using the area to be HeV vaccinated and for horses to be excluded from within the tree canopy area.	1	Nil
Adaptive	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Liaise with the Tweed Hospital and Gold Coast Airport to ensure they are aware of possible changes in flying-fox activity.		
		If any management actions are required, ensure appropriate licences are obtained from OEH (Refer Section 5.2.3)		

10.2 Non-Council managed land

The following camps historically occur on private land and therefore Council will not undertake active works. Council will however assist landowners where possible.

10.2.1 Cougal Street, Tyalgum

Context

Cougal Street camp is located off Brays Creek Road, Tyalgum (Figure 62). The maximum known camp extent is shown in Figure 63 and covers 0.89 ha. Camp vegetation is mapped as camphor laurel dominant closed to open forest and tallowwood open forest. This was ground-truthed during the site assessment and is consistent with vegetation type on site.

Table 53 Cougal Street camp context

Criteria	Attribute
Location	-28.3601, 153.207
Lot and plan	2//DP1019241
Tenure	Private
Current land use	Bushland
Aspect / slope	East to south-east / 5-15^0 incline
Maximum confirmed camp extent	0.89 ha
Potential for camp expansion	Moderate

Figure 62: Cougal St, Tyalgum camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

PR2365_MP2_Extent
A4

Ecological values

Table 54 Cougal Street camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	May occur within area
		Threatened species	3 species or species habitat known to occur within area (SPRAT data not mapped)	41 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	In addition to the GHFF, 4 threatened species have been recorded within area (Figure 63)	
Local	KPoM	KMA	The camp is not on the Tweed Coast and therefore not included within the KPoM	
	TVMS 2004	Vegetation type	Camphor laurel Dominant Closed to Open Forest River She-oak Open Forest	Occurs on site

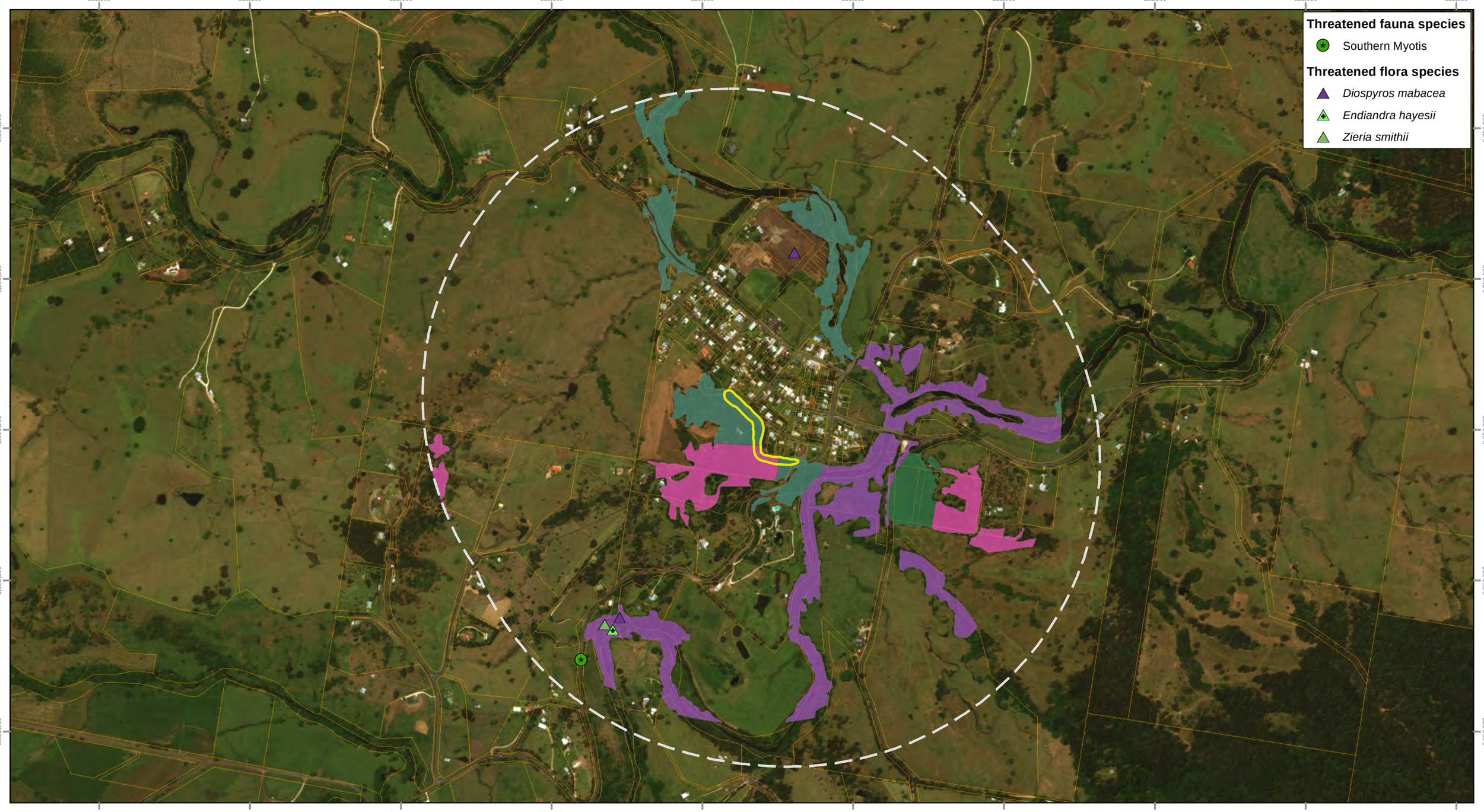


Figure 63: Cougal St, Tyalgum ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Camphor Laurel Dominant Closed to Open Forest
- Flooded Gum Open Forest
- River She-oak Open Forest
- Tallowwood Open Forest

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The camp has been monitored (by NSW National Parks and Wildlife Service and Council staff) on a quarterly basis since November 2012 as part of the NFFMP. During these monitoring events, flying-foxes were first observed in February 2013, and the camp is occasionally occupied by BFF and GHFF. Numbers of both species have fluctuated greatly since monitoring first began. The maximum total number of flying-foxes ever recorded at the camp was approximately 4,620 GHFF in November 2014. A peak in BFF numbers (1,600) was recorded in May 2013.

There have been a number of complaints and concerns submitted to Council regarding noise and odour from flying-foxes at the site.

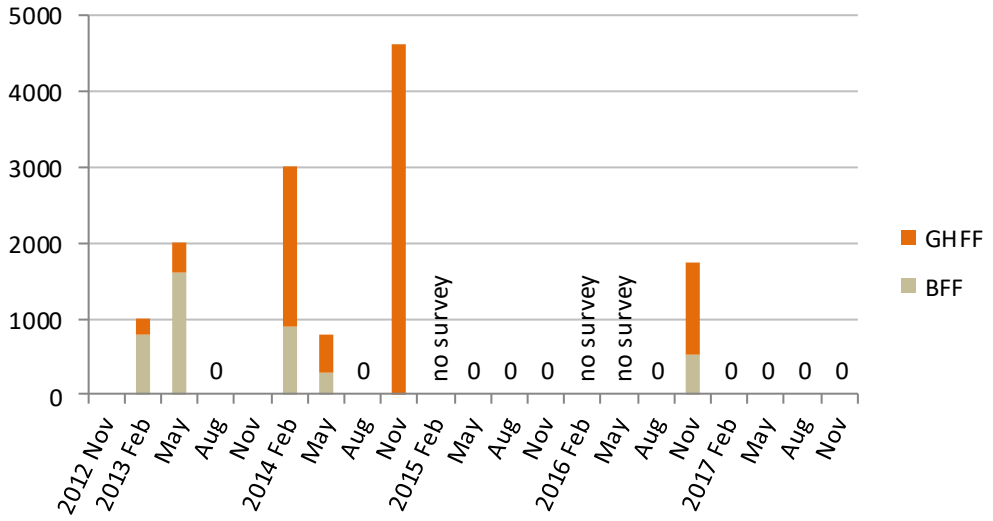


Figure 64 Cougal Street camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Cougal Street camp (or within 13 km for aerodromes) are detailed in Table 55 and Figure 65. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 55 Cougal Street camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Public park or access	36 m	A public park is located east of the camp.	Very low
Residential	26 m	Several houses to the north and east on Cougal Street are approximately 26 m from the camp (across the road).	Moderate
School / child care	358 m	Tyalgum Public School is located 358 m north of the camp.	Low

Figure 65:Cougal St, Tyalgum sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

School

Park / Public access

Residential

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

PR2365_MP4_SensitiveReceptors
A4

Management to date

This camp is monitored (by Council) as part of the NFFMP. The camp is located within close range of residential homes bordering a large tract of vegetation. As this camp occurs on private land, Council will not undertake active works, but will assist landowners where possible.

Management options

Table 56 Management options for Cougal Street camp

Type	When	Action	Management level	Estimated cost
Proactive	Ongoing	Engage the community to promote awareness and understanding of flying-foxes, and inform of planned management Tyalgum Creek.	1	Nil
Adaptive	At landowner request	Provide technical advice and support		
	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). Council to investigate potential for subsidies program (e.g. solar panels, assistance with electricity/water costs).		

10.2.2 Greenvale Court, Burringbar

Context

Greenvale Court camp is located off Greenvale Court, Burringbar (Figure 66). The maximum known camp extent is shown in Figure 67 and covers 0.57 ha. Camp vegetation is mapped as camphor laurel dominant closed to open forest, including area that has been substantially cleared of native vegetation. During the site assessment it was found this site has been substantially revegetated with rainforest species and therefore the mapping is inconsistent with onsite values.

Table 57 Greenvale Court camp context

Criteria	Attribute
Location	-28.443059, 153.4586
Lot and plan	32//DP775276
Tenure	Private
Current land use	Residential / Bushland
Aspect / slope	Mostly north-west / mostly 3-5^0 incline
Maximum confirmed camp extent	0.57 ha
Potential for camp expansion	Moderate

Figure 66: Greenvale Court, Burringbar camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

PR2365_MP2_Extent
A4

Table 58 Greenvale Court camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Listed threatened species	5 species or species habitat are known to occur within area (SPRAT data not mapped)	47 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	In addition to the GHFF, 9 species are known to occur within area (Figure 67)	
Local	KPoM	KMA	The camp is not on the Tweed Coast and therefore not included within the KPoM	
	TVMS 2004	Vegetation type	Camphor Laurel Dominant Closed to Open Forest	Occurs on site

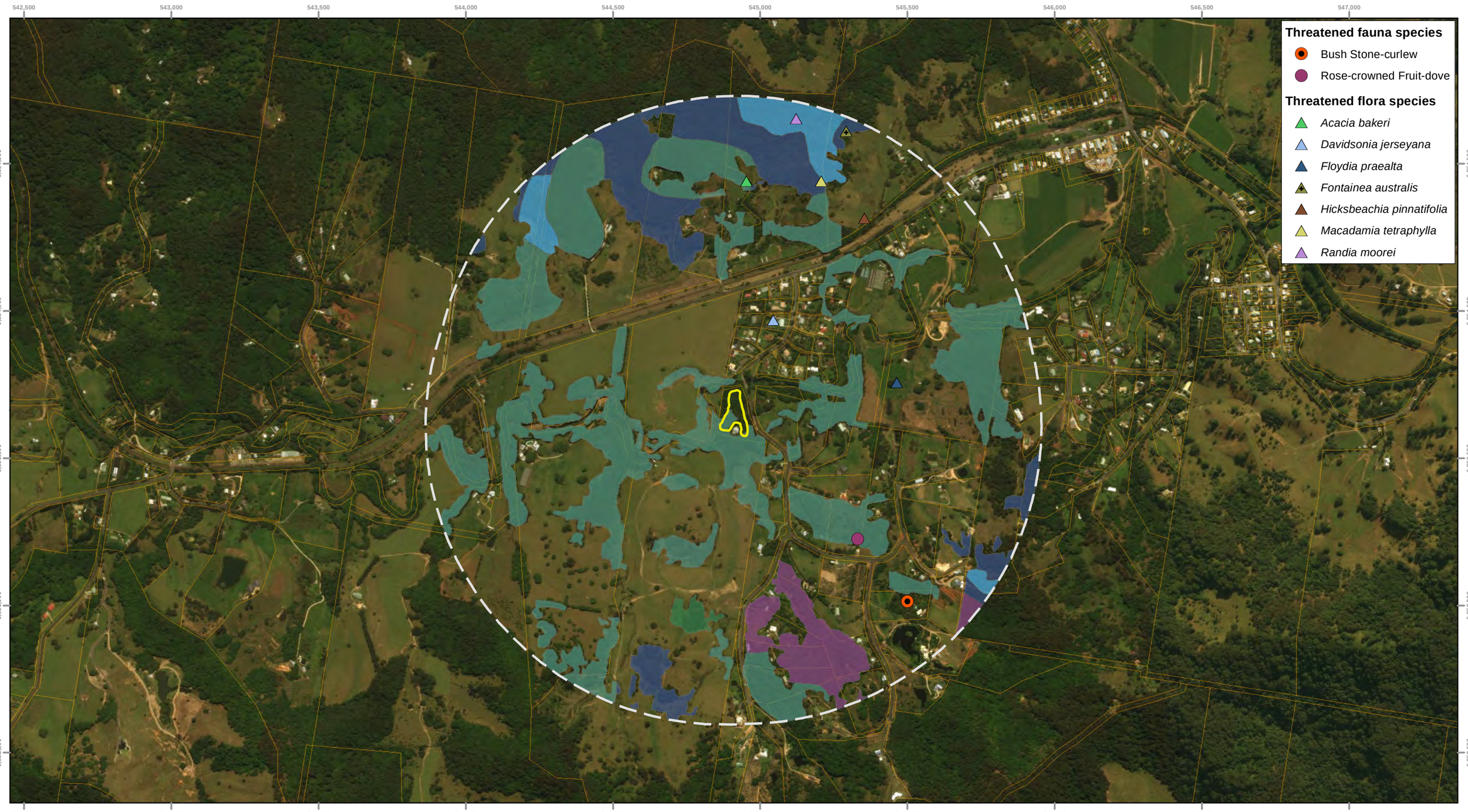


Figure 67: Greenvale Court, Burringbar ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Blackbutt Open Forest Complex
- Brush Box Open Forest
- Camphor Laurel Dominant Closed to Open Forest
- Flooded Gum Open Forest

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The camp was first monitored (by Council staff) in February 2013, and consistently on a quarterly basis since November 2014 as part of the NFFMP. During these monitoring events, flying-foxes were first observed in May 2013, but were not counted at this time. Since this time the camp has been occasionally occupied by both GHFF and BFF (including records of occupation without counts in November 2014, February 2015, November 2015 and February 2016).

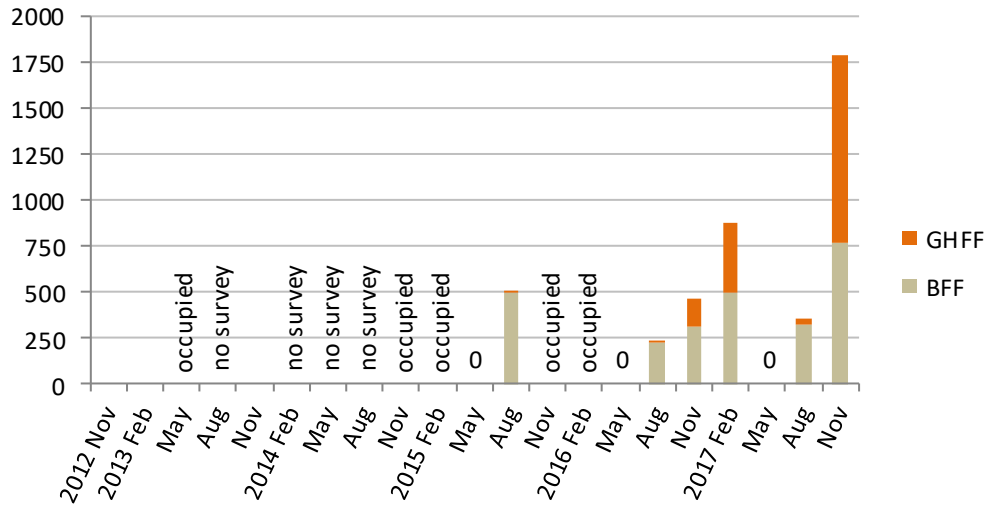


Figure 68 Greenvale Court camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of the Burringbar camp (or within 13 km for aerodromes) are detailed in Table 59 and Figure 69. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 59 Greenvale Court camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Public park or access	49 m	A large, public park is located west of the southern boundary of the known camp extent.	Low
Residential	21 m	A residence lies directly south of the main camp extent and between the camp's two southern extremities, generally within 21 m of the depicted camp extent. At times, the camp occupies vegetation nearer to the dwelling.	Moderate
School / child care	194 m	Gumnut Community Preschool is east of the known camp extent.	Low

543,000 543,500 544,000 544,500 545,000 545,500 546,000 546,500 547,000

6,854,500 6,854,000 6,853,500 6,853,000 6,852,500

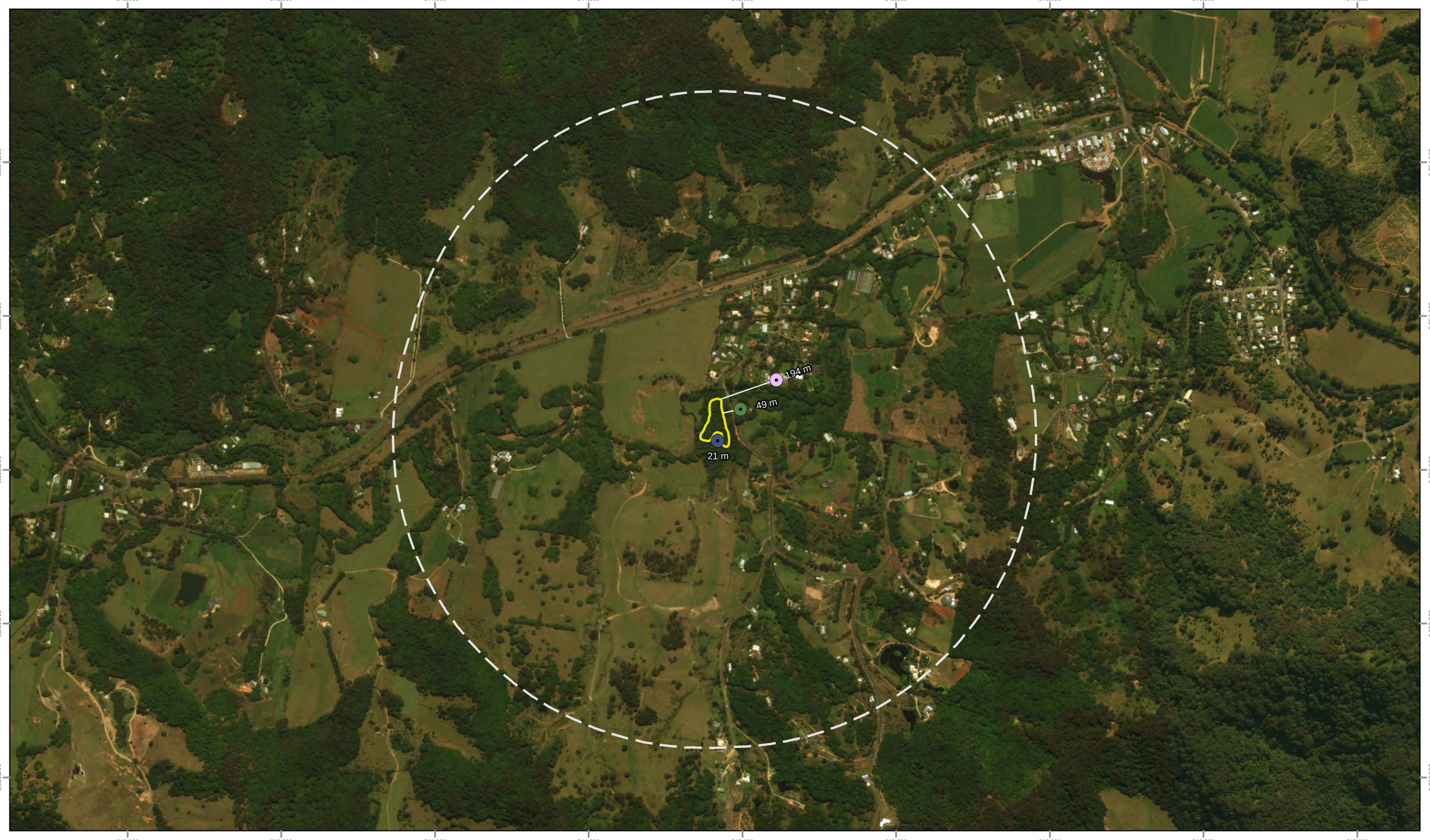


Figure 69:Greenvale Court, Burringbar sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

School

Park / Public access

Residential

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

As this camp occurs on private land, Council will not undertake active works, but will assist landowners where possible.

Management options

Table 60 Management options for Greenvale Court camp

Type	When	Action	Management level	Estimated cost
Proactive	ASAP	Council to investigate potential for subsidies program (e.g. Solar panel, electricity, water)	1	Variable
Adaptive	At landowner request	Provide technical advice and support		
	At landowner request	Investigate whether landowner qualifies for Biodiversity Grant program or other assistance.		
	If stakeholders express concern about camp presence	Conduct a letterbox drop within 100 m of the camp to promote awareness of flying-fox issues that includes contact details for sick or injured flying-foxes, public health information and tips for living with flying-foxes.		
	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7). A public swimming hole exists nearby, interpretive signs could be installed including information on general health and water quality.		

10.2.3 Kauri Avenue, Bogangar

Context

Kauri Avenue camp is located to the west of Kauri Avenue, Bogangar (Figure 70). The maximum extent known camp is shown in Figure 71 and covers 0.01 ha. Camp vegetation is mapped as coastal swamp mahogany open forest. This was ground-truthed during the site assessment and is consistent with vegetation type on site.

Table 61 Kauri Avenue camp context

Criteria	Attribute
Location	-28.3317, 153.5626
Lot and plan	2//DP1172935
Tenure	Private
Current land use	Bushland
Aspect / slope	Nil / flat
Maximum confirmed camp extent	0.01 ha
Potential for camp expansion	High

555,000

6,866,000

CLOTHIERS CREEK ROAD

ROSEWOOD AVENUE

CABARITA ROAD

KAURI AVENUE

555,000

Figure 70: Kauri Ave, Bogangar camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

Ecological values

Table 62 Kauri Avenue camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Cudgen Nature Reserve	This reserve is 500 m to the north of camp
		Threatened ecological communities	Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (CE)	Likely to occur within area
		Threatened species	12 threatened species or species habitat known to occur within area (SPRAT data not mapped)	69 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	27 threatened species have been recorded within area (Figure 71)	
Local	KPoM	KMA	The camp is included within the Southern Tweed Coast KMA	
	TVMS 2004	Vegetation type	Broad-leaved Paperbark + *Eucalyptus spp.* +/- Swamp box Closed Forest to Woodland Broad-leaved Paperbark Closed Forest to Woodland Coastal Swamp Mahogany Open Forest to Woodland	Occurs on site

553,000 553,500 554,000 554,500 555,000 555,500 556,000 556,500 557,000

6,867,000 6,866,500 6,866,000 6,865,500 6,865,000

Threatened fauna species

- Black-necked Stork
- Bush Stone-curlew
- Common Blossom-bat
- Common Planigale
- Eastern Bentwing-bat
- Eastern Long-eared Bat
- Fairy Penguin
- Glossy Black-Cockatoo
- Greater Glider
- Green Turtle
- Grey-headed Flying-fox
- Koala
- Little Bentwing-bat
- Little Eagle
- Loggerhead Turtle
- Magpie Goose
- Olongburra Frog
- Red-tailed Black-Cockatoo (coastal subspecies)
- Tusked Frog
- Wallum Froglet
- White-bellied Sea-eagle
- White-eared Monarch
- Wompoo Fruit-dove

Threatened flora species

- *Archidendron hendersonii*
- *Cryptocarya foetida*
- *Dendrocnide moroides*
- *Syzygium moorei*

Figure 71: Kauri Ave, Bogangar ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Black She-oak Low Open Forest to Woodland
- Blackbutt Open Forest Complex
- Broad-leaved Paperbark + Eucalyptus spp.+/- Swamp Box Closed Forest to Woodland
- Broad-leaved Paperbark Closed Forest to Woodland
- Brush Box Open Forest
- Coastal Pink Bloodwood Open Forest to Woodland
- Coastal Swamp Box Open Forest to Woodland
- Coastal Swamp Mahogany Open Forest to Woodland
- Dry Heathland to Shrubland
- Freshwater Wetlands
- Littoral Rainforest
- Native Grasslands (Murray & James Yes998 Study Area Only)
- Post-mining Regeneration
- Sedgeland / Rushland (Murray & James Yes998 Study Area Only)
- Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates
- Wet Heathland to Shrubland

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

The camp has been monitored (by Council staff) generally on a quarterly basis since August 2013 as part of the NFFMP. During this time BFF were only recorded on three occasions in 2013 and 2014. Approximately 130 flying-foxes were present in November 2013. No flying-foxes have been recorded since this time. No complaints have been received by Council regarding flying-foxes at this site.

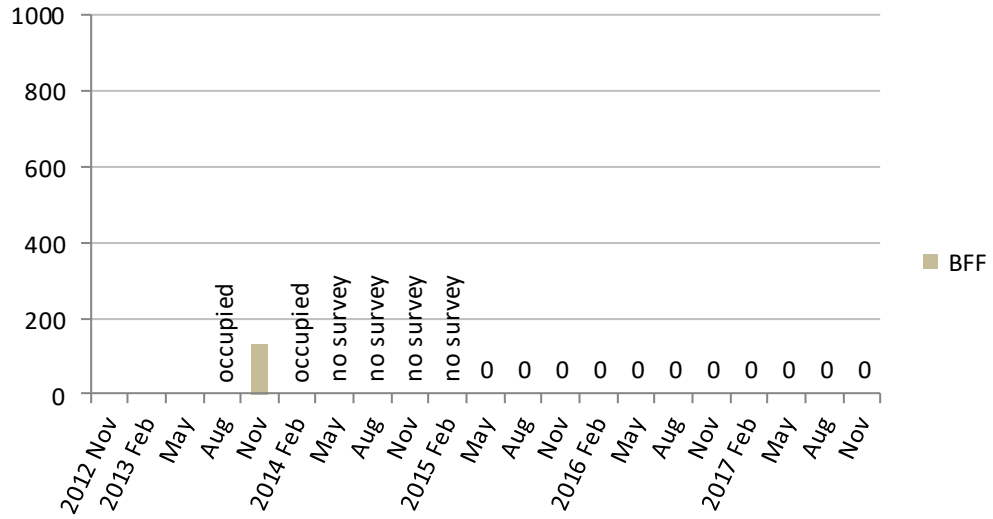


Figure 72 Kauri Avenue camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Bogangar camp (or within 13 km for aerodromes) are detailed in Table 63 and Figure 73. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 63 Kauri Avenue camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Public park or access	135 m	A public park is located off Cabarita Road, to the east of the confirmed camp extent.	Very low
Residential	20 m	The closest resident is on Kauri Avenue with the boundary 20 m from the confirmed camp extent.	Moderate

Figure 73:Kauri Ave, Bogangar sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

Park / Public access

Residential

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored as part of the NFFMP. As this camp occurs on private land, Council will not undertake active works, but will assist landowners where possible.

Management options

Table 64 Management options for Kauri Avenue camp

Type	When	Action
Adaptive	At landowner request	Provide technical advice and support
	If stakeholders express concern about camp presence	Engage the community to promote awareness and understanding of flying-foxes, and dispel misconceptions (e.g. unwarranted fear of disease).
	If any Council management is likely to affect flying-fox behaviour/movement If camp expands beyond known maximum extent / if the situation significantly changes If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate under the management framework (Section 7).
		Ensure appropriate licences are obtained from OEH (Refer Section 5.2.3).
	Future development in the vicinity of the camp	Land use planning decisions to be made in accordance with the relevant controls of Council's Biodiversity and Habitat Management DCP and the provisions of this plan (Section 6.1.10). Existing APZ to be maintained between vegetation and neighbouring properties.

10.2.4 Rowlands Creek, Uki

Context

Rowlands Creek camp comprises three distinct extents, two located on the bank of Rowlands Creek and one on the bank of Smiths Creek, Uki (Figure 74) and covers 2.96 ha in total. All extents are not necessarily occupied at any given point in time. The most frequently occupied extent is located between Rowlands Creek bridge on Kyogle Road and Rowlands Creek Road. Camp vegetation is mapped as river she-oak open forest. This was ground-truthed during the site assessment and is consistent with vegetation type on site.

Table 65 Rowlands Creek camp context

Criteria	Attribute
Location	-28.413426, 153.333793
Lot and plan (each lot and plan corresponds to the same numbered tenure below)	1. 7316//DP1154470 2. 238//DP727286 3. 209//DP755730 4. 7314//DP1163092 5. 5//DP1024230 6. 10//DP778659
Tenure	1. Council Administered Crown Land 2. Private 3. Private 4. State Crown Land 5. Council Administered Crown Land 6. Private
Current land use	Bushland, road reserve, school, waterway, rural
Aspect / slope	Mix of north and south / 5-15^0 incline
Maximum confirmed camp extent	2.96 ha
Potential for camp expansion	Moderate

532,500 533,000 533,500

6,857,000

OLD CONVENT ROAD
MILSOMS LANE
KYOGLE ROAD
NORCO STREET
MITCHELL STREET
GRANTS ROAD
RYDER STREET
SUNRISE PLACE
SMITHS CREEK ROAD
MARSHALL STREET
CHURCH HILL
ROWLANDS CREEK ROAD

532,500 533,000 533,500

Figure 74: Rowlands Creek, Uki camp extent

Tweed Shire Council

Flying-fox Management Plan

Maximum known camp extent

Property boundary

ecosure

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 10 20 40
Metres

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

PR2365_MP2_Extent
A4

Ecological values

Table 66 Rowlands Creek camp ecological values within 1 km

Protection level	Source	Category	Values/significance	Details
Federal	NFFMP	Nationally important camp	See definition Section 5.3.1	Does not meet criteria at present
	MNES SPRAT database	Nationally important wetland	Nil present	
		Threatened ecological communities	Lowland Rainforest of Subtropical Australia (CE)	Likely to occur within area
		Threatened species	2 species or species habitat known to occur within area (SPRAT data not mapped)	42 threatened species or species habitat may occur within area
State	ALA and Bionet	Threatened species	14 threatened species have been recorded within area (Figure 75)	
Local	KPoM	KMA	The camp is not on the Tweed Coast and therefore not included within the KPoM	
	TVMS 2004	Vegetation type	River She-oak Open Forest	Occurs on site

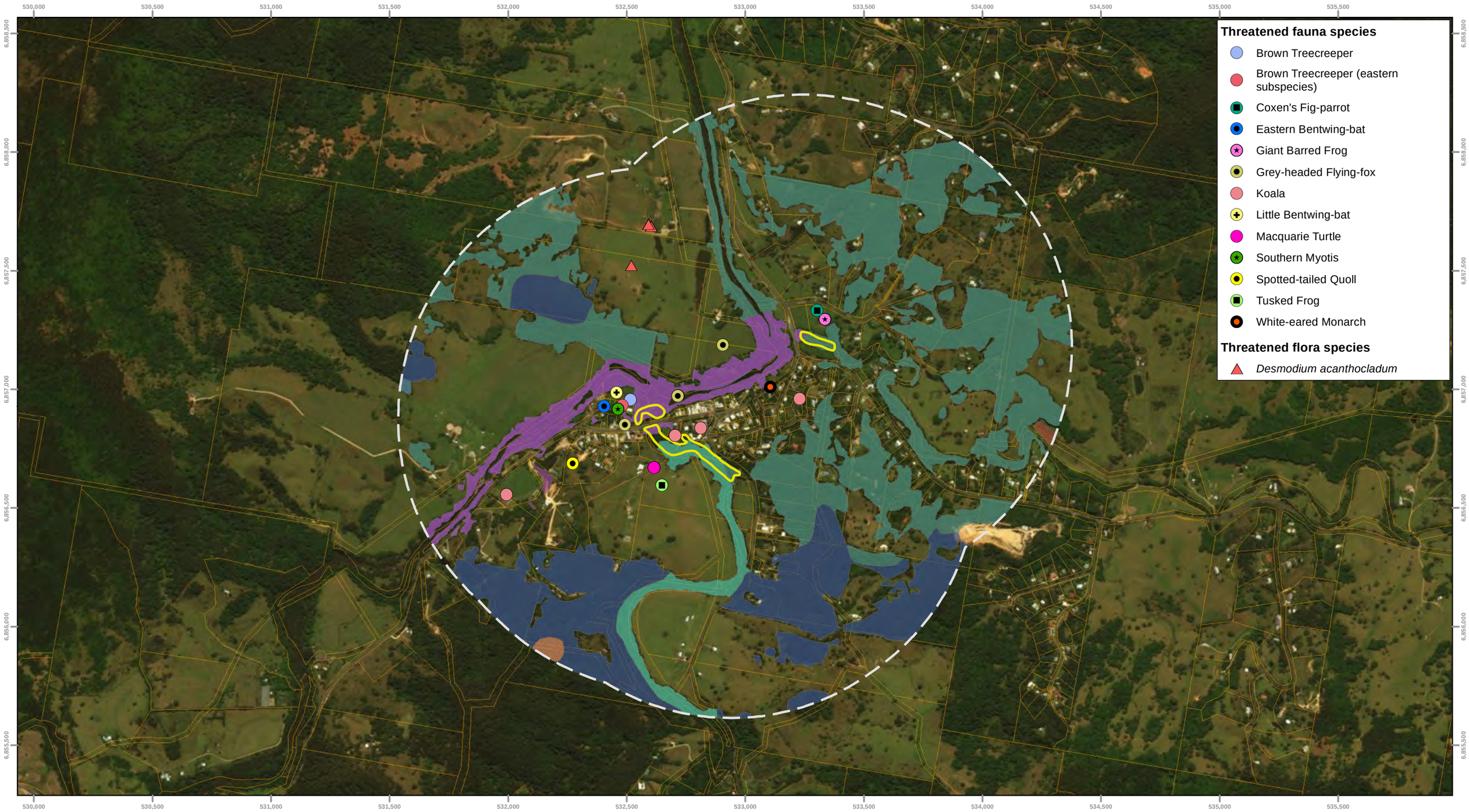


Figure 75: Rowlands Creek, Uki ecological values

Tweed Shire Council

Flying-fox Camp Management Plan

- Maximum known camp extent
- Flying-fox camp 1 km buffer
- Property boundary
- Acacia / Other Sclerophyll Regrowth Open Forest to Woodland
- Brush Box Open Forest
- Camphor Laurel Dominant Closed to Open Forest
- Early Regrowth Rainforest
- Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex
- Lowland Rainforest on Floodplain
- River She-oak Open Forest
- Unspecified Plantation

ecosure

ALA and Bionet records have been mapped, SPRAT records have not been mapped.

Locations of records have been dispersed slightly from their original positions to allow all records to be visible on the map.

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Camp history

A flying-fox camp has been present at this location since at least 1999. Counts by National Parks and Wildlife Service in 2007 and 2008 recorded between 400 and 7,000 flying-foxes. Regular monitoring has been carried out (by Council staff) on a quarterly basis since February 2014. The camp was occupied (but not counted) during the majority of quarterly observations between 2014 and 2016 and counts since then have estimated up to approximately 4,180 GHFF and 600 BFF. Counts are likely to be an underestimate due to poor visibility at this camp.

There have been no complaints or concerns submitted to Council regarding this camp. The presence of the camp in this location restricts use of the school's sports field for much of the year.

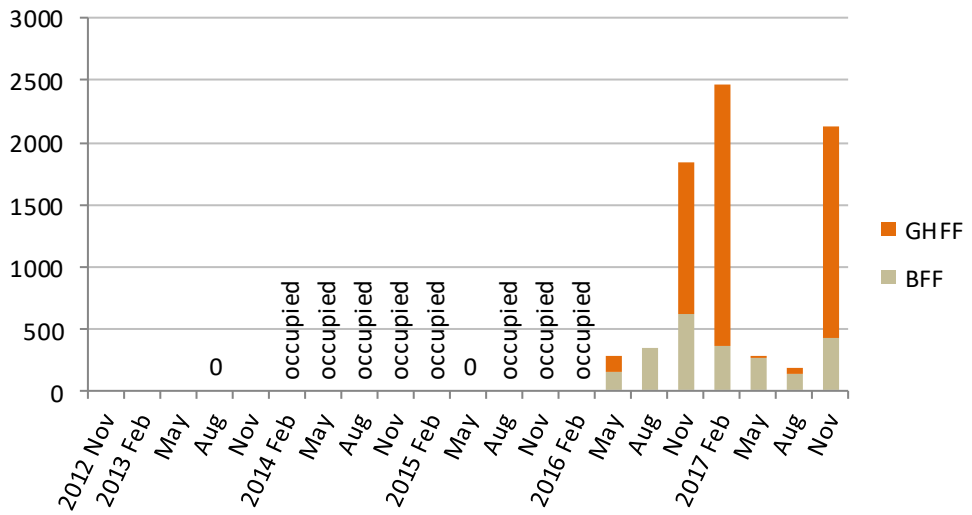


Figure 76 Rowlands Creek camp flying-fox numbers

Risks and potential impacts

Sensitive receptors within 1 km of Uki camp (or within 13 km for aerodromes) are detailed in Table 67 and Figure 77. Where multiple sites of the same category are mapped (e.g. schools) detail is provided on only the closest, or whichever are likely to be impacted (e.g. within 300 m of the camp).

Table 67 Rowlands Creek camp sensitive receptors

Category	Proximity to camp	Details	Risk of direct impact from camp
Public park or access	0 m	The two western and largest extents of the camp are located within public parks and access areas. The south-western extent lies within Fowler Fitzhenry Memorial Park.	Moderate
Residential	31 m	The closest residence is 31 m west of the southern extent, however many residences lie between the three extents.	Moderate

Category	Proximity to camp	Details	Risk of direct impact from camp
School / child care	40 m	School buildings are 40m from the camp.	Very low
Playground/sportsfield	6 m	The south-western extent is adjacent to the school playground/sportsfield.	Moderate
Sportfield	514 m	Uki Sportfield is to the west of the camp	Low

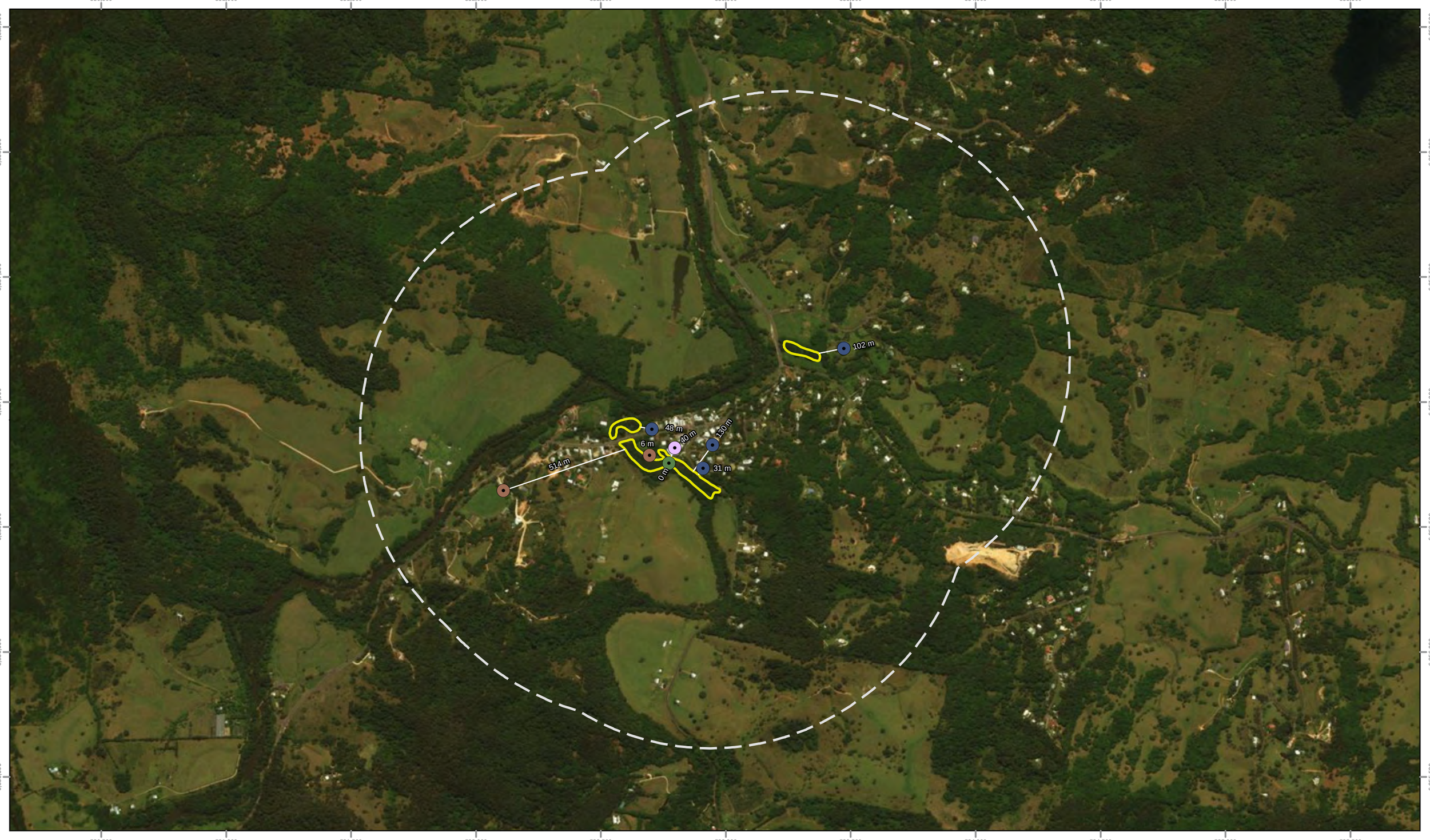


Figure 77:Rowlands Creek, Uki sensitive receptors

Tweed Shire Council

Flying-fox Camp Management Plan

Maximum known camp extent

Flying-fox camp 1 km buffer

Sensitive receptors

- School
- Park / Public access
- Sportsfield
- Residential

ecosure

Distances measured from measured from confirmed extents

Job number: PR2365
Revision: 1
Author: DB
Date: 17/07/2017

0 50 100 200
Metres

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

Management to date

This camp is monitored (by Council) as part of the NFFMP. The camp is often located within close range of school buildings and playground. As this camp occurs on private land, Council will not undertake active works, but will assist landowners where possible.

Management options

Table 68 Management options for Rowlands Creek camp

Type	When	Action	Management level	Estimated cost
Proactive	Year 1-2 of the Plan	Install interpretive signage in the parks to promote awareness and understanding of flying-foxes.	1	$500 + maintenance
Adaptive	At landowner request	Provide technical advice and support.		
	At landowner request	Investigate whether landowner qualifies for Biodiversity Grant program or other assistance.		
	If stakeholders express concern about camp presence	Engage the community to promote awareness and understanding of flying-foxes, and dispel misconceptions (e.g. unwarranted fear of disease).		
	If there is a change in risk level associated with the camp (such as camp extends beyond known maximum extent or other significant change in circumstances)	Re-evaluate the need for management using the management decision tool (Section 7).		
		If any management actions are required, ensure appropriate licences are obtained from OEH (Refer Section 5.2.3).		

10.3 Standard measures to avoid impacts

The following measures have been recommended to mitigate impacts during implementation of any level of activity (Level 1, 2 or 3) within or immediately adjacent to a camp.

10.3.1 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 produces sudden impacts/noise will be limited. Where loud equipment (e.g. chainsaws) is required they will be started away from the camp and allowed to run for a short time to allow flying-foxes to adjust.
- Activities that may disturb flying-foxes at any time during the year will begin as far from the camp as possible, working towards the camp gradually to allow flying-foxes to habituate.
- Any activity likely to disturb flying-foxes so that they take flight will be avoided during the day during the sensitive GHFF/BFF birthing period (i.e. when females are in final trimester or the majority are carrying pups, generally August – December) and avoided altogether during crèching (generally November/December to February). Where works cannot be done at night after fly-out during these periods, it is preferable they are undertaken in the late afternoon close to or at fly-out. If this is also not possible, a person experienced in flying-fox behaviour will monitor the camp for at least the first two scheduled actions (or as otherwise deemed to be required by that person) to ensure impacts are not excessive and advise on the most appropriate methods (e.g. required buffer distances, approach, etc.).
- OEH will be immediately contacted if LRFF are present between March and October, or are identified as being in final trimester / with dependent young.
- Non-critical maintenance activities will ideally be scheduled when the camp is naturally empty. Where this is not possible (e.g. at permanently occupied camps) they will be scheduled for the best period for that camp (e.g. when the camp is seasonally lower in numbers and breeding will not be interrupted, or during the non-breeding season, generally May to July).
- Works will not take place in periods of adverse weather including strong winds, sustained heavy rains, in very cold temperatures or during periods of likely population stress (e.g. food bottlenecks). Wildlife carers will be consulted to determine whether the population appears to be under stress.

- Works will be postponed on days predicted to exceed 35°C (or ideally 30°C), and for one day following a day that reached ≥35°C. If an actual heat stress event has been recorded at the camp or at nearby camps, a rest period of several weeks will be scheduled to allow affected flying-foxes to fully recover. See the OEH fact sheet on responding to heat stress in flying-fox camps.
- 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 cessation of management activities at any time.
- Ensure management actions and results are recorded to inform future planning. See the OEH fact sheet on Monitoring, evaluating and reporting
- Human safety:
    - All personnel to wear protective clothing including long sleeves and pants; additional items such as eye protection and a hat are also recommended. People working under the camp should wash their clothes daily. Appropriate hygiene practices will be adopted such as washing hands with soap and water before eating/smoking.
    - All personnel likely to come into contact with flying-foxes will be vaccinated against ABLV with current titre levels confirmed.
    - 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 2 and 3 actions will be submitted to OEH one month after commencement of works and then in a biennial report (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)
- plan evaluation and review (see Section 11).

10.3.2 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 in or interfere with the program, and details on how to report unusual flying-fox behaviour/daytime sightings. Relevant contact details will be provided (e.g. Program Coordinator). Resident requests for retention of vegetation and other concerns relating to the program will be taken into consideration.
- Where the Plan is being implemented by Council, information will be placed on Council's website along with contact information.
- 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 5 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 (identified in Appendix 2) will undertake an on-site population assessment prior to, during works and after works have been completed, including:
  - number of each species

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

- ratio of females in final trimester
- approximate age of any pups present including whether they are attached or likely to be crèched
- visual health assessment
- mortalities.

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

During works

- A flying-fox expert (identified in Section 13.3) will attend the site as often as OEH considers necessary to monitor flying-fox behaviour and ensure compliance with the Plan and the Policy. They must also be able to identify pregnant females, flightless young, individuals in poor health and be aware of climatic extremes and food stress events. This person will make an assessment of the relevant conditions and advise the supervisor/proponent whether the activity can go ahead.
- Deterrents in buffer areas will be assessed by a flying-fox expert so those that may cause inadvertent dispersal (e.g. canopy-mounted sprinklers) are not used during fly-in.
- At least one flying-fox rest day with no active management will be scheduled fortnightly, preferably weekly. Static deterrents (e.g. canopy-mounted sprinklers) may still be used on rest days.

10.3.3 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 metres).

10.3.4 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 camp trees only where a person experienced in flying-fox behaviour assesses that no flying-foxes are at risk of being harmed. A person experienced in flying-fox behaviour is to remain on site to monitor, when canopy trimming/removal is required within 50 metres of roosting flying-foxes.
- While most females are likely to be carrying young (generally September – January) vegetation removal within 50 metres of the camp will only be done in the evening after fly-out, unless otherwise advised by a flying-fox expert.
- Tree removal as part of management will be offset at a ratio of at least 2:1. Where threatened vegetation removal is required, the land manager will prepare an Offset Strategy to outline a program of restoration works in other locations (in addition to existing programs). The strategy will be submitted to OEH for approval at least two months prior to commencing works.

10.3.5 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 camp tree management in the future.

10.3.6 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 kilometres, and airports within 50 kilometres, will be informed of the intended start date and likely duration, and encouraged to report any change in flying-fox movements.
- Council will liaise with the Environment 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 three kilometres 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 metres, twice weekly checks of 'potential flying-fox habitat' within three kilometres and weekly checks of known camps within 20 kilometres of the site
- where weekly counts are already being undertaken by flying-fox experts at other camps within 20 kilometres, 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 kilometres 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 and dependent young are not 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 2.5 hours in a 12-hour 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 the 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.

10.3.7 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.

10.4 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 69)
- 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.

Dispersal will cease if:

- in the opinion of the land manager or OEH, there is ongoing 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 a dispersal program is stopped it may be permanently abandoned and other strategies considered, or reassessed and resumed in consultation with OEH.

Table 69 Signs of stress and action required

Welfare trigger	Signs	Action
Unacceptable levels of stress	If any individual is observed: · panting · saliva spreading · located on or within 2 m of the ground	Works to cease for the day.
Fatigue	In-situ management · more than 30% of the camp takes flight · individuals are in flight for more than 5 minutes · flying-foxes appear to be leaving the camp Dispersal · low flying · laboured flight	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.

Welfare trigger	Signs	Action
	· settling despite dispersal efforts	
Injury/death	· a flying-fox appears to have been injured/killed on site (including aborted foetuses) · any flying-fox death is reported within 1 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 2) OR stopped indefinitely and alternative management options investigated.

11 Plan evaluation and review

The Plan will have a scheduled review biennially, which will include evaluation of management actions against measures shown in Sections 3 and 8.

The following will trigger a reactive review of the Plan:

- completion of significant management actions (Level 2 or above)
- changes to relevant policy/legislation
- an incident associated with a camp.

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 (2023) prior to being re-submitted to OEH.

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Appendix 1 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 does not pose a risk of exposure to ABLV, nor does living, playing or walking near bat camping 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 (e.g handling). Pre-exposure vaccination provides reliable protection from the disease for people who are likely to have direct contact with bats, and it is generally a mandatory workplace health and safety requirement that all persons working with bats receive pre-vaccination and have their level of protection regularly assessed. Like classical rabies, ABLV infection in humans also appears to be effectively treated using post-exposure vaccination and so any person who suspects they have been exposed should seek immediate medical treatment. Post-exposure vaccination is usually ineffective once clinical manifestations of the disease have commenced.

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

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

If bat saliva contacts the eyes, nose, mouth or an open wound, flush thoroughly with water

and seek immediate medical advice.

Hendra virus

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

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

Humans may contract the disease after close contact with an infected horse. HeV infection in humans presents as a serious and often fatal respiratory and/or neurological disease and there is currently no effective post-exposure treatment or vaccine available for people. The mortality rate in horses is greater than 70% (DPI 2014). Since 1994, 81 horses have died and four of the seven people infected with HeV have lost their lives (DPI 2014).

Previous studies have shown that HeV spillover events have been associated with foraging flying-foxes rather than camp locations. Therefore risk is considered similar at any location within the range of flying-fox species and all horse owners should be vigilant. Vaccination of horses can protect horses and subsequently humans from infection (DPI 2014), as can appropriate horse husbandry (e.g. covering food and water troughs, fencing flying-fox foraging trees in paddocks, etc.).

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

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 virus recorded in Australia.

General health considerations

Flying-foxes, like all animals, carry bacteria and other microorganisms in their guts, some of which are potentially pathogenic to other species. Direct contact with faecal material should be avoided and general hygiene measures taken to reduce the low risk of gastrointestinal and other 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 microorganisms, and are filtered and disinfected before being distributed. Management plans for community supplies should consider whether any large congregation of animals, including flying-foxes, occurs near the supply or catchment area. Where they do occur, increased frequency of monitoring should be considered to ensure early detection and management of contaminants.

Appendix 2 Expert assessment requirements

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

Flying-fox expert

Essential

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

Desirable

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

Ecologist

Essential

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

Desirable

- Tertiary qualification in ecology or similar.

- Local knowledge and experience.
- Accredited Biodiversity Offset Scheme Assessor under the *Biodiversity Conservation Act 2016*.
- Practising member of the Ecological Consultants Association of NSW.

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

Appendix 3 Dispersal 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 29 November 2013). An overview of findings[7] is summarised below.

- 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 6250%.
- Dispersal methods included fog[8], birdfrite, lights, noise, physical deterrents, smoke, extensive vegetation modification, water (including cannons), paintball guns and helicopters.
- The most common dispersal methods were extensive vegetation modification alone and extensive vegetation modification combined with other methods.

[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 are considered toxic.

- In nine of the 24 roosts dispersed, dispersal actions did not reduce the number of flying-foxes in the LGA.
- In all cases it was not possible to predict where new roosts would form.
- When flying-foxes were dispersed, they did not move further than 6 km away.
- As at November 2014 repeat actions had already been required in 18 cases.
- 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.
- The financial costs of all dispersal attempts, regardless of methods used were considerable, ranging from $7500 to more than $400,000 (with costs ongoing).

Appendix 4 Methods

Camp assessment

Ecological values

Ecological values within one kilometre of each camp were identified via desktop assessment (e.g. Council vegetation mapping, MNES searches (SPRAT database), NSW Bionet and Atlas of Living Australia). Limited ground-truthing was undertaken during the site assessment. ALA and Bionet records have been included on the maps and dispersed slightly from their original locations for readability. MNES SPRAT database results are received in PDF format and provide information on the likelihood of species or species habitat occurring within the searched area. This information is not included on the ecological maps. Due to licensing agreements with government providers Ecosure is not permitted to disclose the location of some species. Consequently, these species records have been addressed in the report but are not included on the maps.

All areas of a site where roosting flying-foxes have been confirmed is mapped as the "maximum known camp extent". Where anecdotal reports of roosting flying-foxes have been received but not confirmed through site inspection, this has been mapped as "unconfirmed flying-fox camp extent".

Sensitive receptors

The proximity of the 16 active flying-fox camps within the Shire to sensitive receiving sites were analysed for level of risk. A one kilometre buffer was placed around each of the 16 sites and the proximity to sensitive receiving sites determined, including:

- residential areas
- airports and airstrips
- schools and daycare
- aged care
- equine facilities, and, where possible residential properties with horses
- other sites with high potential for conflict.

Council takes a risk-based approach to management, where camp intervention is generally only considered where there is actual risk, or significant amenity impacts that cannot be managed using other measures (e.g. consultation, education, property modification, etc.). Dispersal is generally not supported, and would only be considered for a high risk camp.

The level of risk associated with the nearby flying-fox camp was assigned to each sensitive receptor based on land use type and proximity to the camp. 'Risk' is defined as actual risk to human/animal health, safety or economic loss. Risk assignment was based on the following:

- Very low risk = Negligible risk associated with the camp. Level 1 actions beneficial but no action required.
- Low risk = Flying-fox camp unlikely to influence risk. Level 1 actions may be required.
- Moderate risk = Flying-fox camp may create some level of risk. Level 1 actions required, Level 2 actions may be required.
- High risk = Flying-fox camp causes significant risk. Level 1 actions required, Level 2 actions likely required (and in extreme cases, Level 3 actions considered).

History of conflict and management

History of conflict and camp management was summarised from community engagement and Council's knowledge of the site, including formal correspondence on file regarding each camp.

Other data

Recent (since 2012) monitoring data was obtained from Council's regular counts, which are also reported to the NFFMP. It should be noted that not all camps have been counted during each monitoring event. These cases are identified and distinguished from zero counts by the annotation "no survey". The annotation "occupied" identifies that flying-foxes were present at a particular camp during the survey period, but a formal count was not undertaken. It should be noted that counts are an estimate of minimum numbers only, and that the accuracy of the direct count method used is limited due to varying visibility and other site conditions.

Historical occupancy and count information in camp history sections was summarised from NPWS reports, correspondence on file, knowledge provided by local wildlife care groups and information received through community engagement. Tenure was identified using Council datasets.

Potentially suitable camp habitat analysis

Methods for Potential Habitat Mapping

An analysis was carried out to delineate potential flying-fox habitat using habitat preference criteria identified in Roberts (2006). The predictive criteria identifying areas of highest likelihood of flying-fox roost occurrence are summarised as being:

- closed canopy at least 5 m high
- complex vegetation structure – upper, mid- and understorey layers
- dense vegetation within 500 m of a river or creek
- within 50 km of the coastline or at an elevation < 65 m above sea level
- level topography less than 5º and moderate inclines between 5º and 15 º
- proximity to urban areas

- within nightly commuting distance (between 20-50 km) of sufficient food resources to support the population.

Of the above criteria, the below were modified or excluded as follows:

- Due to Tweed Shire Council being located entirely within 50 km of coastline, the elevation criteria of <65m above sea level was not included in the model.
- The slope criteria were based on the flying-fox camps within Tweed Shire Council occurring on mostly flat or moderately inclined land (approximately 80% on land less than 5º incline and 20% on land between 5 and 15º).

Step 1: Elevation and slope

A Digital Elevation Model (DEM) was derived using a 10m contour dataset provided by Council and a detailed river dataset provided by Office of Environment (OEH). The DEM was produced using a 10m resolution for the entire Tweed Shire Council. A slope layer was then created from this DEM.

Step 2: Presence of vegetation favoured by flying-foxes

The vegetation mapping for Tweed Shire Council (reference) was used to identify suitable flying-fox habitat based on our understanding of their roosting and foraging preferences. A precautionary approach was applied where vegetation structure (i.e. early regeneration regrowth) may not meet the height criteria but where information on vegetation characteristics (such as height) was unavailable. In these instances, vegetation was identified as suitable habitat. All patches, regardless of their size, were included in the analysis. This dataset was then converted to raster (10 m resolution) using the Tweed Shire Council as an extent and snapped to the DEM.

Step 3: Urban areas

Urban areas were identified using the Tweed Local Planning Scheme 2014 land zone overlay. The following areas were marked as urban and included in the analysis:

- General Residential
- Large Lot Residential
- Local Centre
- Low Density Residential
- Tourist
- Medium Density Residential
- Mixed Use
- Neighbourhood Centre
- Private Recreation
- Public Recreation
- Tweed City Centre LEP 2012
- Village.

An urban area distance raster (10 m resolution using the Tweed Shire Council as an extent and snapped to the DEM) was produced using the Euclidean distance tool in ArcGIS (version 10.3, spatial analyst extension).

Step 4: Proximity to water

All major watercourses (Council supplied data) were used in analysing the proximity of vegetation to watercourses. A watercourse distance raster (10 m resolution using the Tweed Shire Council as an extent and snapped to the DEM) was produced using the Euclidean distance tool in ArcGIS (version 10.3, spatial analyst extension).

Step 5: Nightly commute to foraging habitat

Eby and Law (2008) has ranked foraging habitat based on the feeding habitats of the grey-headed flying-fox. This spatial dataset coincides with the vegetation types provided by Council and has been used as a surrogate in this model for identifying quality foraging habitat available for all flying-foxes. The dataset ranks habitat 1 to 4, with rank 1 being the highest rated foraging habitat. A raster of each ranked habitat within the Tweed Shire Council was created so that each rank could be scored separately.

A foraging habitat distance raster for each of the 4 ranked habitats was produced using the Euclidean distance tool.

Step 6: Scored raster

Datasets (outputs from steps 1, 3, 4, 5) were reclassified using the raster classify tool to allocate scoring according to table below. Datasets in the table below were then combined using a Summed Overlay operation to provide an overall scored raster.

Score ranges for attributes

Score	Proximity to water	Rank 1 foraging habitat	Rank 2 foraging habitat	Rank 3 foraging habitat	Rank 4 foraging habitat	Distance to urban area	Slope
0	>500 m	>50 km	>50 km	>50 km	>50 km	>20 km	>15º
1	400-500 m			20-50 km	<20 km	10-20 km	10-15º
2	300-400m		20-50 km	<20 km		1-10 km	5-10º
3	200-300 m	20-50 km	<20 km			0-1 km	Flat to 5º
4	<200 m	<20 km				Within urban area	Flat OR within 100 m of waterway

Step 7: Final modelled raster

The final output was then generated by clipping the scored raster (step 6) to an analysis mask. The analysis mask was created by extracting areas identified as suitable flying-fox habitat (step 2) that occur on land with a slope less than 15º using the Raster Calculator.

The output provided a scored raster only in areas identified as suitable flying-fox habitat on land less than 15º incline. The output was assessed and the total scores attributed to the following preference ranking:

- 10 to 13: Less preferred
- 13 to 16: Preferred
- 16 to 21 Most preferred.

Raster analysis

Spatial analysis was undertaken in ArcGIS version 10.3 using the tools available in the spatial analysist extension. Rasters were assessed using a 10 m resolution, confined to the Tweed Shire Council Extent and snapped to the DEM.

Appendix 5 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 (FSCs) or wildlife rescue personnel on site during dispersal activities to monitor, capture or provide first aid treatment for sick or injured flying-foxes that may require human intervention for their survival. Flying-fox rescue must only be attempted by personnel trained and experienced in flying-fox rescue and handling.

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

Requirements

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

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

Human first aid

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

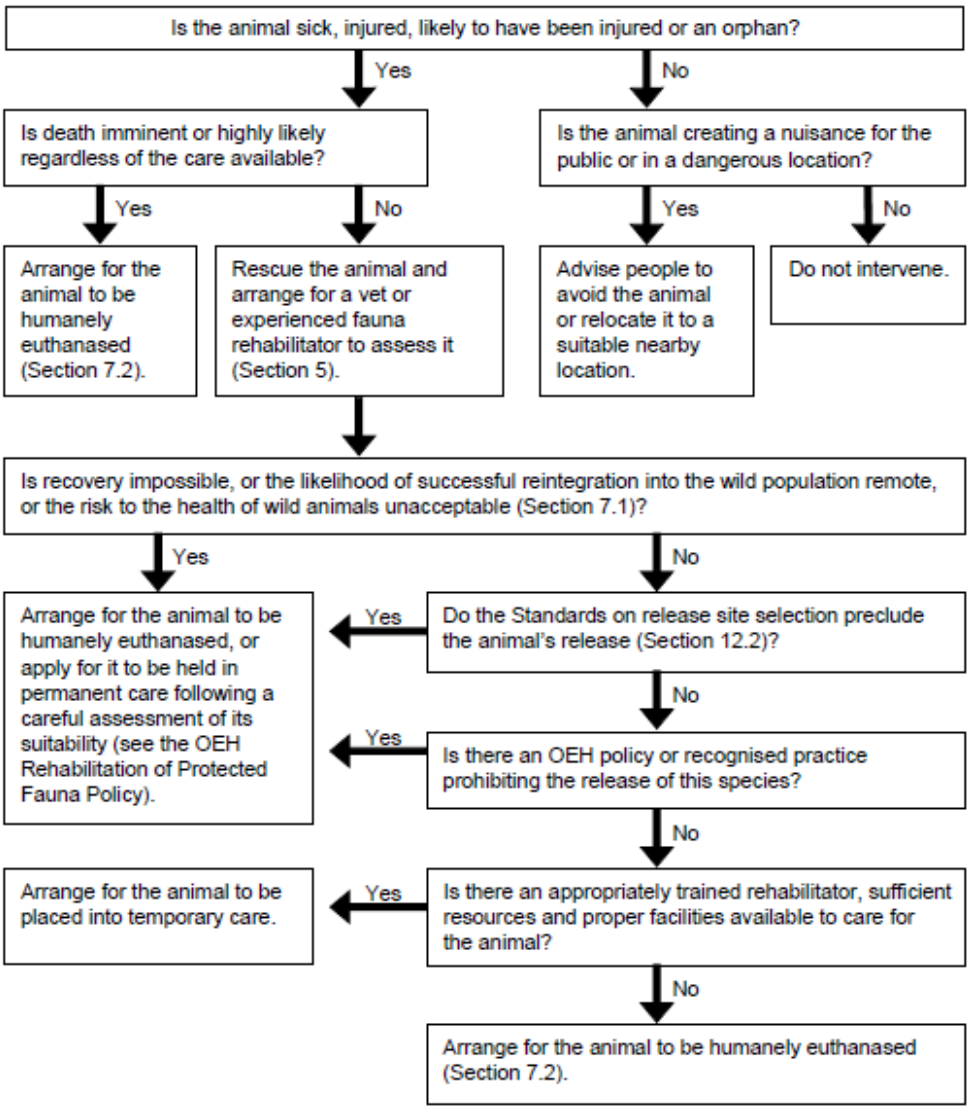
Equipment

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

Work instructions

Case assessment

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



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

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

Rescue instructions

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

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

2. Before a rescue attempt, rescuers must assess the risks to the flying-fox from environmental hazards and from capture.
3. Rescuers must employ the correct rescue equipment for the condition and location of the flying-fox, and be trained in its use.

Example scenarios

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

Animal first aid

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

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

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

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

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

Transport to veterinarian / wildlife carer

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

Objective

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

Standards

1. The transport container must be tall enough for the flying-fox to hang by its feet without hitting its head on the floor.
2. 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.
3. The container must be designed to prevent the flying-fox from escaping.
4. 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.
5. The container must be kept at a temperature which is appropriate for the age and condition of the flying-fox. A range of 25–27°C is appropriate for an adult. A temperature of 28°C is appropriate for an orphan. A cool or warm water bottle may be required.
6. The container must be ventilated so air can circulate around the flying-fox.
7. The container must minimise light, noise and vibrations and prevent contact with young children and pets.
8. During transport, a container holding a flying-fox must have a clearly visible warning label that says ‘Warning – live bat’.
9. A flying-fox must not be transported in the back of an uncovered utility vehicle or a car boot that is separate from the main cabin.

Guidelines

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

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	16/06/2017	Tweed Shire Council Flying-fox Camp Management Plan - draft	Emily Hatfield, Ecologist Mandy Todd, Ecologist Jessica Bracks, Principal Wildlife Biologist	Jessica Bracks, Principal Wildlife Biologist	Beth Kramer, South East Queensland Manager
01	19/06/2017	Tweed Shire Council Flying-fox Camp Management Plan – draft R1	Emily Hatfield, Ecologist	Jessica Bracks, Principal Wildlife Biologist	
02	18/07/2017	Tweed Shire Council Flying-fox Camp Management Plan – draft R2		Emily Hatfield, Ecologist (incorporating Council comments)	Jessica Bracks, Principal Wildlife Biologist
03	28/08/2017	Tweed Shire Council Flying-fox Camp Management Plan – draft R3		Emily Hatfield, Ecologist (incorporating Council comments)	Jessica Bracks, Principal Wildlife Biologist

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Copy #	Date	Type	Issued to	Name
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2	28/07/2017	Electronic	Tweed Shire Council	Marama Hopkins
3	28/07/2017	Electronic	Ecosure	Administration

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