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<table>
<thead>
<tr>
<th>Project Name</th>
<th>Camellia Gardens Flying-fox Camp Management Plan</th>
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<tbody>
<tr>
<td>Project Manager</td>
<td>Beth Noel Environmental Science and Policy Unit</td>
</tr>
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<td>Company</td>
<td>Sutherland Shire Council</td>
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<td>Prepared by</td>
<td>Beth Noel</td>
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<tr>
<td>Reviewed by</td>
<td>Dr Rodney Armistead, Bec Williams and Ian Drinnan</td>
</tr>
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<td>Approved by</td>
<td>Ian Drinnan, Manager Environmental Science and Policy</td>
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<td>Cover photo</td>
<td>Camellia Gardens Camp photos by: Beth Noel</td>
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<td>Camellia Gardens duck pond photo back cover by: Bec Williams</td>
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Acknowledgements

We acknowledge input by the NSW Office of Environment and Heritage, and consultants Ecosure, in developing the template on which this Camp Management Plan was based. Peggy Eby also provided advice which was included in the template. Ian Drinnan, Rebecca Williams and Rodney Armistead were pivotal in providing advice and feedback in order to enhance and complete this document.
Executive Summary

The Camellia Gardens flying-fox camp is located in Caringbah South in the Sutherland Shire LGA at the junction of Kareena Rd, President Ave and Matson Crescent.

The camp was first formally recorded in July 2016 and has only been occupied by Grey-headed Flying-fox (GHFF) to date. It is not yet clear if it is a permanent camp but it has been occupied the majority of days since July 2016. The land is owned by Sutherland Shire Council and has staff and visitors onsite 7 days a week 362 days per year. The number of flying-foxes has generally ranged from 1,000 to 2,000 individuals since initial occupation.

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

- Manage, and where possible, reduce impacts from the camp on the surrounding community.
- Manage and minimise public health and safety risks.
- Manage potential conflict between Camellia Gardens users and flying foxes and their habitat.
- Manage the flying foxes and their habitat so as to protect special planting and cultural aspects of the gardens.
- Enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes.

Community engagement was initiated when flying-foxes first arrived at Camellia Gardens and was escalated in order to gain community feedback on this Camp Management Plan (CMP).

Flying-foxes are considered ‘keystone’ species in Australia given their contribution to the health, longevity and diversity among and between vegetation communities. The Grey-headed Flying-fox has been declared Vulnerable under the Biodiversity Conservation Act 2016 (NSW) and Environment Protection Biodiversity Conservation Act 1999 (Federal). This means they are at risk of becoming extinct in the medium term and therefore have been accorded levels of protection by the State and Federal Government as a Threatened Species.

GHFF often roost in large numbers and are increasingly moving into urban areas, where they can create amenity issues and other concerns within the community.

This CMP has been prepared to inform and address concerns of Council staff, directly affected residents and gardens visitors. The CMP prioritises the following actions for management of the Camellia Gardens camp:

- Risk management for the general public, gardens staff and adjacent residents.
- Community education and awareness.
- Alternative roosting habitat creation and regeneration.
- Vegetation management actions to protect garden specimens.
- Nudging of flying-foxes to suitable habitat areas.
- Cocos palm removal program.

This CMP was updated following community consultation on the previous draft document.
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## Acronyms and abbreviations

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<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>ABLV</td>
<td>Australian Bat Lyssavirus</td>
</tr>
<tr>
<td>BFF</td>
<td>Black Flying-fox (<em>Pteropus alecto</em>)</td>
</tr>
<tr>
<td>BC Act</td>
<td>Biodiversity Conservation Act 2016</td>
</tr>
<tr>
<td>DoE</td>
<td>Commonwealth Department of the Environment</td>
</tr>
<tr>
<td>DoEE</td>
<td>Commonwealth Department of the Environment &amp; Energy (new name)</td>
</tr>
<tr>
<td>DPI</td>
<td>Department of Primary Industries (NSW)</td>
</tr>
<tr>
<td>EP&amp;A Act</td>
<td><em>Environmental Planning and Assessment Act 1979</em> (NSW)</td>
</tr>
<tr>
<td>EPA</td>
<td>Environment Protection Authority (NSW)</td>
</tr>
<tr>
<td>EPBC Act</td>
<td><em>Environment Protection and Biodiversity Conservation Act 1999</em> (Commonwealth)</td>
</tr>
<tr>
<td>GHFF</td>
<td>Grey-headed Flying-fox (<em>Pteropus poliocephalus</em>)</td>
</tr>
<tr>
<td>the Guideline</td>
<td>Referral guideline for management actions in Grey-headed and Spectacled Flying-fox camps 2015 (Commonwealth)</td>
</tr>
<tr>
<td>HeV</td>
<td>Hendra Virus</td>
</tr>
<tr>
<td>LGA</td>
<td>local government area</td>
</tr>
<tr>
<td>LGNSW</td>
<td>Local Government NSW</td>
</tr>
<tr>
<td>LRFF</td>
<td>Little Red Flying-fox (<em>Pteropus scapulatus</em>)</td>
</tr>
<tr>
<td>MNES</td>
<td>matters of national environmental significance</td>
</tr>
<tr>
<td>NPW Act</td>
<td><em>National Parks and Wildlife Act 1974</em> (NSW)</td>
</tr>
<tr>
<td>NPWS</td>
<td>National Parks and Wildlife Service (NSW)</td>
</tr>
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<td>OEH</td>
<td>Office of Environment and Heritage (NSW)</td>
</tr>
<tr>
<td>PEPs</td>
<td>protection of the environment policies</td>
</tr>
<tr>
<td>the Plan</td>
<td>Camp Management Plan</td>
</tr>
<tr>
<td>POEO Act</td>
<td><em>Protection of the Environment Operations Act 1997</em> (NSW)</td>
</tr>
<tr>
<td>the Policy</td>
<td>Flying-fox Camp Management Policy 2015 (NSW)</td>
</tr>
<tr>
<td>SEPPs</td>
<td>State Environmental Planning Policies</td>
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<tr>
<td>SIS</td>
<td>species impact statement</td>
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<tr>
<td>SSC</td>
<td>Sutherland Shire Council</td>
</tr>
<tr>
<td>TEC</td>
<td>threatened ecological community</td>
</tr>
</tbody>
</table>
1. Overview

1.1 Objectives

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

- Minimise impacts to the community.
- Manage, and where possible, reduce impacts from the camp on the surrounding community.
- Manage and minimise public health and safety risks.
- Manage potential conflict between park/garden users and flying foxes and their habitat.
- Manage the flying fox and their habitat so as to protect special plantings and cultural aspects of the gardens.
- Enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes.
- Effectively communicate with stakeholders during planning and implementation of management activities.
- Ensure management is sympathetic to flying-fox behaviours and requirements.
- Improve community understanding and appreciation of flying-foxes, including their critical ecological role.
- Ensure flying-fox welfare is a priority during all works.
- Ensure camp management is consistent with broader conservation management strategies that may be developed to protect threatened species/communities.
- Ensure camp management does not contribute to loss of biodiversity or increase threats to threatened species/communities.
- Clearly outline the camp management actions that have been approved and will be utilised at the camp.
- Ensure management activities are consistent with the NSW flying-fox camp management policy (OEH 2015b).
- Support licence approval (where required) for actions at the camp.
- Implement an adaptive management approach to camp management based on evidence collected.
2. Context

2.1 Camp area

The camp is located in Caringbah South in Sutherland Shire Council’s Camellia Gardens at the junction of Kareena Rd, President Ave and Matson Crescent.

The camp extent as at January 2017 is shown in Figure 1. The camp currently covers 0.35 ha (Mar 2018), with no real contiguous canopy but approximately 5 hectares of trees, shrubs and some bushland in the vicinity of this roosting site. Camps are recommended to be at least 300m away from residential dwellings. This camp is 60m from the closest residential dwelling and therefore is not ideal as a permanent roosting site.

Figure 1 – Camellia Gardens Flying Fox Camp Location Map

2.1.1 History of the camp

The camp was first formally recorded in July 2016 and has only been occupied by Grey-headed Flying-fox. It is not clear yet if it is a permanent camp but it has been occupied the majority of days since July 2016. Some anecdotal evidence exists that there was occupation of this site in the 2007 food shortage; however, no formal records were made. Numbers of animals started at 10 initially and have increased to between 1000 and 2000 since initial occupation. The species present are Grey-headed Flying-fox (GHFF), and dependent young were observed being left in the camp overnight from mid October 2016 to August 2017 and again from October 2017 to date.

Figure 2 below shows flying-fox activity at the Camellia Gardens site. *
Figure 2 Showing flying-fox roosting activity since the camp was first occupied

*the gap in data shown on the graph from late July to early August 2016 is a result of no formal observations being made. The camp has been continuously occupied from July to September 2016 and then again from early November 2016 to date with a gap in occupation from September to November in 2016. Counts are conducted at least weekly with no gap in occupation since 2016 as discussed previously.

Council staff have been observing the Camellia Gardens site since it first became occupied in July 2016, anywhere from daily to once a week. Numbers increased from November 2016 to October 2017 and since the then the numbers have remained consistent. The Camellia Gardens has sprinklers operating to irrigate the tree and plant specimens in hot weather. This may have prevented heat stress events occurring and prevented animals from dying during periods of elevated temperatures. See Appendix 8 for heat stress information.
2.2 Land tenure

Sutherland Shire Council is the owner of Part Lot 57 DP663328 where the Camellia Gardens are located. The Part Lot 57 DP663328 is zoned E2 Environmental Conservation and RE1 Public Recreation under the Sutherland Shire LEP 2015. The area the flying-foxes are roosting in is zoned RE1 Public Recreation. See Figure 3 below for land zoning of the site and its surrounds.

Figure 3 – Land Zoning of Camellia Gardens and surrounding land

Low Density and Environmental Living residential zonings are the predominant land use surrounding the Camellia Gardens. A large area of Environmental Conservation zoning is present directly south of the Camellia Gardens, known as Kareena Park reserve, which is composed of remnant bushland. Laguna Street Public School is located approximately 280m south of the roosting area.

2.3 Reported issues related to the camp

The main issues with flying foxes roosting at this location are the high level of exposure to the general public, damage to roosting trees and impacts on adjacent residential properties. This site is open to the public from 9am to 4pm, 362 days per year. The area of roosting activity is directly above popular duck ponds, and families occupy these locations on a daily basis to feed the ducks and picnic. During the 2016-2017 food shortage there was great concern that flying-foxes (both young and adults) in poor health could come into contact with members of the public.

Council have aimed to reduce the risk of human contact with flying foxes by:

- educating Camellia Gardens staff on what to do if they encounter a flying-fox;
- answering staff and the general public’s questions about flying-foxes and health;
- formalising a flying-fox encounter protocol so that staff can gain assistance from trained and vaccinated staff or Wildlife Information Rescue and Education Service (WIRES);
Flying-fox Camp Management Plan

- arranging for staff to conduct daily checks of the roosting area prior to the public being admitted to the gardens, and to follow the formal protocol if they encounter a flying-fox;
- placing signage adjacent to the roost area with information on GHFF and health risks, including directing people not to touch flying-foxes and to call WIRES if there is an injured, orphaned or dead flying-fox; and
- conducting a risk assessment for the locality to ensure that all possible risks have actions to mitigate them.

These actions worked well during the food shortage period in 2016-2017 with dead, injured or abandoned young being removed or rescued by the appropriate Council staff or WIRES volunteers. Approximately four live baby flying-foxes and three deceased adults were removed over an eight month period during the food shortage. The Gardens’ staff have been extremely cooperative in ensuring they, and members of the public, are kept safe by employing procedures and communicating with other Council staff when assistance or intervention is required.

The properties within 300m of the Camellia Gardens were notified of the presence of flying-foxes roosting in early August 2016, and no response either by phone, email or mail was received following this mail out. Since then a few random reports of flying-foxes feeding in backyard palm trees, giant bird of paradise and fig trees within 1-2 km of Camellia Gardens were received and a Facebook complaint about noise (during the 2017 mating season), but no formal, direct complaints came from residents adjacent the camp regarding roosting activity following this communication.

A second mail out to properties within a 400m radius of Camellia Gardens was prepared in January 2017 and, following this, only formal complaints about flying-foxes feeding in palm trees and fig trees in surrounding properties were received. This mail out included a flying-fox health fact sheet and what to do if members of the public encounter a flying-fox.

Damage to botanic tree specimens at the Camellia Gardens is a concern for Gardens staff and visitors to the Gardens. This site was historically planted to display Camellia specimens and, although the flying-foxes are not roosting in Camellias, other botanic specimens which make this site iconic are being damaged by roosting flying-foxes. Some visitors and local residents have expressed concerns about damage to vegetation to the Gardens staff and directly to Council.

Council have an online reporting tool which enables the general community to report flying-fox activity. This has resulted in many residents being contacted to discuss their concerns and many reports of flying-fox feeding activity, which has helped Council to understand what flying-foxes are using as a food source. This will help Council be more aware of the status of a food shortage when reports involve uncommon or non-primary food sources.

The following list is a collation of the issues related to the camp that have been reported by the community. The list has been compiled from informal interactions with visitors at the Gardens, Gardens staff, informal conversations with adjacent residents and Council’s customer request management system. Further consultation has since been conducted to gain feedback on the draft CMP. Additional information on community engagement efforts and outcomes can be found in Section 3.

Reported issues include:

- noise at night during mating season;
- noise from the camp during the day whilst visiting the gardens;
- flying-foxes overhanging pathways;
- faecal drop on outdoor areas, residential property, pathways and increased resources associated with cleaning areas adjacent to the camp;
- impacts to wedding organisers due to the presence of flying-foxes;
- odour following light rain or heavy dew especially when it’s hot;
- fear of disease;
Flying-fox Camp Management Plan

- reduced general amenity of the gardens; and
- damage to garden vegetation.

Elevated noise levels can be observed between March and May, which coincides with GHFF mating. The faecal drop issues are an all year round impact. Faecal drop is particularly impacting on the public paths underneath the camp, which can become slippery and quite messy, especially when Cocos palms are being consumed by flying-foxes.

Less than ten complaints have been received from less than ten complainants over 12 months, despite two formal letters being sent to properties within 300 and 400m of the Camellia Gardens. This represents 3% of the total number of households living within 400m of the camp. There are also several people in the surrounding area, and some who attend the Camellia Gardens, who enjoy the camp. Reported positive feedback from garden visitors stems from people who:

- Recognise the landscape-scale benefits flying-foxes provide through seed dispersal and pollination.
- Enjoy watching flying-foxes at the camp and/or flying out or in.
- See the value of the camp as a tourism opportunity/attraction.
- Appreciate the natural values of the camp and habitat.
- Feel the camp does not negatively impact on their lifestyle.
- Value the opportunity the camp provides for them and their family to get close to nature.
- Recognise the need for people and wildlife to live together.

2.4 Management response to date

To date, some community engagement through direct letters to surrounding properties and two community education Bat Nights were conducted at the Camellia Gardens in 2017. In situ management has involved actions that reduce the risk of people coming into contact with flying-foxes and this has worked well, with no near misses with the general public and staff following dedicated protocols. Dispersal was attempted in August 2016 when the camp first arrived and as this was not successful options are now focussed on minimising the impacts of the camp on visitors, staff, adjacent residents and garden vegetation. It is not clear if this camp is a permanent camp however this CMP will dictate future actions.

2.5 Surrounding Habitat

There is a range of feeding and roosting habitat surrounding Camellia Gardens. The following Figure 3 shows the appropriate and inappropriate roosting habitat. Appropriate roosting habitat is defined by being a reasonable distance from residents and sensitive receptors (such as schools and other sensitive land uses) and having continuous 1ha of bushland with a water body nearby. Other nearby flying-fox camps are also shown on the map.
Figure 3 20km radius flying-fox habitat mapped as appropriate and inappropriate based on distance to residential properties and sensitive receptors.
3. Community engagement

Since the camp arrived Council have contacted residents within 400m of the Camellia Gardens on three occasions to gain feedback. Following the endorsement of the Draft Camellia Gardens Camp Management Plan (CMP) in December 2017, it was placed on exhibition to gain community feedback from 5 February to 4 March 2018.

3.1 Stakeholders

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

Table 1: Stakeholders in the camp and Plan

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Interest/report impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents</td>
<td>Noise, odour, faecal drop</td>
</tr>
<tr>
<td>Business owners – Camellia Gardens Tea House</td>
<td>Impacts on business, noise, odour, faecal drop</td>
</tr>
<tr>
<td>Schools – Laguna Street Public School</td>
<td>Possibly some faecal drop</td>
</tr>
<tr>
<td>Civic leaders and influencers (including local, state and federal politicians)</td>
<td>Interests include ensuring that the community’s impacts are managed using best practice management actions as detailed in a Camp Management Plan</td>
</tr>
<tr>
<td>Mark Speakman State MP, Scott Morrison Federal MP, B Ward Councillors: Cr Kent Johns, Cr Jack Boyd, Cr Barry Collier (Camellia Gardens flying fox camp is in B Ward), C Ward Councillors: Cr Croucher, Cr Plibersek, Cr Nichols (Kareela flying-fox camp is in C Ward) and A Ward Councillors: Carol Provan, Marie Simone, Michael Forshaw (Captain Cook Drive flying-fox camp and Kurnell flying-fox camps are in A Ward)</td>
<td></td>
</tr>
<tr>
<td>Local government – Sutherland Shire Council</td>
<td>Sutherland Shire Council is the owner and manager of the land on which the Camellia Gardens Flying-fox camp is situated. SSC is also the owner of the CMP and responsible for implementing actions within the CMP</td>
</tr>
<tr>
<td>Local Government NSW (LGNSW)</td>
<td>Administer grants to local government land managers for assisting with flying-fox management</td>
</tr>
<tr>
<td>OEH</td>
<td>OEH is responsible for administering legislation relating to (among other matters) the conservation and management of native plants and animals, including threatened species and ecological communities.</td>
</tr>
<tr>
<td>Commonwealth Department of the Environment &amp; Energy (DoEE)</td>
<td>DoEE is responsible for administering federal legislation relating to matters of national environmental significance, such as the Grey-headed Flying-fox and any other federally-listed values of the camp site.</td>
</tr>
<tr>
<td>Wildlife carers and conservation organisations</td>
<td>Wildlife carers and conservation organisations have an interest in flying-fox welfare and conservation of flying foxes and their habitat. WIRES is the main wildlife care agency in southern Sydney</td>
</tr>
<tr>
<td>Researchers/universities/CSIRO</td>
<td>Researchers have an interest in flying-fox behaviour, biology and conservation. Peggy Eby from UNSW visited the camp to observe the reproductive rate during the 2016-17 food shortage.</td>
</tr>
</tbody>
</table>
3.2 Engagement methods

Extensive efforts were made to engage with the community regarding the flying-fox camp to:

- Understand the issues directly and indirectly affecting the community.
- Raise awareness within the community about flying-foxes.
- Correct misinformation and allay fears.
- Share information and invite feedback about management responses to date.
- Seek ideas and feedback about possible future management options.

The following methods were used to engage with the community in order to gain feedback regarding the CMP:

- An advertisement in the local newspaper was arranged to alert people to the CMP exhibition.
- A mail out to properties within 400m of the camp was conducted to invite the local community to comment on the CMP, attend an information session and/or fill in a survey. A fact sheet on Cocos palms was also included with this letter.
- A drop in session was held 14 February 2018 at Caringbah Senior Citizens centre to allow the community a one on one session with Council staff. Hard copy surveys were provided at this session.
- Council’s website – the CMP was made available for comment and an online survey provided on Council’s “Join the Conversation”.
- Council’s Facebook page – the community were notified on Facebook of the CMP exhibition.
- Council’s administration building – the CMP was made available at the front counter and hard copies of the survey were provided.
- Sutherland and Caringbah Libraries – hard copies of the CMP were made available for public exhibition at these locations.
- Councillors were made aware of the exhibition via a Councillor Bulletin.
- Internal stakeholders were notified by email of the CMP exhibition.

3.3 Community feedback – management options

A summary of the main feedback received is as follows:

- Eighteen submissions were made online by filling in the survey on Council’s Join the Conversation website.
- Two submissions were made in person by filling in hard copy surveys at the drop in session 14 February 2018.
- One submission was made via mail in hard copy letter form.
- Three submissions were made via email directly to staff.
- Eight comments were made on Council’s Facebook page.

The overall feedback from the community received via engagement indicated the following:

- The majority of respondents supported the Camp Management Plan in its draft form.
- The community indicated that faecal drop, adverse impacts on human health and damage to garden vegetation were the top three concerns in that order.
- The majority of respondents put a high priority on:
  o protecting Camellia Gardens vegetation;
Flying-fox Camp Management Plan

- routine camp maintenance;
- giving residents a buffer from the camp without removing vegetation;
- creation and rehabilitation of habitat in the adjacent Kareena Park reserve; and
- nudging/dispersal of the camp.

• The majority of respondents put a low priority on:
  - subsidised property modifications for affected residents; and
  - the installation of noise attenuation fencing.

• The community feedback was inconclusive as to whether education was a high priority action with many people prioritising it as High and many prioritising it as Low in the community survey. However many of the comments and feedback gained during the exhibition confirm that education is important to ensure facts about disease are clear and the importance of flying-foxes is understood.

• Feedback regarding Cocos palm fruit and the impact to residents that have Cocos palms on their property in the immediate area indicated that residents would like support in managing removal of Cocos palms and/or fruit. This is a complaint that Council receive most commonly from the general community in relation to flying-foxes feeding.

• Camellia Gardens staff supported the use of ropes to increase flying-fox roosting habitat whilst reducing damage to garden vegetation.
4. Legislation and policy

4.1 State

4.1.1 Flying-fox Camp Management Policy 2015

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

4.1.2 Biodiversity Conservation Act 2016

The objects of the Biodiversity Conservation Act 2016 (BC Act) include to conserve biological diversity and protect the critical habitat of threatened species, populations and ecological communities. The Grey-headed Flying-fox is listed as threatened under the BC Act (see also Why the Grey-headed Flying-fox is listed as a threatened species).

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

a. Harm to any animal that is of, or is part of, a threatened species, population or ecological community.

b. The picking of any plant that is of, or is part of, a threatened species, population or ecological community.

c. Damage to critical habitat.

d. Damage to habitat of a threatened species, population or ecological community.

An application for a biodiversity conservation licence is to be made on the form approved by OEH and must contain the information required by OEH. OEH can grant a licence with or without conditions or refuse the application.

4.1.3 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 9.2 will ensure compliance with this Act.

4.1.4 Environmental Planning and Assessment Act 1979

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

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

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

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

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

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

4.2 Commonwealth

4.2.1 Environment Protection and Biodiversity Conservation Act 1999

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

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

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

The 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 SFF1 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.

The camp at Camellia Gardens does not currently meet these criteria.

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

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

---

1 spectacled flying-fox (P. conspicillatus)
4.3 Mitigation Standards for Actions that Directly Impact on Flying-foxes

The following is a list of standards that the State and/or Federal Government may impose if actions proposed to manage flying-fox camps are likely to have an impact:

- The action must not occur if the camp contains females that are in the late stages of pregnancy or have dependent young.
- 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. In NSW an OEH approved ecologist is a suitable person as approved by officers at the Office of Environment and Heritage.
- The action must not involve the clearing of all vegetation supporting a nationally-important flying-fox camp. Sufficient vegetation must be retained to support the maximum number of flying-foxes ever recorded in the camp of interest.

These standards have been incorporated into mitigation measures detailed in Section 9.2. If actions cannot comply with these mitigation measures, and the size and duration of the camp increases, referral for activities at nationally important camps is likely to be required.

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\(^2\) A ‘heat stress event’ is defined for the purposes of the Australian Government’s [Referral guideline for management actions in GHFF and SFF camps](https://www.environment.gov.au/system/files/2015/04/ReFlGuideline.pdf) 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](http://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.
5. Other ecological values of the site

Vegetation is generally described as a botanic garden. This site was established as part of the Sutherland Shire’s Bicentennial celebrations. It was designed as a four season garden showcasing a collection of Camellias interspersed amongst the native bushland. Over time the Camellia Gardens has become a blend of flowering ornamentals, deciduous trees and shrubs and annual displays. The site is a part of the Sutherland Shire Greenweb (wildlife) corridor, it plays a critical role in providing fauna habitat and is situated adjacent 2.9 hectares of remnant bushland on Yowie Bay known as Kareena Park reserve, making it a transit corridor for fauna.

A list of threatened species known to occur within 2 km of the site is provided in Table 2, including the likelihood of each occurring on site.

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

<table>
<thead>
<tr>
<th>Species name</th>
<th>Common name</th>
<th>Status</th>
<th>Likelihood of occurring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ninox strenua</td>
<td>Powerful Owl</td>
<td>Vulnerable under NSW Biodiversity Conservation Act 2016, Vulnerable under EPBC Act 1999</td>
<td>Very likely to be present at certain times of the year. They have been observed roosting during the day at this site outside of their nesting period.</td>
</tr>
<tr>
<td>Pteropus poliocephalus</td>
<td>Grey-headed Flying-fox</td>
<td>Vulnerable under NSW Biodiversity Conservation Act 2016, Vulnerable under EPBC Act 1999</td>
<td>Are present at this site and have been roosting since July 2016</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flora</th>
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</table>

<table>
<thead>
<tr>
<th>Threatened ecological communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estuarine Swamp Oak Forest</td>
</tr>
<tr>
<td>Coastal Flat Swamp Mahogany Forest</td>
</tr>
</tbody>
</table>
6. **Flying-fox ecology and behaviour**

6.1 **Ecological role**

Flying-foxes, along with some birds, make a unique contribution to ecosystem health through their ability to move seeds and pollen over long distances (Southerton et al. 2004). This contributes directly to the reproduction, regeneration and viability of forest ecosystems (DoE 2016a).

It is estimated that a single flying-fox can disperse up to 60,000 seeds in one night (ELW&P 2015). Some plants, particularly Corymbia spp., have adaptations suggesting they rely more heavily on nocturnal visitors such as bats for pollination than daytime pollinators (Southerton et al. 2004).

Grey-headed Flying-foxes may travel 100 km in a single night with a foraging radius of up to 50 km from their camp (McConkey et al. 2012), and have been recorded travelling over 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) and only pollinate during the day.

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).

6.2 **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 roosts or orchards.
- Urban effects on local climate.
- Refuge from predation.
- Movement advantages e.g. ease of manoeuvring in flight due to the open nature of the habitat or ease of navigation due to landmarks and lighting.

6.3 **Under threat**

Flying-foxes roosting and foraging in urban areas more frequently can give the impression that their populations are increasing as they are more often seen by more people; however, the Grey-
Flying-fox Camp Management Plan

Grey-headed Flying-fox is in decline across its range and in 2001 was listed as vulnerable by the NSW Government through the TSC Act 1995, which has since been replaced by the BC Act 2016.

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 (approx. 10 years) given the continuation of the current rate of habitat loss, threats to their survival (e.g. backyard fruit netting, barbed wire and power lines adjacent food trees) and culling.

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

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

- Habitat loss and degradation.
- Conflict with humans (including culling at orchards).
- Infrastructure-related mortality (e.g. Entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.).
- Predation by native and introduced animals.
- Exposure to extreme natural events such as cyclones, drought and heat waves.

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

6.4 General flying-fox 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 roost 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).
6.5 Species profiles

6.5.1 Grey-headed Flying-fox (Pteropus poliocephalus)

The Grey-headed Flying-fox (GHFF) (Figure 2) 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 Black Flying-fox (BFF) (DECCW 2009). For these reasons it is listed as vulnerable to extinction under NSW and federal legislation (see Section 4).
6.5.2 **Black Flying-fox (Pteropus alecto)**

![Map of Australia with an orange area indicating the distribution of Black Flying-fox](image)

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

The Black Flying-fox (BFF) (Figure 1) has traditionally occurred throughout coastal areas from Shark Bay in Western Australia, across Northern Australia, down through Queensland and into 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 vulnerable 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 roost beside a creek or river in a wide range of warm and moist habitats, including lowland rainforest gullies, coastal stringybark forests and mangroves. During the breeding season camp sizes can change significantly in response to the availability of food and the arrival of animals from other areas. The BFF is not listed as a threatened species under NSW or Federal legislation.
6.5.3 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 4).

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
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<tbody>
<tr>
<td>GHFF</td>
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</tbody>
</table>

- Green: Peak conception
- Dark grey: Final trimester
- Blue: Peak birthing
- Light blue: Crèching (young left at roost)
- Light grey: Lactation

Figure 4: Indicative flying-fox reproductive cycle. The breeding season of all species is variable between years and location, and expert assessment is required to accurately determine phases in the breeding cycle and inform appropriate management timing.
7. Human and animal health

Flying-foxes, like all animals, carry pathogens that may pose human health risks. Many of these are viruses which cause only asymptomatic infections in flying-foxes themselves, but may cause significant disease in other animals that are exposed. In Australia the most well-defined of these include Australian Bat Lyssavirus (ABLV), Hendra Virus (HeV) and Menangle virus. Specific information on these viruses is provided in Appendix 4.

ABLV is carried by approximately 1% of flying-foxes and a person must be bitten or scratched by an infected animal to risk contracting ABLV. If a person is bitten or scratched the rabies vaccine is administered by a medical professional to prevent the onset of ABLV. The vaccine is successful if administered directly following a bite or scratch. Three people in Australia have died from ABLV as a result of not being treated for ABLV.

In comparison HeV infection in humans requires transfer from an infected intermediate equine host and direct transmission from bats to humans has not been reported. Thus despite the fact that human infection with these agents can be fatal, the probability of infection is extremely low and the overall public health risk is judged to be low (Qld Health 2016).

7.1 Disease and flying-fox management

The effects of stress are linked to increased susceptibility and expression of disease in both humans (AIHW 2012) and animals (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.
8. Potential Camp management options

8.1 Site-specific analysis of camp management options

Table 3 below shows a summary of all management actions that could potentially be used at a flying-fox camp, the table details the pros and cons and costs of the actions as well as a brief description. Not all actions are likely to be suitable for implementation at all flying-fox camps. Section 9 details the actions deemed practical and suitable to be implemented at the Camellia Gardens camp. More detailed descriptions of actions in Table 3 below are provided in Appendix 5.

Table 3: Analysis of management options; definitions and descriptions of each management option

<table>
<thead>
<tr>
<th>Management option</th>
<th>Issues/Impacts</th>
<th>Cost</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 actions</strong></td>
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<td></td>
</tr>
<tr>
<td>Education and awareness programs</td>
<td>Fear of disease</td>
<td>~$1000 per year</td>
<td>Low cost, promotes conservation of FFs, contributes to attitude change within the general community which may reduce general need for camp intervention. Increasing awareness and providing options for landholders to reduce impacts can be an effective long-term solution, can be undertaken quickly, and will not impact on ecological or amenity value of the site. Can be conducted without the need for Threatened Species Licence application or EPBC referral.</td>
<td>Education and advice itself will not mitigate all issues, and may be seen as not doing enough by directly affected residents. Hard to sell something that doesn’t remove the cause of the problem.</td>
</tr>
<tr>
<td></td>
<td>Noise</td>
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<td></td>
<td>Odour</td>
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<td></td>
<td>Faecal drop</td>
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<tr>
<td>Property modification</td>
<td>Noise</td>
<td>Varied but greater than $15,000</td>
<td>Property modification is one of the most effective ways to reduce amenity impacts of a camp without dispersal (and associated risks), relatively low cost (compared with other options), promotes conservation of FFs, can be undertaken quickly, will not impact on the site, may add value to the property. Can be conducted without the need for Threatened species licence application or EPBC referral.</td>
<td>May be cost-prohibitive for private landholders, unlikely to fully mitigate amenity issues in outdoor areas.</td>
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<td></td>
<td>Odour</td>
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<td>Faecal drop</td>
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<td>Health/wellbeing</td>
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<td></td>
<td>Property devaluation</td>
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<td></td>
<td>Lost rental return</td>
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<td></td>
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</tr>
<tr>
<td>Fully-fund/subsidise property modification</td>
<td>Noise</td>
<td>$7,750 one off (cost to Council using same eligibility and grant funding as Kareela)</td>
<td>Potential advantages as per property modification, but also overcomes issue of cost for private landholders. Can be conducted without the need for a Threatened Species Licence application or EPBC referral.</td>
<td>Costs to the land manager will vary depending on what item/s they choose to purchase/install. May lead to expectations for similar subsidies for other issues.</td>
</tr>
<tr>
<td></td>
<td>Odour</td>
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<td>Faecal drop</td>
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<td>Property devaluation</td>
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<td>Lost rental return</td>
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<tr>
<td>Management option</td>
<td>Issues/Impacts</td>
<td>Cost</td>
<td>Advantages</td>
<td>Disadvantages</td>
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<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Service subsidies including rate rebates</td>
<td>Noise Odour Faecal drop Health/ wellbeing Property devaluation Lost rental return</td>
<td>$100 /property /year = $1200 /year (using same eligibility as above)</td>
<td>May encourage tolerance of living near a camp, promotes conservation of FFs, can be undertaken quickly, will not impact on the site, and would reduce the need for property modification.</td>
<td>May be costly across multiple properties and would incur ongoing costs, may set unrealistic community expectations for other community issues, effort required to determine who would receive subsidies.</td>
</tr>
<tr>
<td>Routine camp management</td>
<td>Health/ wellbeing/visual amenity</td>
<td>$20,000/ year</td>
<td>Will allow camp maintenance, likely to improve habitat, could improve public perception of the site, will ensure safety risks of a public site can be managed. Weed removal has the potential to reduce roost availability and reduce numbers of roosting FFs. To avoid this, weed removal should be staged and alternative roost habitat planted, otherwise activities may constitute a Level 3 action.</td>
<td>Will only mitigate visual amenity impacts for nearby land holders and maybe allergy sufferers (specific weed species).</td>
</tr>
<tr>
<td>Alternative habitat creation</td>
<td>All</td>
<td>$30,000 to $100,000</td>
<td>If successful in attracting FFs away from high conflict areas, dedicated habitat in low conflict areas will mitigate all impacts, promotes FF conservation. Rehabilitation of degraded habitat that is likely to be suitable for FF use could be a more practical and faster approach than habitat creation.</td>
<td>Generally costly, long-term approach so cannot be undertaken quickly, previous attempts to attract FFs to a new site have not been known to succeed.</td>
</tr>
<tr>
<td>Protocols to manage incidents</td>
<td>Health/ wellbeing</td>
<td>-$1000 /year</td>
<td>Low cost, will reduce actual risk of negative human/pet–FF interactions, promotes conservation of FFs, can be undertaken quickly, will not impact the site.</td>
<td>Will not generally mitigate amenity impacts.</td>
</tr>
<tr>
<td>Research</td>
<td>All</td>
<td>Low cost to Council</td>
<td>Supporting research to improve understanding may contribute to more effectively mitigating all impacts, promotes FF conservation.</td>
<td>Generally cannot be undertaken quickly, management trials may require further cost input.</td>
</tr>
<tr>
<td>Appropriate land-use planning</td>
<td>All</td>
<td>Low cost</td>
<td>Likely to reduce future conflict, promotes FF conservation. Identification of degraded sites that may be suitable for long-term rehabilitation for FFs could facilitate offset strategies should clearing be required under Level 2 actions.</td>
<td>Will not generally mitigate current impacts, land-use restrictions may impact the landholder.</td>
</tr>
<tr>
<td>Property acquisition</td>
<td>All for specific property owners Nil for broader community</td>
<td>$16 million upwards (acquire properties within 75m of the camp)</td>
<td>Will reduce future conflict with the owners of acquired property.</td>
<td>Owners may not want to move, only improves amenity for those who fit criteria for acquisition, very expensive.</td>
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</table>
# Flying-fox Camp Management Plan

<table>
<thead>
<tr>
<th>Management option</th>
<th>Issues/Impacts</th>
<th>Cost</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do nothing</td>
<td>Nil</td>
<td>Nil</td>
<td>No resource expenditure.</td>
<td>Will not mitigate impacts and unlikely to be considered acceptable by the community.</td>
</tr>
</tbody>
</table>

## Level 2 actions

| Buffers through vegetation removal | Noise, Odour, Health/wellbeing, Property devaluation, Lost rental return | $50,000 | Will reduce impacts, promotes FF conservation, can be undertaken quickly, limited maintenance costs. | Will impact the site, will not generally eliminate impacts, vegetation removal may not be favoured aesthetically by the community. May require Threatened Species Licence and an EPBC approval. Not suitable for a botanic gardens site like Camellia Gardens. |
| Buffers without vegetation removal e.g. deterrents such as sprinklers or lights | Noise, Odour, Health/wellbeing, Damage to vegetation, Property devaluation, Lost rental return | $50,000 | Successful creation of a buffer will reduce impacts, promotes FF conservation, can be undertaken quickly, options without vegetation removal may be preferred by the community. Is more suitable for a botanic gardens style site like Camellia Gardens | May impact the site, buffers will not generally eliminate impacts, maintenance costs may be significant, often logistically difficult, limited trials so likely effectiveness unknown. |
| Noise attenuation fencing | Noise, Odour, Health/wellbeing, Property devaluation, Lost rental return | $150,000 | Will eliminate/significantly reduce noise impacts, may reduce other impacts, limited maintenance costs. | Costly, likely to impact visual amenity of the site, will not eliminate all impacts, may impact other wildlife at the site. May require a Threatened Species Licence and an EPBC approval. Neighbours of the gardens may not want to lose their view. |

## Level 3 actions

<p>| Nudging | All | $90,000 for one month | If nudging is successful this may mitigate all impacts. | Costly, FFs will continue attempting to recolonise the area unless combined with habitat modification/deterrents. Will require a Threatened Species Licence and may require an EPBC approval. |</p>
<table>
<thead>
<tr>
<th>Management option</th>
<th>Issues/Impacts</th>
<th>Cost</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive dispersal through vegetation management</td>
<td>All at that site but not generally appropriate for amenity impacts only (see Appendix 5)</td>
<td>$150,000</td>
<td>If successful can mitigate all impacts at that site, compared with active dispersal: less stress on FFs, less ongoing cost, less restrictive in timing with ability for evening vegetation removal.</td>
<td>Costly, will impact site, risk of removing habitat before outcome known, potential to splinter the camp creating problems at other locations (although less than active dispersal), potential welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk (see Section 7.1), potential to impact on aircraft safety. Will require a Threatened Species Licence and may require an EPBC approval.</td>
</tr>
<tr>
<td>Passive dispersal through water management (piping the creek or stemming the stormwater or groundwater)</td>
<td>All at that site but not generally appropriate for amenity impacts only (see Section 5)</td>
<td>$100,000-$5,000,000</td>
<td>Potential advantages as per with passive dispersal through vegetation removal, however likelihood of success unknown.</td>
<td>Highly costly at this site with a creek line running through. Potential disadvantages as per passive dispersal through vegetation removal, however likelihood of success unknown. Will require a Threatened Species Licence and may require an EPBC approval. Loss of amenity through loss of a watercourse/stream. This option would reduce habitat for gardens fauna.</td>
</tr>
<tr>
<td>Active dispersal</td>
<td>All at that site but not generally appropriate for amenity impacts only (see Section 5)</td>
<td>$450,000 for 3 years</td>
<td>If successful can mitigate all impacts at that site, often stated as the preferred method for impacted community members.</td>
<td>May be very costly, most likely unsuccessful, ongoing dispersal is generally required unless combined with habitat modification, potential to splinter the camp creating problems in other nearby locations, potential for significant animal welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk (see Section 7.1). Will require a Threatened Species Licence and may require an EPBC approval.</td>
</tr>
<tr>
<td>Early dispersal before a camp is established at a new location</td>
<td>All at that site</td>
<td>$50,000-$90,000</td>
<td>Potential advantages as per other dispersal methods, but more likely to be successful than dispersal of a historic camp.</td>
<td>May not be successful. Potential disadvantages as per other dispersal methods, but possibly less costly and slightly lower risk than dispersing a historic camp. Potential to increase pressure on FFs that may have relocated from another dispersed camp, which may exacerbate impacts on these individuals. Will require a Threatened Species Licence and may require an EPBC approval.</td>
</tr>
</tbody>
</table>
9. Proposed management approach

9.1 Camellia Gardens priority actions

Whilst the camp size and roosting area at Camellia Gardens remains fairly consistent and management actions are working to protect people, minimise and/or mitigate vegetation impacts and impacts on adjacent properties remain moderate, the following are the recommended management actions from Table 4 below. Table 4 details how each of the management actions reduce the associated impacts.

The following are the proposed Camellia Gardens priority management actions which are listed in order below:

- Level 1: Protocols to manage incidents - Risk Management for the General Public, Staff and adjacent residents.
- Level 1: Community education and awareness campaign.
- Level 1: Routine camp management – weed removal, tree pruning, garden maintenance.
- Level 1: Appropriate land-use planning.
- Level 1: Alternative habitat creation – creation of additional roosting habitat within the gardens and/or linking to Kareena Park to give roosting habitat a rest.
- Level 1: Dense fragrant planting at boundaries – if residents deemed that odour and visual amenity are a significant issue, this could be implemented.
- Level 2: Buffers without vegetation management – the use of sprinklers and/or lighting to direct flying-foxes away from residential properties and important tree specimens.
- Level 1: Alternative habitat improvement – the western part of Kareena Park could have its understorey regenerated to make it more suitable as roosting habitat.
- Level 1: Installation of artificial roosting habitat – installation of rope between roosting branches to increase roosting area whilst minimising damage to existing vegetation.
- Level 1: Cocos palm removal grant program – offer grants to residents within 250m of the camp the opportunity to apply for up to $500/property for Cocos palm removal as a once off.
- Level 2: Nudging – pushing flying-foxes away from sensitive areas such as residential properties and valuable tree specimens

Should GHFF numbers within the camp increase or impacts to residents and users of the environment increase, a review of actions will be undertaken and if necessary a more active management approach will be considered. However at the time this report was prepared the following option is not recommended:

- Level 3: Active dispersal – if risks at the site are increased or population exceeds reasonable levels for the site, dispersal may be attempted to reduce the population. Early dispersal was attempted, as the camp had formed. The
dispersal was not successful, which was likely due to animals being in poor condition due to a food shortage but may also be that animals are habituated to noise at this site e.g. lawn mowing, hedge trimming and general garden maintenance.

The success of the actions implemented and population and extent of roosting will be assessed regularly to determine if this section of the CMP requires updating.
### Table 4: Impact management overview – this table shows how actions aim to mitigate the impacts of flying-fox roosting

<table>
<thead>
<tr>
<th>Issue</th>
<th>Management aim</th>
<th>Success measures</th>
<th>Management actions to be considered</th>
<th>Level 3 actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>Mitigate noise impacts.</td>
<td>Respond to noise complaints within 7 days of report. Provide advice on seasonal nature of noise generation. Reasonable level of amenity achieved for the majority of time.</td>
<td>Property modification (including providing subsidies if possible). Appropriate land-use planning. Revegetate and manage land to create alternative habitat further from sensitive receptors such as residential properties. Cocos palm removal grant. Buffers. Noise attenuation fencing. Level 3 actions will not be considered to mitigate this issue.</td>
<td></td>
</tr>
<tr>
<td>Flying-foxes overhanging residential properties</td>
<td>Prevent flying-foxes overhanging properties.</td>
<td>No roosting flying-foxes overhanging residential properties.</td>
<td>Appropriate land use planning. Revegetate and manage land to create alternative habitat further from sensitive receptors such as residential properties. Trim overhanging vegetation / install deterrents (deterrents may constitute a Level 3 action, provide details). Level 3 actions will not be considered to mitigate this issue.</td>
<td></td>
</tr>
<tr>
<td>Faecal drop</td>
<td>Mitigate impacts of faecal drop.</td>
<td>Reduce impacts of faecal drop on visitors, staff and adjacent residents.</td>
<td>Education and awareness (e.g. managing foraging attractants and tips to reduce impacts / fear of disease). Property modification (including providing subsidies if possible). Appropriate land-use planning. Provide appropriate training, WHS procedures and PPE for staff working in and around the gardens. Employ a gurney for cleaning paths, vegetation, seating and railings. Cocos palm removal grant. Buffers. Level 3 actions will not be considered to mitigate this issue.</td>
<td></td>
</tr>
</tbody>
</table>
### Camellia Gardens Flying-fox Camp Management Plan

<table>
<thead>
<tr>
<th>Issue</th>
<th>Management aim</th>
<th>Success measures</th>
<th>Management actions to be considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odour</td>
<td>Mitigate impacts of odour.</td>
<td>Respond to odour complaints within 7 days of report. Reasonable level of amenity</td>
<td><strong>Level 1 actions</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>achieved for the majority of time.</td>
<td><strong>Level 2 actions</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Level 3 actions</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Education and awareness programs (e.g. ensuring community understand not associated</td>
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<td></td>
<td></td>
<td>with uncleanliness). Property modification (including providing subsidies if</td>
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<td></td>
<td></td>
<td>possible). Appropriate land-use planning.</td>
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<td></td>
<td>Dense planting at boundaries (including use of fragrant flowers to mask odour).</td>
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<td></td>
<td>Revegetate to create alternative habitat.</td>
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<tr>
<td></td>
<td></td>
<td>Support research to determine odour masking techniques.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td><strong>Level 3 actions</strong> will not be considered to mitigate this issue.</td>
<td></td>
</tr>
<tr>
<td>Disease</td>
<td>Promote awareness of actual low disease</td>
<td>Respond to health and wellbeing complaints within two working days of report.</td>
<td><strong>Buffers.</strong></td>
</tr>
<tr>
<td></td>
<td>risk. Prevent public and staff from</td>
<td>All concerned community and staff members are provided access to factual information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>coming into contact with flying-foxes.</td>
<td>on disease. Community and staff educated and have their concerns addressed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Education and awareness programs (e.g. ensuring community understands actual low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>risk of disease transfer and simple mitigation measures). Site risk assessment and</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>implementation of protocols to prevent incidents.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Level 3 actions</strong> will not be considered to mitigate this issue.</td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>Management aim</td>
<td>Success measures</td>
<td>Management actions to be considered</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Health / wellbeing impacts</strong></td>
<td>Mitigate health and wellbeing impacts.</td>
<td>Respond to health and wellbeing complaints within two working days of report. All concerned community and staff members are provided access to factual information on disease. Community and staff educated and have their concerns addressed. Establish a line of communication for affected staff and residents.</td>
<td><strong>Level 1 actions</strong>&lt;br&gt;Education and awareness programs. Property modification (including subsidies) to reduce wellbeing impacts. Routine management actions to improve the amenity of the site. Revegetate land to create alternative habitat further away from sensitive receptors such as residential properties. Fragrant vegetation buffer. Online flying-fox reporting tool. Targeted mail out to immediately-affected neighbours. Regular onsite presence of Council flying-fox management representatives Revegetate and manage land to create alternative habitat further from sensitive receptors. Cocos palm removal grant. <strong>Level 2 actions</strong>&lt;br&gt;Buffers. Noise attenuation fencing. Visual screen. <strong>Nudging. Dispersal may be considered if unable to be mitigated any other way.</strong>&lt;br&gt;<strong>Level 3 actions</strong>&lt;br&gt;Buffers. Noise attenuation fencing. Visual screen.</td>
</tr>
<tr>
<td><strong>Damage to vegetation</strong></td>
<td>Mitigate impacts to vegetation.</td>
<td>Long-term viability of gardens vegetation not at risk, or plant species at risk can be replanted as they are common.</td>
<td>Improvement of Kareena Park reserve as overflow habitat. Revegetate and manage land to create alternative habitat further from sensitive receptors such as residential properties and schools. Installation of ropes to supplement roosting habitat. Deterrents such as sprinklers and lighting to be used to protect selected roosting trees to give them a rest, particularly deciduous trees in bud or those at risk of dying in the short term. <strong>Nudging. Dispersal is not considered as an action for mitigating damage to vegetation.</strong>&lt;br&gt;<strong>Level 3 actions</strong>&lt;br&gt;Buffers. Noise attenuation fencing. Visual/odour/noise screens.</td>
</tr>
<tr>
<td><strong>Property devaluation/ reduced rental return</strong></td>
<td>Reduce economic loss associated with potential property devaluation.</td>
<td>Property value impacts reduced where practicable.</td>
<td>Property modification (including subsidies). Appropriate land-use planning. Dense planting to create screens at residential boundaries. Revegetate and manage land to create alternative habitat further from sensitive receptors such as residential properties. <strong>Buffers. Noise attenuation fencing. Visual/odour/noise screens.</strong> <strong>Nudging. Dispersal is not considered as an action for reducing devaluation.</strong>&lt;br&gt;<strong>Level 3 actions</strong>&lt;br&gt;Buffers. Noise attenuation fencing. Visual/odour/noise screens.</td>
</tr>
</tbody>
</table>
### Animal welfare

<table>
<thead>
<tr>
<th>Management aim</th>
<th>Success measures</th>
<th>Management actions to be considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce the impact of garden management on flying-foxes.</td>
<td>No flying fox deaths or injuries resulting from works conducted at Camellia Gardens.</td>
<td>Appropriate welfare procedures in place to prevent impacts to flying-foxes (see section 9.2).</td>
</tr>
</tbody>
</table>

Level 1 actions: NA

Level 2 actions: NA

Level 3 actions: NA
Figure 6: Flow chart to demonstrate the process for management decision-making
9.2 Management of animal welfare impacts

Management of animal welfare is critical to sustainable management of a flying-fox camp as they are a Threatened Species and any measurable impacts could effect the species population and will prevent Council doing further Level 2 or 3 actions. Management actions will cease and will not recommence or progress to subsequent levels without consulting OEH in accordance with the following table:

<table>
<thead>
<tr>
<th>Camp Management Category</th>
<th>Types of action</th>
<th>Triggers for Actions to Cease</th>
<th>Monitoring Action Required to Confirm Triggers</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Tree trimming, lawn mowing, mulching, other loud machinery operation</td>
<td>More than 30% of the camp takes flight and/or more than 10 animals are circling for more than 3 minutes</td>
<td>Onsite workers are to be informed of what to look for. Includes Bush regenerators, lawn mowers, aborists, onsite staff etc. Loud machinery is to be started away from the camp to allow animals to adjust.</td>
<td>Cease works if trigger behaviours are observed. Contact Gardens supervisor and/or Environmental Science Unit. Modification of works can be attempted but if the same trigger occurs then works must cease.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If individuals observed are: panting, saliva spreading or located within 2m of the ground</td>
<td>Onsite workers are to be informed of what to look for. Includes Bush regenerators, lawn mowers, aborists, onsite staff etc. Loud machinery is to be started away from the camp to allow animals to adjust.</td>
<td>Cease works if trigger behaviours are observed. Contact Gardens supervisor and/or Environmental Science Unit. Modification of works can be attempted but if the same trigger occurs then works must cease.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During and following heat stress events (temperatures above 40°C) where animals were visibly affected or animals required rescue are likely to need at least a week to recover. See Heat Stress Appendix B</td>
<td>If site workers are unsure about conditions an OEH approved ecologist is to review the camp and weather conditions.</td>
<td>Cease works if conditions deemed that they may impact upon the animals in the camp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During the period when females are carrying young (October to December) non urgent and/or excessively loud work should not be undertaken</td>
<td></td>
<td>Do not commence non essential works if dependent young are present.</td>
</tr>
<tr>
<td></td>
<td>Buffer creation i.e. roosting habitat removal or sprinkler/deterrent installation to prevent flying-foxes roosting close to sensitive receptors</td>
<td>During vegetation removal actions or installation of sprinklers/deterrents no works to occur if flying-foxes are present in the work area</td>
<td>OEH approved ecologist to check camp prior to vegetation removal works commencing to confirm camp is empty and/or that no flying-foxes are present within 20m of the work area.</td>
<td>Do not commence works if flying-foxes are present within 20m of work zone and/or more than 20 animals are observed to be occupying any of the habitat.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Sprinkler/deterrent operation</td>
<td>More than 30% of the camp takes flight and/or more than 10 animals are circling for more than 3 minutes</td>
<td>Operators of the sprinkler system are to be informed of what to look for.</td>
<td>Cease works if trigger behaviours are observed. Contact Gardens supervisor and/or Environmental Science Unit. Modification of works can be attempted but if the same trigger occurs then works must cease.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If dependent young are present in the sprinkler affected trees</td>
<td>Operators of the sprinkler system are to be informed of what to look for. If site workers are unsure about conditions an OEH approved ecologist is to review the camp.</td>
<td>Cease works if dependent young are observed in sprinkler affected trees. If young relocate to other trees actions can continue. Contact Gardens supervisor and/or Environmental Science Unit. Modification of works can be attempted but if the same trigger occurs then works must cease.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Works to cease if unacceptable impacts at other camps are occurring or have occurred</td>
<td>Maintain contact with 20km radius camp managers.</td>
<td>Cease works and reassess actions if any 20km radius camp managers complain formally in writing that their camp has been adversely affected by sprinkler operation at Camellia Gardens.</td>
</tr>
<tr>
<td>Types of action</td>
<td>Triggers for Actions to Cease</td>
<td>Monitoring Action Required to Confirm Triggers</td>
<td>Response</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
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<td>-----------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Presence of dependent young</td>
<td>OEH approved ecologist to listen for mum/young calling, observe first thing in the morning and during daylight for young feeding on mum, watch animals in flight to see if any are carrying young and check at least 10 trees containing females at least once every 24 hours during daylight for the presence of young.</td>
<td>Cease works if dependent young are observed. No further works to be undertaken unless dependent young are no longer detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of heavily pregnant females</td>
<td>OEH approved ecologist to observe at least 10 roost trees containing females, observe them in flight. Check at least once every 24 hours during daylight for signs of late pregnancy.</td>
<td>Cease works if heavily pregnant females are observed. No further works to be undertaken unless heavily pregnant females are no longer detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undernourished individuals are observed</td>
<td>OEH approved ecologist to watch animals in flight early morning and roosting during daylight hours. At least once every 24 hours to observe signs of malnutrition.</td>
<td>Cease works if undernourished individuals are observed. No further works to be undertaken unless undernourished individuals are no longer detected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise complaints have been received</td>
<td>Cease works if greater than two properties submit written complaints to Council. If noise complaints are received verbally during activities onsite, modify activities and if complaints continue cease works and seek advice.</td>
<td>Cease works if more than two of the residents complain in writing and modify the methodology. Consult with complainants to see if impacts have reduced to a suitable level, if they have then modified works can recommence if not then work cease.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New camps have formed as a result of actions or other camps are unsustainably impacted</td>
<td>Monitor all habitat locations within 600m of the camp daily, within 1km of the camp weekly and within 20km of the camp monthly. The definition of a new camp forming is if it appears that roosting has occurred in a location for more than 3 days in numbers greater than 50. Remain in contact with 20km radius camp managers.</td>
<td>Cease works if a new camp has been confirmed to have formed following habitat monitoring during dispersal work. Reassess if it is in an unsuitable location or there is further risk of forming other camps in unsuitable locations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Works to cease if unacceptable impacts at other camps is occurring or has occurred during or following works</td>
<td>Check 20km radius camps weekly during initial dispersal and monthly during maintenance dispersal. Monitor camps for population numbers or any unexplained ill health e.g. spontaneous abortion and reproductive abnormalities.</td>
<td>Cease works and reassess if populations at 20km radius camps have increased to unacceptable levels. Cease works and seek advice if reproductive abnormalities are observed or suspected and dispersal could be a contributing or causal factor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dispersal methods are not successful</td>
<td>If by day 14 of initial dispersal numbers have not reduced by at least 40-50% (on initial numbers); then dispersal is deemed unsuccessful.</td>
<td>Cease works if monitoring shows dispersal to be unsuccessful. Re evaluate work methods with OEH.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial dispersal actions conducted outside of Jun-Aug</td>
<td>No initial dispersal outside of Jun-Aug.</td>
<td>No initial dispersal works to be initiated outside of Jun-Aug.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance dispersal actions conducted during Jan-Feb/creching time</td>
<td>No maintenance dispersal within Jan-Feb or when dependent young are left alone at night in the camp (creching).</td>
<td>No dispersal activities during creching.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unacceptable levels of stress</td>
<td>Panting, saliva spreading, animals within 2m of the ground as observed by the OEH approved ecologist.</td>
<td>Dispersal must cease if these behaviours are observed. Re evaluate work methods with OEH.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>Low flying, laboured flight, settling despite dispersal efforts.</td>
<td>Dispersal must cease if these behaviours are observed. Re evaluate work methods with OEH.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injury/death</td>
<td>A flying fox appears to have been injured/killed on site (including aborted foetuses). Any flying fox death reported within 1km of the dispersal site that could be related to dispersal.</td>
<td>Dispersal must cease if any injury or death occurs on site or within 1km of the site. Re evaluate work methods with OEH.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A person with experience in flying-fox behaviour (as per Appendix 1) will monitor for welfare triggers and direct works where required in the above table. Non critical works will be conducted in periods where the camp is either empty or numbers are lowest, timed to avoid late stage pregnancy and the presence of dependent young (usually Jun-Jul). A maximum of two unsuccessful attempts to recommence work are allowed before ceasing for the day. A Dispersal Plan must be developed to detail how actions will be managed. OEH and DoEE conditions must be adhered to for all Level 2 & 3 actions.

9.3 **Management of personnel safety**

- People working under the camp for the majority of their working day should wash their clothes daily. Appropriate hygiene practices should be adopted such as washing hands with soap and water before eating, smoking or applying sun cream or skin products. Personal protective equipment should be made available to all staff and worn on an as-needed basis.

- A person vaccinated and trained to handle flying-foxes should be onsite at all times during Level 2 and 3 actions. Level 2 actions such as sprinkler installation should have vaccinated and trained staff onsite. However sprinkler operation, once established, is considered to have similar impacts on the flying-foxes as Level 1 actions. The likelihood of staff coming into contact with flying-foxes is significantly reduced during sprinkler operation and a vaccinated person need not be onsite.

- A wash station will be available on site during works along with an anti-viral antiseptic containing iodine provolone (e.g. Betadine) should someone be bitten or scratched.

See below in case of a bite or scratch.
BAT BITE & SCRATCH EMERGENCY PROCEDURE

FIRST AID

1. Immediately wash the wound thoroughly with SOAP and WATER for at least 5 minutes.

2. Apply an antiseptic such as aqueous iodine solution or alcohol (ethanol) after washing.

3. Attend the local hospital emergency department.

4. Direct nurse/treating physician to contact the NSW PUBLIC HEALTH UNIT on 9382 8333 (menu 3) to discuss and arrange appropriate treatment, including delivery of vaccine/immunoglobulin.

<table>
<thead>
<tr>
<th>Treatment for Vaccinated patient</th>
<th>Treatment for Unvaccinated patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you have received a prior course of at least 3 doses of rabies vaccine, you can attend a local GP/medical centre for assessment and should only require 2 more doses (day 0 and 3) of rabies vaccine only.</td>
<td>If you have not received at least 3 doses of rabies vaccine or are uncertain, you will require a course of 4 doses (days 0, 3, 7 and 14) of rabies vaccine, PLUS a dose of rabies immunoglobulin that is in part to be injected into the wound.</td>
</tr>
</tbody>
</table>
10. Evaluation and review of CMP

Council has always taken an adaptive approach to flying-fox management by evolving its actions in response to flying-fox behaviour, community feedback and changing management strategies. However, to formalise the process, the following details how and what triggers will result in an update of the CMP.

The Plan will have a minor informal review annually, which will include evaluation of management actions against success criteria shown in Section 9.1.

The following will trigger an assessment of the currency of the CMP:

- Pressure to deviate from priority actions listed in section 9.1.
- Significant changes to relevant policy/legislation.
- Major outcomes of research that may influence the CMP.
- Incidents associated with the camp.
- Significant changes to the number of flying foxes within the camp.
- Significant increase in community complaints.

If the plan requires a major review (for example, all actions previously proposed have been conducted or have been deemed not viable and/or a major change in the health risk at the site), a major review will be conducted in consultation with OEH.

If the CMP is to remain current, a full review including stakeholder consultation and expert input will be undertaken after five years and will be re-submitted to OEH.
11. Plan administration

11.1 General monitoring of the camp
Monitoring of flying-foxes at Camellia Gardens will occur on a weekly basis for:

- population numbers;
- the presence of dependent young and/or heavily pregnant females;
- reproductive status of the camp; and
- general health.

Other monitoring of the camp for Level 1 actions will be conducted as per section 9.2 on an as-needed basis, or as part of the requirements of a State or Federal licence/referral to undertake Level 2 or 3 actions.

11.2 Reporting
Reporting will be conducted on an as-needed basis, or as part of the requirement of a State or Federal licence/referral to undertake Level 2 or 3 actions or grant reporting requirements.

11.3 Management structure and responsibilities
Table 5 below will be considered when preparing for any works that are proposed to be undertaken on an as-needed basis prior to Level 2 or 3 actions being implemented when licence/referral applications are prepared. If subsequent plans are required e.g. Vegetation Management Plan or Dispersal Plan, then Table 5 will be used in these documents.
Table 5: Roles and responsibilities

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Required experience/approvals</th>
<th>Responsibilities/authority</th>
<th>Communication lines</th>
</tr>
</thead>
</table>
| Program Coordinator        | [insert] | Project management  
Human resource management  
Community engagement  
Reporting                                                                 | Inform and consult with stakeholders and interested parties  
Community engagement  
Evaluate program  
Submit reports to OEH/DoE  
Ensure all landowners have provided consent prior to works | Reports to: [insert]  
Direct reports: Project Manager |
| Project Manager             | [insert] | Project management  
Team leadership and coordination  
Data management                                                                   | Coordinate field teams and ensure all personnel are appropriately experienced and trained for their roles  
Induct all personnel to the program  
Collect and collate data  
Liaise with OEH and DoE  
Liaise with wildlife carers/veterinarians (for orphaned/injured wildlife only) | Reports to: Program Coordinator  
Direct reports: Supervisor, Contractor |
| Supervisor                  | [insert] | Knowledgeable in flying-fox biology, behaviour and camp management (see Appendix 1 for detail)  
ABLV-vaccinated and trained in flying-fox rescue  
Team training, leadership and supervision | Pre- and post-management monitoring  
Surrounding camp monitoring  
Coordinate daily site briefings  
Coordinate daily activities  
Monitor flying-fox behaviour  
Rescue flying-foxes if required (and no carer/vet on site)  
Determine daily works end point  
Participate in management activities | Reports to: Project Manager  
Direct reports: Team members, Observers/support |
| Team member                 | [insert] | Recommended ABLV-vaccinated (employer to assess risk)  
Ideally all team knowledgeable in flying-fox biology, behaviour and camp management however not required | Attend daily site briefings  
Participate in relevant management activities | Reports to: Supervisor  
Direct reports: Nil |
| Contractor                  | [insert type e.g. arborist] | Relevant licences and experience in field                                                                 | Conduct specified activities (e.g. tree trimming)  
Adhere to all directions given by Supervisor | Reports to: Project Manager  
Direct reports: Nil |
| Observer/support            | [insert] | Approval to access site                                                                                                                                 | Provide care of injured/orphaned wildlife (under licence) if required | Reports to: Supervisor  
Direct reports: Nil |
| Flying-fox expert           | [insert] | See Appendix 1                                                                                                                                         | On-site population assessment, monitor flying-fox behaviour and ensure compliance with the Plan. | Reports to: Supervisor  
Direct reports: Nil |
11.4 Funding commitment

Council have provided approximate costs of actions in section 8.1. Table 3 shows approximate costing for proposed actions. It is anticipated that Council will provide a formal commitment to financing actions within the CMP when it is formally adopted in May 2018. A council report will detail what funding is to be allocated for expenditure over current and future financial years.
12. References and additional resources


Camellia Gardens Flying-fox Camp Management Plan


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


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

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

**Flying-fox expert/OEH approved ecologist**

**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 with titre levels measured within 12 months (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 Biobanking 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.
2. **Appendix: Summary of other key legislation likely to apply at flying fox camps**

**Local government legislation**

Local government is required to prepare planning schemes (including Environmental Planning Instruments and Development Control Plans) consistent with provisions under the *Environmental Planning and Assessment Act 1979* (EP&A Act; see Section 4.1.4 of the template).

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

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

**State legislation**

*Rural Fires Act 1997*

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

*Protection of the Environment Operations Act 1997*

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

The use of smoke as a dispersal mechanism may constitute ‘chemical production’ under Schedule 1, clause 8 of the POEO Act, so this type of dispersal activity may require a licence under Chapter 3 of the Act.

The POEO Act also regulates noise including ‘offensive noise’. The Protection of the Environment Operations (Noise Control) Regulation 2008 (Part 4, Division 2) provides information on the types of noise that can be ‘offensive’ and for which the Environment Protection Authority (EPA) can issue fines. This may include noise generated as a part of dispersal activities. It is best to discuss the types of noise makers and the sound levels and times these will be generated, along with identified noise receptors, with Council prior to any dispersal. Detailed advice and guidance on noise regulation can be found in the EPA’s *Noise guide for local government* (EPA 2013).

*Crown Lands Act 1989*

The principles of Crown land management include the observance of environmental protection principles and the conservation of its natural resources, including water, soil, flora, fauna and scenic quality. Any works on land that is held or reserved under the Crown Lands Act 1989
(including vegetation management and dispersal activities) are an offence under the Act without prior authorisation obtained through the Department of Primary Industries (Lands).

**Local Government Act 1993**

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

**State Environmental Planning Policies**

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

**SEPP 14 – Coastal Wetlands**

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

**SEPP 26 – Littoral Rainforests**

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

**SEPP 19 – Bushland in Urban Areas**

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

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

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

**Coastal Management Act 2016**

This act is soon to replace SEPP 14 and SEPP 26. The legislative and policy framework introduced by the coastal reforms recognises natural coastal processes and the local and regional dynamic character of the coast, and promotes land use planning decisions that accommodate them. The reforms ensure coordinated planning and management of the coast and support public participation in these activities.
3. Appendix: Desktop ecological assessment guideline

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

Sources of information for database searches
Depending on the location and extent of the project, the following databases may provide information on flora and fauna species and ecological communities for the site and surrounds.

Sources of ecological information

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlas of Living Australia</td>
<td>Biodiversity knowledge contributed by Australia’s academic, scientific, environmental and general communities.</td>
<td><a href="http://www.ala.org.au">www.ala.org.au</a>, page provides a link to a mapping and analysis page where you can view records within an area of interest.</td>
</tr>
<tr>
<td>NSW BioNet</td>
<td>Contains government-held information about plants and animals in NSW. The following organisations provide data: Office of Environment and Heritage; National Parks and Wildlife Service; Royal Botanic Gardens and Domain Trust; Department of Primary Industries; Forests NSW; Australian Museum. Users can register for a log-in version which provides additional detail and functionality.</td>
<td><a href="http://www.bionet.nsw.gov.au">www.bionet.nsw.gov.au</a></td>
</tr>
<tr>
<td>Vegetation Information System: Maps</td>
<td>Statewide regional scale vegetation map, and for some areas, a local fine-scale map.</td>
<td><a href="http://www.environment.nsw.gov.au/research/PlantCommunityIDsoftware.htm">www.environment.nsw.gov.au/research/PlantCommunityIDsoftware.htm</a></td>
</tr>
</tbody>
</table>

Other sources of data
Depending on the type of project and location, the local council, or National Parks and Wildlife Service may hold more detailed vegetation mapping than publicly available. The relevant authority should be contacted to confirm if the most detailed mapping and data records have been obtained.
4. Appendix: 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). No deaths have been recorded in NSW.

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

Transmission of the virus from bats to humans is through a bite or scratch, but may have potential to be transferred if bat saliva directly contacts the eyes, nose, mouth or broken skin. ABLV is unlikely to survive in the environment for more than a few hours, especially in dry environments that are exposed to sunlight (NSW Health 2013).

Transmission of closely related viruses suggests that contact or exposure to bat faeces, urine or blood does not pose a risk of exposure to ABLV, nor does living, playing or walking near bat roosting areas (NSW Health 2013).

The incubation period in humans is assumed similar to rabies and variable between two weeks and several years. Similarly the disease in humans presents essentially the same clinical picture as classical rabies. Once clinical signs have developed the infection is invariably fatal. However, infection can easily be prevented by avoiding direct contact with bats (i.e. handling). Pre-exposure vaccination provides reliable protection from the disease for people who are likely to have direct contact with bats, and it is generally a mandatory workplace health and safety requirement that all persons working with bats receive pre-vaccination and have their level of protection regularly assessed. Like classical rabies, ABLV infection in humans also appears to be effectively treated using post-exposure vaccination and so any person who suspects they have been exposed should seek immediate medical treatment. Post-exposure vaccination is usually ineffective once clinical manifestations of the disease have commenced.

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

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

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

**Hendra Virus**

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

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

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

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

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

**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.
5. Appendix: General camp management options in full

Level 1 actions: routine camp management

Education and awareness programs

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

Such a program would include managing risk and alleviating concern about health and safety issues associated with flying-foxes, options available to reduce impacts from roosting and foraging 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. See also Section 3 and incorporate an education and awareness program into any community engagement plan.

An education program may include components shown in Figure 5.

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.

Figure 5: Possible components of an education program
**Property modification without subsidies**

The managers of land on which a flying-fox camp is located would promote or encourage the adoption of certain actions on properties adjacent or near to the camp to minimise impacts from roosting and foraging flying-foxes (note that approval may be required for some activities, refer to Section 4 for further information):

- Create visual/sound/smell barriers with fencing or hedges. To avoid attracting flying-foxes, species selected for hedging should not produce edible fruit or nectar-exuding flowers, should grow in dense formation between two and five metres (Roberts 2006) (or be maintained at less than 5 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 appropriately secured 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.
- Include suitable buffers and other provisions (e.g. covered car parks) in planning of new developments.
- Turn off lighting at night, as this may assist flying-fox navigation and increase fly-over impacts.
- Consider removable covers for swimming pools and ensure working filter and regular chlorine treatment.
- Appropriately manage rainwater tanks, including installing first-flush systems.
- Avoid disturbing flying-foxes during the day as this will increase camp noise and incidental faecal drop.

The cost would be borne by the person or organisation that 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.

**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. These would ideally be supported by grant funding opportunities.

**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. Sensitive properties would be prioritised to receive this type of subsidy.

**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 in areas not critical as roosting habitat.
- 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 or permanent 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.

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

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

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

When improving a site for a designated flying-fox camp, preferred habitat characteristics detailed in Section 6.4 should be considered.

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

The presence of a water source is likely to increase the attractiveness of an alternative camp location. Supply of an artificial water source should be considered if unavailable naturally, however this may be cost-prohibitive.

Potential habitat mapping using camp preferences (see Section 6.4) and suitable land tenure can assist in initial alternative site selection. A feasibility study would then be required prior to site designation to assess likelihood of success and determine the warranted level of resource allocated to habitat improvement.
Provision of artificial roosting habitat
This management option involves constructing artificial structures to augment roosting habitat in current camp sites or to provide new roosting habitat. Trials using suspended ropes have been of limited success as flying-foxes only used the structures that were very close to the available natural roosting habitat. It is thought that the structure of the vegetation below and around the ropes is important.

Protocols to manage incidents
This management option involves implementing protocols for managing incidents or situations specific to particular camps. Council have a Risk Assessment and Bat Encounter Protocol for Camellia Gardens to ensure staff and the public are not placed at risk.

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.

Appropriate land-use planning
Land-use planning instruments may be able to be used to ensure adequate distances are maintained between future residential developments and existing or historical flying-fox camps. While this management option will not assist in the resolution of existing land-use conflict, it may prevent issues for future residents. Council will endeavour to prevent inappropriate land use adjacent flying-fox camps where possible. All Sutherland Shire camps have formed in the last 10 years after development had already been established in those localities.

Cocos Palm Removal Grants
Provide residents within 250m of the camp the opportunity to apply for up to $500/property for Cocos palm removal as a one-off grant. This would result in reducing night time feeding activity within the immediate locality and hence complaints. Residents in this location are already potentially impacted by the camp and this will help to reduce nuisance feeding activity that can result in faecal drop, noise and amenity impacts. No approvals are required and no direct impacts on the camp. This action may result in a loss of a source of food during food shortage periods as flying-foxes tend to rely on Cocos palms where other food is not available.

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.

Level 2 actions: in-situ management –

Buffers
Buffers can be created through vegetation removal and/or the installation of permanent/semi-permanent deterrents.
Creating buffers may involve planting low-growing or spiky plants between residents or other conflict areas and the flying-fox camp. Such plantings can create a visual buffer between the camp and residences or make areas of the camp inaccessible to humans.

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

**Buffers through vegetation removal**

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

Any vegetation removal should be done using a staged approach, with the aim of removing as little native vegetation as possible. This is of particular importance at sites with other values (e.g. ecological or amenity), and in some instances the removal of any native vegetation will not be appropriate. Thorough site assessment (further to desktop searches, see Appendix 4) will inform whether vegetation management is suitable (e.g. can impacts to other wildlife and/or the community be avoided?).

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

Suitable experts (Appendix 1) should be consulted to assist selective vegetation trimming/removal to minimise vegetation loss and associated impacts.

The importance of under- and mid-storey vegetation in the buffer area for flying-foxes during heat stress events also requires consideration.

**Buffers without vegetation removal**

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

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

- **Visual deterrents** – Visual deterrents such as plastic bags, fluoro vests (GeoLINK 2012) and balloons (Ecosure 2016, pers. comm.) in roost trees have shown to have localised effects, with flying-foxes deterred from roosting within 1–10 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.

- Strategically placed lighting underneath roost trees requiring protection. Lights that come on prior to sunrise on a timer to prevent a specific tree being roosted in. A trial of this action is to be undertaken prior to formal implementation.

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.

**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 bat and bird strike must be considered. 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.

**Level 3 actions: disturbance or dispersal**

**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. Nudging will only work in areas of connected or closely situated habitat.

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).

**Dispersal**

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

There is a range of potential risks, costs and legal implications that are greatly increased with dispersal (compared with in-situ management as above). See Appendix 6 for more details. These include:

- Impact on animal welfare and flying-fox conservation.
- Splintering the camp into other locations that are equally or more problematic.
- Shifting the issue to another area.
- Impact on habitat value.
- Effects on the flying-fox population, including disease status and associated public health risk.
- Impacts to nearby residents associated with ongoing dispersal attempts.
• Excessive initial and/or ongoing capacity and financial investment.
• Negative public perception and backlash.
• Increased aircraft strike risk associated with changed flying-fox movement patterns.
• Unsuccessful management requiring multiple attempts, which may exacerbate all of the above.

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

**Passive dispersal**

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

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

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

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

**Active dispersal through disturbance**

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

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

This method does not explicitly use habitat modification as a means to disperse the camp, however if dispersal is successful, some level of habitat modification should be considered. This will reduce the likelihood of flying-foxes attempting to re-establish the camp and the need for follow-up dispersal as a result. Ecological and aesthetic values will need to be considered for the site, with options for modifying habitat the same as those detailed for buffers above.
Early dispersal before a camp is established at a new location

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

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

Maintenance dispersal

Maintenance dispersal refers to active disturbance following a successful dispersal to prevent the camp from re-establishing. It differs from initial dispersal by aiming to discourage occasional over-flying individuals from returning, rather than attempting to actively disperse animals that have been recently roosting at the site. As such, maintenance dispersal may have fewer timing restrictions than initial dispersal; provided that appropriate mitigation measures are in place (see Section 9.2).

Unlawful activities

Culling

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

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

1. In all cases, dispersed animals did not abandon the local area.
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 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, birfdrite, 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.
- 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 $7,500 to more than $400,000 (with costs ongoing).

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

6 This was based on responses to questionnaires sent to councils; some did not respond and some omitted responses to some questions.

7 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.
7. **Appendix: Threatened Species licence application**

At the time the Plan is submitted to OEH for approval, it should include a completed Threatened Species licence application form. The form can include information already contained in the Plan. Alternatively, the land manager should inform OEH that the proposed works are to be assessed under Part 5 of the EP&A Act and will not require a licence application under the *Biodiversity Conservation Act 2016*.

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


Find below a link to Sutherland Shire Council’s licence for Level 2 action of sprinklers and lighting to deter flying-foxes from certain locations and allow vegetation to rest at Camellia Gardens, expires 31 December 2022.

8. Appendix: Heat Stress

Heat stress affects flying-foxes when temperatures reach 42°C or more. Over the past two decades, a number of documented heat stress events have resulted in significant flying-fox mortality (OEH 2017).

Heat stress or hyperthermia occurs when the body produces more heat than it can dissipate. Post-mortems suggest that flying-foxes mainly die from resulting heat shock i.e. the body can no longer function effectively. (OEH 2017)

When ambient temperatures rise above 35°C flying-foxes tend to alter their behaviour to reduce exposure to heat. A range of behaviours may be exhibited, depending on multiple variables in their environment. The impacts of heat stress events are likely to vary site by site, and can depend on conditions in the preceding days.

Ambient temperature alone may thus not be a sound indicator of a heat stress event, and flying-fox behaviour may provide more reliable information. As flying-foxes experience heat stress, they are likely to exhibit a series of behaviours indicating progressive impact of that stress, including:

• clustering or clumping;
• panting, licking wrists and wing membranes; and
• descending to lower levels of vegetation or to the ground.

If these behaviours coincide with 35°C plus temperatures then heat stress should be assumed. Camellia Gardens has a lack of mid-storey vegetation that would normally provide some protection from heat stress; however the moisture levels can be increased artificially at this site.

When the maximum temperature at Sydney Airport Bureau of Meteorology weather station is predicted to be 40°C or above, Council Environmental Science staff are to implement Council’s Heat Stress Emergency Response Plan. The Heat Stress Emergency Response Plan was developed in conjunction with Camellia Gardens’ staff and incorporates contact with WIRES if flying-foxes require medical attention. The affected area of Camellia Gardens may be closed if the emergency results in members of the public or staff being put at risk of contact with flying-foxes.

If a heat stress emergency occurs animals may require a week with limited disturbance before regular noise making maintenance activities can resume. This should be assessed by an OEH approved ecologist or GHFF expert.