Vegetation Management Plan

Newbury Park Flying-fox Camp,
Raymond Terrace



Port Stephens
C·O·U·N·C·I·L
... a community partnership

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1.0 Introduction

1.1 Preface

The vegetation at Newbury Park at Raymond Terrace has been home to and supported a Flying-fox camp since 2010. To date there has been no management activities concerning the camp. Up until recently there had been little conflict with nearby residents but when numbers escalated to over 10 000 Flying-foxes in September 2013, there was an increase in complaints caused by the Flying-foxes overflowing the core camp area and roosting in adjacent residents back yards.

A long term strategic management activity has to be implemented due to:

- Increasing community concerns and conflicts when the camp is full
- The vegetation at the reserve is becoming degraded over time from the roosting activity of Flying-foxes
- Weed species are increasingly growing as breaks appear in the vegetation canopy

There is a proven need to manage camps on a local and regional level over an integrated long-term management strategy rather than smaller makeshift response actions. In this light Council hopes to produce Flying-fox Management Strategy for Port Stephens Council to deal with urban camps. As part of the overall strategy, Council will develop and implement (under Office of Environment and Heritage (OEH) licensing requirements) a Vegetation Management Plan for each urban park that contains a Flying-fox camp.

1.2 Aims and Objectives

The aim of this Vegetation Management Plan (VMP) is to carefully manage the vegetation within Newbury Park to enhance environmental and social values thus protecting and enhancing the existing Flying-fox camp so it can continue to survive within an urban environment with reduced conflict by way of:

- Revegetate native vegetation within the reserve to re-establish forest structure that will over time provide potential roosting habitat for Flying-foxes away from adjacent residences and increase the reserves overall Flying-fox roosting values and carrying capacity.
- Reduce and remove exotic weed infestation throughout the site to maximise the potential for controlled and natural vegetation restoration.
- Design and establish a residential buffer and a camp vegetation buffer in specific areas to enhance amenity and improve microclimatic conditions suitable for ongoing forest regeneration.

Objectives of the VMP include:

- Allow for passive recreation in designated areas
- Enhance aesthetic values of the reserve
- Protect all native species, Endangered Ecological Communities (EEC) and their habitat within the reserve and increase habitat quality and quantity through restoration works

- Increase habitat function and values
- Minimise inappropriate biodiversity and human conflicts such as disturbances to the Flying-fox camp
- Undertake vegetation management surveys across the park, documenting floristic structure and composition, conservation significance
- Develop a species list and corresponding percentage cover per species to form a bench mark for subsequent monitoring
- Identify invasive exotic weed species and provide a detailed weed control and restoration strategy for each identified management zones
- Map management zones throughout the site and identify specific restoration works required in each zone
- Development of a prioritised restoration schedule that will maximise efficiency of labour and funding using recognised restoration techniques
- Outline a 3, 5 and 10 year maintenance plan for weed control, habitat enhancement and monitoring.

1.3 Location

Newbury Park is a 2.23ha, triangular drainage reserve situated in Raymond Terrace between Adelaide Street in the north, Mount and Thomas Streets in the south and adjacent to residences in both Thomas Street (south) and Hillside Close to the east (Figures 1a & 1b). A trunkline runs through the middle of the park with maintained grassland along the eastern side of the trunk line. The western side of Newbury Park is an extensively vegetated drainage area with a moderate sized stormwater drain that enters the reserve from the south and exits at several culverts adjacent to Adelaide Street in the north to Ross Walbridge Reserve. There is a smaller stormwater culvert at the north eastern side of Newbury Park that captures stormwater from Adelaide Street and the McDonalds site.

Although the park is within a 167ha catchment area that drains to the Hunter River, the area that drains directly into Newbury Park is 16ha. This drainage area is predominantly to the south and east and is residential.

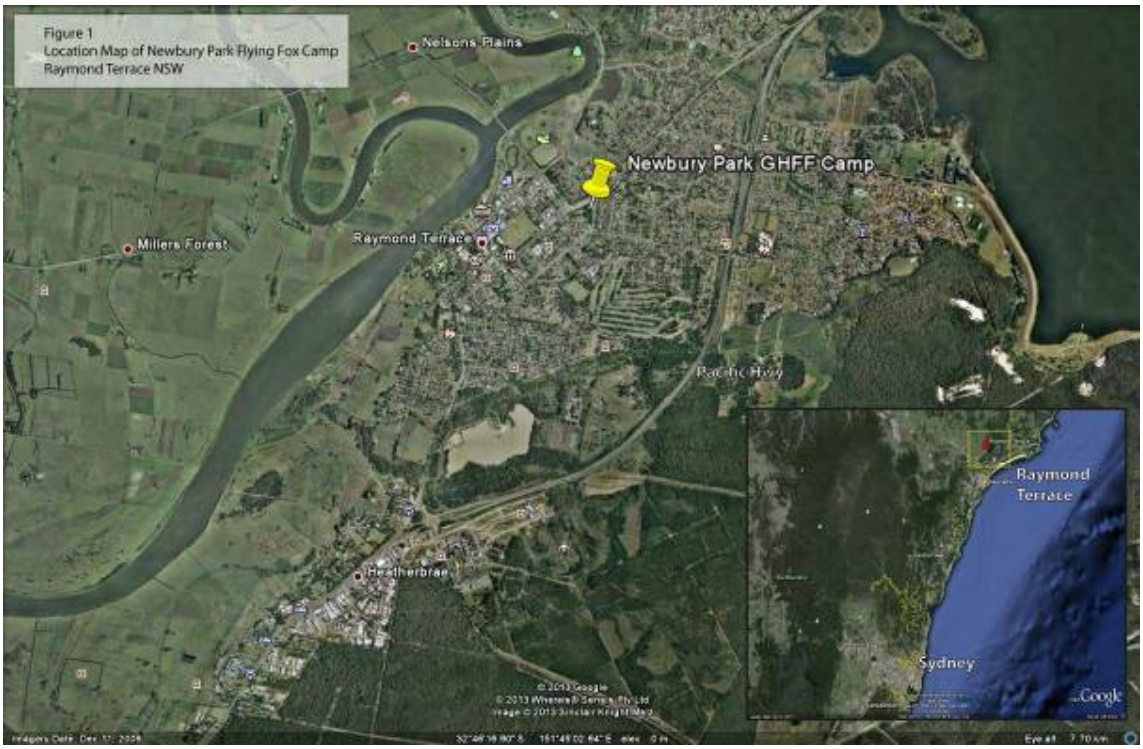

Figure 1a – Location map of Newbury Park, Raymond Terrace, NSW

Figure 1b – Newbury Park showing adjacent residential areas

1.4 Tenure

Port Stephens Council is the land owner of Newbury Park and consists of 3 parcels of land as follows:

- Lot 35 DP 259487
- Lot 36 DP 259487
- Lot 38 DP 259487

These parcels of land are zoned RE1 (Public Recreation) in the Port Stephens Local Environment Plan 2013.

1.5 Consultation

Consultation was held internally between Natural Resources Group and the Civil Assets Group for permission to do enhancement works within the Council drainage reserve.

2.0 Natural Environment

2.1 Topography, Geology and Soils

Newbury Park is located approximately 900mts from the confluence of the Hunter and Williams River on the floodplain and is nestled along the river terrace. Elevation of Newbury Reserve is from 2.5 through to 3.5 m AHD and will flood in a 1:20 year flood.

Estuarine mud deposits at depth are overlain by Quaternary Holocene alluvial sediment which is predominately clay, silt and sand deposited from overbank deposition of the Lower Hunter and Williams River.

The dominant soil landscape features of the area are extensive alluvial floodplain on recent sediments in the Lower Hunter Plain region with deep, imperfectly to poorly drained Prairie Soils (Matthei 1995). The top soil (usually 10-55cm) is slightly acidic, well structured (10-20mm sub angular blocky peds that easily crumb) brownish black silty clay loam that has a texture ranging from fine to sandy clay loam to silty clay. The subsoil (approx >120cm) is slightly alkaline and consists of well structured (20-50mm angular blocky peds which are harder to part) brown silty clay that has a texture of medium clay to silty clay (Matthei 1995).

Limitations of the site are:

- flood hazard,
- permanently high watertables,
- seasonal waterlogging,
- localised waterlogging,
- Topsoil has seasonally hardsetting surface, and
- Potential ASS at depth

The top soil fertility is described by Matthei (1995) as a suitable growth media with high organic matter content, high nutrient storage capacity and a very high water retention capacity whilst the subsoil is not suitable as it has a high water retention capacity, seasonally waterlogged with localised salinity.

2.2 Climate

The climate at Raymond Terrace is subject to hot summers a warm wet autumn, cooler winter and a warn dry spring. The indicative average recorded monthly temperatures and rainfall are provided in figure 2 and Table 1, recorded from the Williamtown RAAF base (32.7932°S 151.8359°E 9m AMSL) commencing 1942 to October 2013 (10.2km away). The mean rainfall is 1142.4 mm typically between January and peaking in June with an average of 129.6mm.

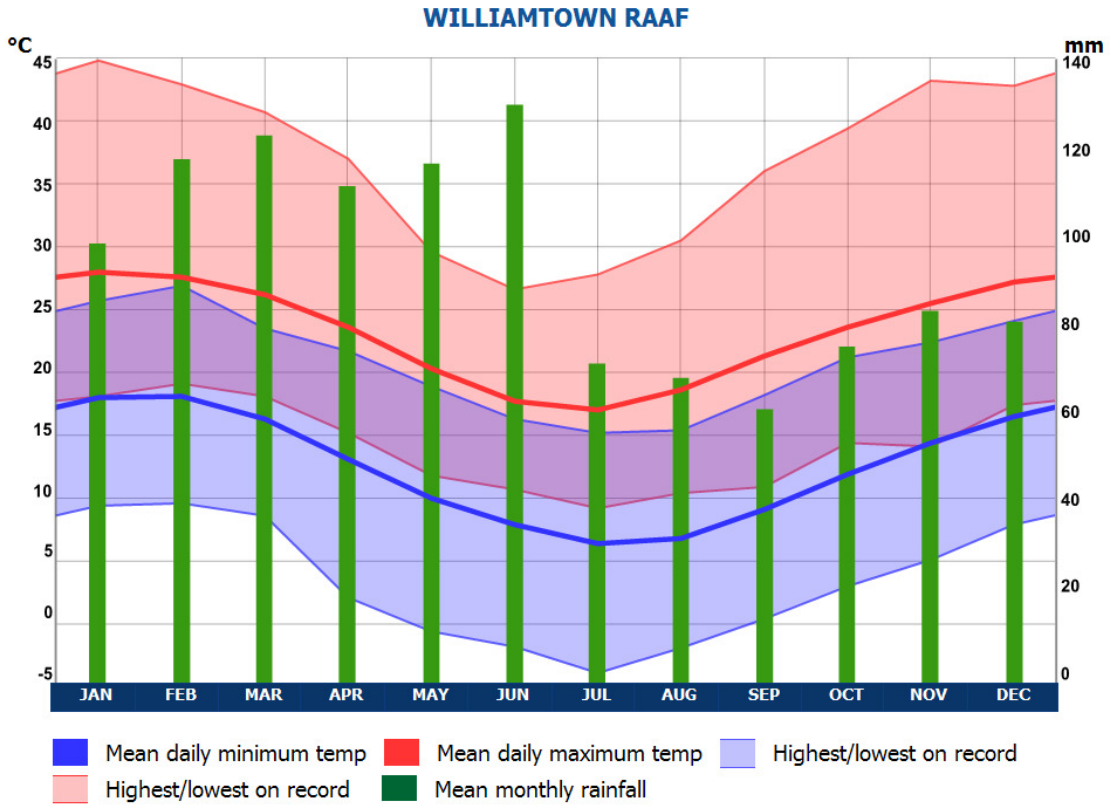

Figure 2: Indicative Climate Graph for Raymond Terrace
(Williamtown RAAF, Hunter NSW records from 1942 to present)

Table 1 Indicative Climate Data for Raymond Terrace (Williamtown RAAF, Hunter NSW records from 1942 to present)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
High Mn. Max (°C)	30.9	30.9	28.5	26.2	22.3	19.9	18.7	21.9	25.1	27.1	28.5	30.8	***24.5***
Low Mn. Max (°C)	24.4	24.9	23.8	21.7	18.8	15.9	15.5	17.0	18.5	20.9	22.7	23.8	***21.9***
High Mn. Min (°C)	19.8	20.2	19.2	16.3	12.9	12.2	9.0	9.4	11.6	14.4	16.8	18.8	***13.6***
Low Mn. Min (°C)	16.1	16.0	14.0	11.0	6.9	5.6	2.5	4.5	7.2	10.2	11.9	14.8	***11.2***
High Rain (mm)	327.3	599.6	398.5	361.2	410.2	414.2	190.4	212.2	179.2	237.5	241.4	238.0	***1793.7***
Low Rain (mm)	2.2	5.6	2.2	4.4	5.0	14.6	0.0	0.0	0.4	1.0	6.8	14.2	***541.0***

Climate change within this region has been included in work commissioned by the Hunter Council's (Blackmore & Goodwin 2010 and HCCREMS 2010). Port Stephens has experienced statistically significant annual increase in average minimum temperatures of ~0.9*C in the coastal zone and ~0.6*C in the central zone (west of Pacific Hwy). Average maximum temperatures have experienced a statistically significant annual increase with ~0.9*C in the coastal area and a ~1.2*C in the central area. Analysis from the report found that there has been a significant trend of an increase of extreme heat events numbering 5 for the central area and 3.3 for the coastal area. Rainfall has declined by ~274mm over the period from 1948 to 2007.

These findings with projected state and Commonwealth policies will show an increased intensity and frequency of extreme rainfall, changes to the occurrence of intense storm events, droughts and extreme heat events as seen from 2007 to 2013 period.

Key issues affecting the GHFF at Newbury Park will include extreme heat events over several days, Newbury Park sits on a westerly aspect and will be affected by the hot North West winds reaching 40+*C during the summer months. Other local factors include frequency and extent of nearby bushfires, availability of food resources due to potential vegetation changes and changes in food species. This tends to have a direct affect on camp numbers and roosting periods.

2.3 Flora

Field surveys were carried out over several months in 2013. See section 5 for a detailed site assessment. Fifty four species of flora were found and of those 63% were weed species.

Newbury Park was found to support 2 to 3 main vegetation types:

- Open Grassland
- Extensive weed forest
- Swamp Oak Floodplain Forest, an EEC

2.3.1 Endangered Ecological Communities

The reserve was found to support an area that constitutes *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions* Under the Threatened Species Conservation Act 1995.

The vegetation is in poor condition which is contributed to:

- Significant weed infestation, particularly tree (Willow (*Salix babylonica*), Camphor laurel (*Cinnamomum camphora*) and Small leaf Privet (*Ligustrum sinense*)), woody (Lantana (*Lantana camara*) and Blackberry (*Rubus fruticosus*)) and vine weeds (Japanese Honesuckle (*Lonicera japonica*) and Maderia Vine (*Anredera cordifolia*)).
- Historic clearing – cleared in 1979 for residential subdivision and creation of drainage reserve.
- Dumping of rubbish and excavation materials.

Although extensively modified there is some forest vegetation communities that appear to have retained some integrity as an EEC. The features of the current vegetation give an appropriate micro-climate for the Flying-fox colony.

Management issues include:

- Weed invasion – this site supports three key threatening processes under the TSC Act 1995. these include:
  - *Invasion and Establishment of exotic vines and scramblers* - a major threat that requires management
  - *Invasion, establishment and spread of Lantana* – a major threat that requires management

    - *Invasion of Native plant communities by exotic perennial grasses*
    - *Loss and degradation of native plant and animal habitat by invasion of escaped garden plants including aquatic plants* (also under EPBC Act 1999) – a major threat to the perimeter adjacent to residential areas.
- Dumping of rubbish and garden waste – there is both household bulk waste and some industrial construction waste. Asbestos is present as a boundary fence of number 2 Thomas Street.
- Degradation by the Flying-fox colony – roost trees have been stripped bare increasing light availability and allowing further groundcover and shrub layer weed invasion.

2.4 Fauna – Flying-foxes

2.4.1 Flying-foxes found in Newbury Park

Flying-foxes are large endemic megachiropteran bats and are classified below:

Order: Chiroptera
Suborder: Megachiroptera
Family: Pteropodidae
Genus: Pteropus
Species: 66 species worldwide

There are seven species of Flying-fox found in mainland Australia (Pinson 2009) and three found in NSW, all the NSW species have been found roosting in Newbury Park, these are:

- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Black Flying-fox (*Pteropus alecto*)
- Little Red Flying-fox (*Pteropus scapulatus*)

2.4.1.1 Grey-headed Flying-fox

The Grey-headed Flying-fox (GHFF) has dense shaggy fur, and the only species in Australia to have an orange/brown collar completely encircling its head, and have leg fur extending all the way down the leg to the toes (Churchill 2008). The head and belly is covered in grey fur and the fur on the back is darker grey and some have a silver appearance (figure 3).

Weight: 600-1000g Length: 230-280mm

Their distribution extends from Queensland through to Victoria and in recent times been known to roost in the Mt Gambier region of South Australia (figure 4).

Figure 3: Male Grey-headed Flying-fox – Photo J. Ashby

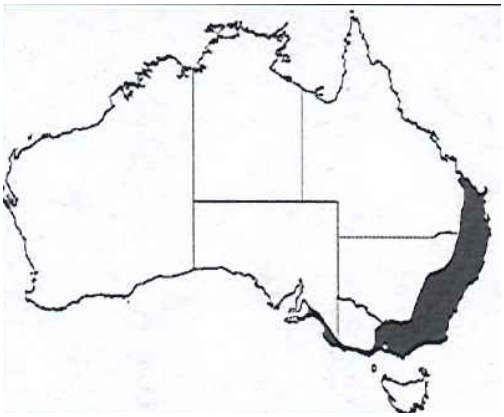

Figure 4: Current range of GHFF (Eby Unpublished)

2.4.1.2 Black Flying-fox

The Black Flying-fox (BFF) has mainly uniformly black fur all over its body and some individuals have a reddish/brown mantle on the back of the neck and shoulders (figure 5). The leg is furred to the knee and bare to the ankle.

Weight: 500-1000g Length: 240-260mm

The Black Flying-fox is common and found predominantly in far northern Australia (Western Australia, Northern Territory and Queensland). In recent years their range has moved steadily south and they are now found in NSW and mid-coast of WA (figure 6). There have been reports of Black Flying-foxes in Victoria (Eby pers. Comm).

Figure 5: BFF - Photo: Pinson (2009)

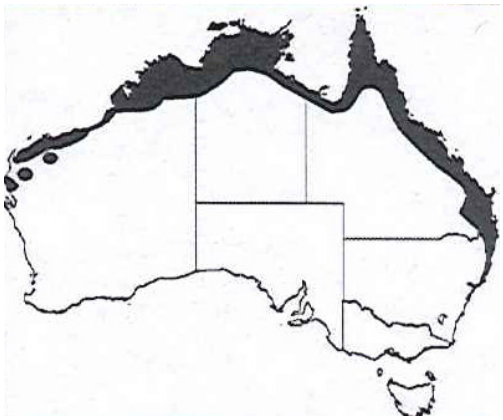

Figure 6: Current range of BFF (Eby Unpublished)

2.4.1.3 Little Red Flying-fox

The Little Red Flying-fox (LRFF) is the smallest Australian flying-fox. Its whole body including fur, wing membranes, ears and nose is predominately reddish/brown to light brown in colour (figure 7). Some individuals have a creamy yellow patch on the back of the neck and shoulders. Their legs are bare and their wing membrane is translucent in flight.

Weigh: 300-600g Length: 195-235mm

The Little Red Flying-fox is the most widespread and nomadic of all flying-foxes. The range for this species is from Shark Bay in WA around the top end of Australia down and around into Victoria (figure 8). The species also extends further inland than other flying-foxes.

Figure 7: Little Red Flying-fox – Photo J. Ashby

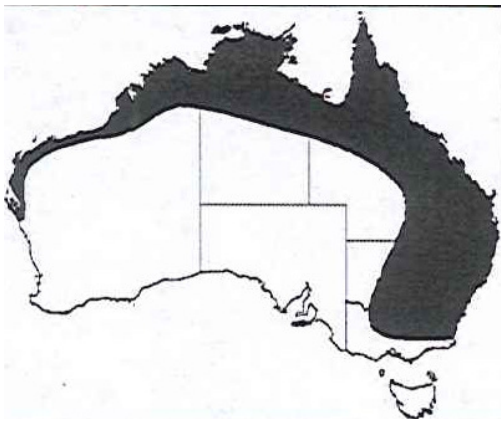

Figure 8: Current range of LRFF (Eby Unpublished)

2.4.2 Importance of Flying-foxes

Flying-foxes are large long-distance pollen and seed dispersers, essential in spreading genetic plant material across vast areas, continuing the critical role in the reproductive and evolutionary biological processes of forest communities (Eby pers comm. 2013). Long distance dispersal allows genetic plant material to be spread across fragmented and degraded landscapes to allow for regeneration. Flying-foxes travel vast distances, sometimes over 2000km seasonally (Eby 1996). Eby (1996) showed in a study done near Lismore in NSW, that Flying-foxes use a vast network of feed trees within a 20km radius of their camp.

2.4.3 Reproduction and Lifecycle

The reproductive cycle of Grey-headed Flying-foxes and Black Flying-foxes are the same and the cycle of the Little Red Flying-fox is 6 months out of sync.

Male GHFF and BFF's achieve effective fertility at 30 months of age and their sperm reaches a peak in February/March. The LRFF peak mating period is in Nov/December.

Female GHFF and BFF are sexually mature at the second breeding cycle after birth. Females ovulate from late February to April and give birth from late September until November. LRFF are sexually mature at 18 months old, ovulate between November and January and will give birth in May through to June.

After a 6 month gestation the GHFF and BFF females will combine in maternity camps and give birth to a single young. At this stage the young are carried by the mother when foraging but once the offspring becomes too heavy it is left in the camp during the nightime camp vacation. Lactation lasts for 6 weeks and following its cessation the females are able to breed again.

The young are able to fly out and forage with the mother in January and February and are fully weaned by February/March.

The LRFF gestation is 5 months and the young are born March/April in predominantly female camps. The young are carried by the mothers for the first month and then left in the camp while she forages at night. At 2 months of age the young can fly and go out to forage with the mother. The young are semi-depended for several months.

2.4.4 Diet of Flying-foxes

The diet of Flying-foxes consists of more than 100 species of native trees and introduced species (Eby & Law 2008). They forage for food (nectar and fruit) over an extensive area creating a complex foraging landscape. Flying-foxes will follow their food and therefore travel great distances to forage. Eby & Law (2008) found that few diet species flower in the colder months, flower infrequently and are widely distributed along the east coast of Australia. It was also found that the diet species that flower frequently are sparse in the population and have a limited distribution. In recent times Flying-foxes feed on introduced tree species in urban areas and also eat commercial fruit crops. A list of recorded flowering species that Flying-foxes eat is included in Appendix A.

2.4.5 Foraging Behaviour

Flying-foxes are dietary generalists and feed on a mix of nectar, pollen and fruits which the composition varies widely with availability (Eby 1991) and generally forage exclusively at night, leaving their camps at dusk and returning before dawn. Flying-foxes are very mobile and can fly as far as 50km to feeding areas within one night (Churchill 2008). McDonald *et al.* (2005) found that the probability of detecting a foraging Flying-fox declined with increasing distance from the camp site but increased with increasing tree cover in an urban setting. Foraging decisions are based on a suite of choices that can trade-off costs and benefits (Stephens & Krebs (1986) in McDonald *et. al.* (2005). It has been found that foraging is influenced by a number of variables, such as; the quality and spatial arrangements of resources, nutritional state of the animal, competition and predation risk (McDonald *et al.* 2005).

Eby (unpublished) found that there has been a behavioural response by Flying-foxes to food shortages, these include; reduced body mass, increased mortality and reduced reproductive output. The main initial response is to change their diet to marginal nutritional value species and to feed on crops, either commercial or backgarden fruit trees. Other responses include; reducing their minimum feeding height, going into new habitat areas and a reduced energy expenditure (not being able to fly vast distances to feeding areas).

2.4.6 Flying-fox Camps

2.4.6.1 Roles of Camps

Flying-foxes are highly colonial animals and therefore camps are large aggregations of flying-foxes that provide resting habitat close to food, stopover habitat during migration, protection from predators, sites of social interaction, information exchange and refuge during significant phases of their annual lifecycle.

2.4.6.2 *Location of Camps*

Choices of camp sites are becoming more restricted due to forest clearing and loss of food resources. Flying-fox camp physical characteristics are fairly consistent. Camps are made in closed forest vegetation with a continuous canopy greater than 1ha with a canopy height greater than 8mts, close proximity to a waterway and level topography (Eby 2013). Camp formation is unpredictable.

2.4.6.3 *Population Dynamics of a camp*

Camps can be occupied on a permanent, seasonal or irregular basis and smaller camps are part of a larger networks of camps. Camps are usually occupied when food resources are within 20km (DECC 2007).

There is irregular camp occupation due to several influences such as annual-seasonal movement of Flying-foxes, availability of food resources and disruptions. There are many continuously occupied camps in which the population fluctuates seasonally, from year to year (Eby 1991) and support a small resident population.

The populations of camps are not cohesive groups and movements of individuals may vary in: timing, distance, frequency, destination and fidelity to sites.

2.4.6.4 *Camp Structure*

The Camps are highly structured and depending on the type of camp, season and available food resources, can be a mixed sex group, majority female (maternity camps) and majority male camps.

The roost structure has been found by Eby (unpublished) and Wellberegen (2007) to be consistent in larger camps, with roost positions being specific to individuals.

Figure 9 and Figure 10 show the population dynamics of a typical camp for male and female GHFF & BFF breeding cycles.

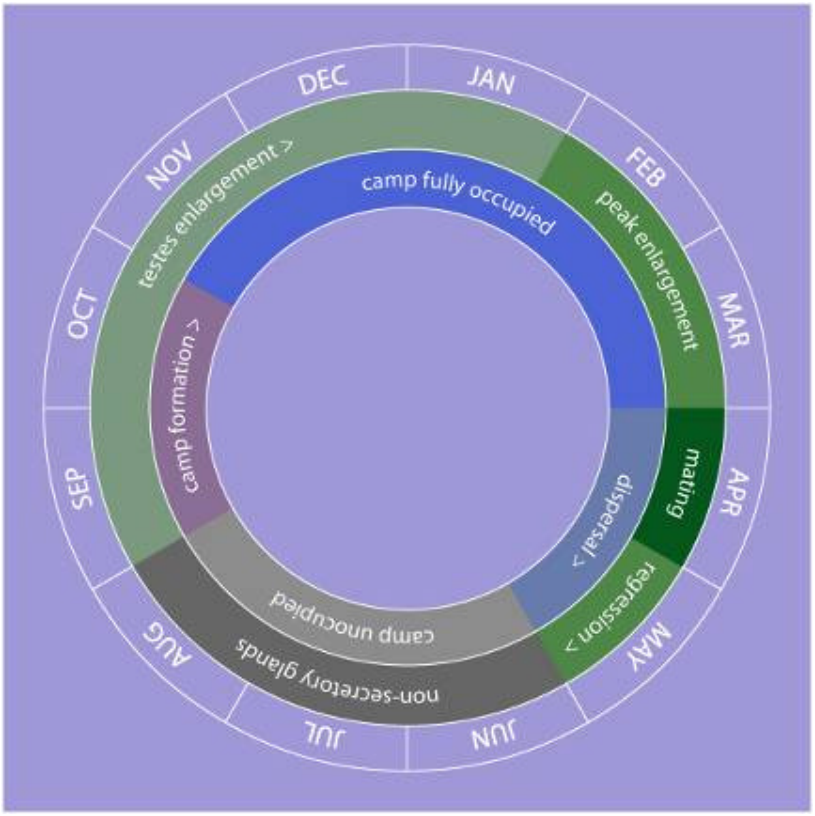

Figure 9: Male GHFF & BFF breeding cycle and typical camp formation (source Pinson 2009)

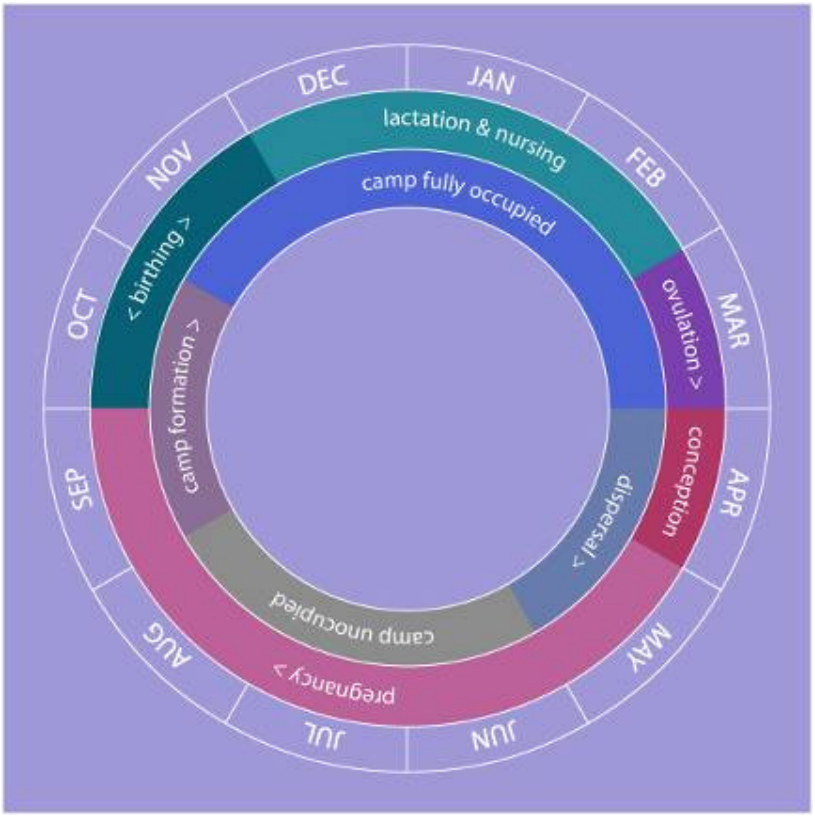

Figure 10: Female GHFF & BFF breeding cycle and typical camp formation (source Pinson 2009)

2.4.6.5 Changes in the distribution of camps

The distribution of camps in South East Australia has been changing since the turn of the century. Prior to 2002 the distribution of seasonal and static (permanent) camps were sparse and had predictable seasonal fluctuations (Eby unpublished). Since 2002 many of the static camps have been abandoned and more seasonal camps have been formed including a large number of smaller irregular camps closer to urban areas.

Unpublished data from several research institutions have found that the population of Flying-foxes in Sydney and Brisbane has not changed. In1986 there were 7 known camps in Sydney and in 2013 there were 23. In Brisbane there were 7 camps in 1996 and 33 in 2013. Numbers of Flying-foxes in both cities did not increase during the time frame, in Brisbane numbers were found to be decreasing.

Eby (unpublished) found that the changes with known behavioural responses to food shortages are consistent and thus the Flying-foxes are responding to changing environmental conditions (reduced feeding opportunities). In 2010 there was a food shortage study and found that the Flying-foxes displayed two distinct behavioural responses; the first, the Flying-foxes pushed into new habitats, and the second, reduced energy expenditure. This lead to records of Flying-foxes in unexpected locations, larger congregations and the LRFF further south than usual. Some of the camps formed during the 2010 food shortage have persisted, such as the Raymond Terrace camp.

The Royal Botanic Garden Sydney relocation monitoring program 2010 aimed to monitor roosting locations via radio tracking GHFF and showed that;

- Many of the individuals showed a reduced body condition
- Increased encounters by wildlife rescue groups
- Reduced pre-weaning reproductive output

- Reduced foraging area average 10km radius
- As feeding distances reduced new camps were established
- Roosting in small clusters closer to food sources
- Roosting in feeding trees
- Commuting distances from roosts to feeding areas fell during the food shortage and increased again after.
- Percentage of animals roosting in new camps or dispersed from camps increased during the food shortage and fell after the food shortage.
- A correlation between mean commuting and percentage roosting in new locations. This means that by establishing new camps, Flying-foxes are reducing their energetic costs.

2.4.7 Newbury Park Flying-fox Camp

The Newbury Park Flying-fox camp was established in 2010 most probably in response to the well documented food shortage. Like many of the irregular camps that established in 2010 the Newbury Park camp has persisted. The camp, since 2010, has been periodically/seasonally occupied, but since the 2012/13 season, the camp has been permanently occupied (A. Marchment pers comm.).

As part of the National Flying-fox Census the Newbury Park camp has been regularly counted quarterly since February 2013 with monthly counts continuing from August 2013. The mix of species, gender and numbers are included in Table 2. The camp appears to be a mixed gender camp with low numbers of birthing females (GHFF & BFF). The GHFF (figure 11) is the only species that has been present year round with seasonal influxes of BFF and LRFF (figure 12).

Table 2 Newbury Park – Flying-fox Counts 2013/14

Newbury Park - Flying-fox Camp, Raymond Terrace, NSW									
Month		**Feb-13**	**May-13**	**Aug-13**	**Sep-13**	**Oct-13**	**Nov-13**	**Dec-13**	**Jan-14**
Total Number		1500	4096	7124	10032	808	1300	545	3568
Species		GHFF	GHFF	GHFF, BFF	GHFF, BFF	GHFF, BFF	GHFF, BFF, LRFF	GHFF, BFF, LRFF	GHFF, BFF, LRFF
Species	**GHFF**	100%	100%	92%	80%	98%	55%	58%	50%
	BFF	0%	0%	8%	20%	2%	5%	2%	0.50%
	LRFF	0%	0%	0%	0%	0%	40%	40%	49.50%
Gender		unk	unk	5-10% GHFF female	unk	5-10% GHFF female	5-10% GHFF females	10-15% GHFF with young	10-15% GHFF with young

Occupation of Newbury Park is associated with the structured vegetation allowing a micro-climate suitable for roosting during hot periods and a reliable and significant food sources within nightly foraging distance 10-20km radius of the camp.

Within a 20km radius there are 9 known camps of various occupation statuses (occupied, unoccupied, seasonal or permanent) and within 30km there is a total of 13 with 6 of those falling within the boundaries of Port Stephens LGA (figure 13).

Figure 11 Grey-headed Flying-foxes at Newbury Park – Photo: J. Ashby

Figure 12 Little Red Flying-foxes at Newbury Park – Photo: J. Ashby

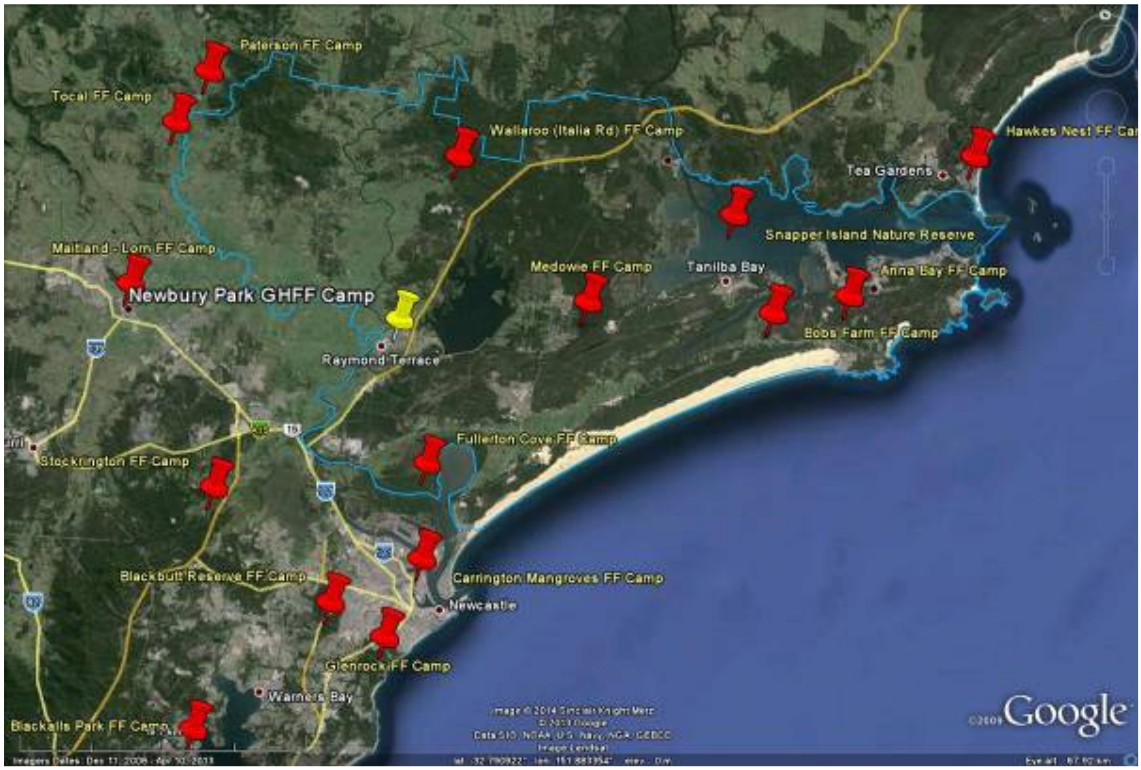

Figure 13: location of known nearby camps (source: Google Earth)

2.5 Newbury Park FF Camp Management Issues – Threats

2.5.1 *Negative Public Attitudes And Conflict With Humans*

It is known that negative attitudes from media, community members and in certain cases uninformed elected representatives (local, state and federal) impede the successful management of Flying-foxes throughout Australia (Hall & Richards 2000). These negative attitudes lead to the members of the community taking things into their own hands such as unauthorised disturbance to camps which cause the Flying-foxes added stress. These stresses include; fatigue, reduced responses to breeding, females aborting their young and if other factors are present such as heat, and disease they may die. The overall well being of flying foxes have been heavily influenced by human induced impacts, such as habitat loss leading to food shortages and changed population dynamics.

Reducing the conflicts between humans and Flying-foxes is important in the long term conservation and management of the species.

2.5.2 Loss And Degradation Of Habitat

Through agricultural clearing, urban settlement, industrial development, forestry activities, development for transport and utility corridors, recreation developments and tourism has resulted in extensive habitat loss (foraging resources and roosting habitat).

Normal cycles of flowering and fruiting schedules are vulnerable to natural factors such as temperature, rainfall, drought, fire and climate change and can lead to food shortages (DECCW 2009).

The floodplains and foothills surrounding Raymond Terrace have been extensively cleared for agriculture and this has reduced the extent of preferred roost and foraging habitat for Flying-foxes locally.

2.5.3 Electrocution On Powerlines and Entanglements In Fencing/Netting

Powerlines and other aerial wires including fencing and netting are responsible for many deaths and injuries requiring assistance from wildlife carers each year (Hall & Richards 2000). The presence of power lines adjacent to Newbury Park along Adelaide Street and suburban powerlines along surrounding streets is likely to affect the Flying-foxes locally. Some local electricity providers have placed protective areal bundle cabling on wires where frequent flying-fox electrocutions occur – this maybe a viable option for Newbury Park.

It is known that Flying-foxes cause threats to small aircraft near airports at dusk. It has been reported that F111 fighters have struck Flying-foxes at 100 meters AHD when on exercises, causing serious engine damage (Hall & Richards 2000). The proximity of Williamtown jet base is 7km to the south east and the flight path is less than a kilometre away, this could be an issue locally.

2.5.4 Shooting

Unregulated and regulated shooting of Flying-foxes have occurred in camps across Australia. Shooting of GHFF is now seen as a threat to survival (DECCW 2009). As Newbury Park is in an urban setting there will be a minimal threat of Flying-foxes being shot.

2.5.5 Climate Change

Climate change is recognised as a threat to Flying-foxes (DECCW 2009) and has been discussed in section 2.2 (Climate).

2.6 Newbury Park FF Camp Management Issues – Community Concerns

2.6.1 Noise And Well Being Impacts

Flying-foxes are very sociable animals and have over 30 different communication calls they make that include; foraging, mating, courtship, territorial disputes, warnings and breeding (mother and offspring have special calls so they can find each other when the mother flies back into camp in the pre-dawn) (DECCW 2009). The calls (like loud squabbling) during daylight hours are usually that of mating (when in season) or disturbances, such as; dogs barking, predators, lawn mowers, loud music or car noise. It is noted in DECCW (2009) that Flying-foxes habituate to general noise and can be tolerant to traffic and other regular noises. Eby (2008) found that Little Red Flying-foxes are more active and noisier than the other species.

The main noisy times for the camps are when they are preparing to disperse at dusk and when they are returning at dawn. For some people, Flying-fox camp noise can lead to well-being issues, such as sleep deprivation and stress for those living adjacent.

2.6.2 Odour

Wellbeing and lifestyle impacts' including health issues (respiratory issues) from the odour of the camp is a big issue. The musky odour is produced by the scent gland of the male Flying-fox to mark their territory on branches to attract females during the mating season. The odour is usually more pungent after rain as the males re-scent their branches. Most droppings from flying-foxes are found where they eat rather than where they sleep (NSW Health 2014).

2.6.3 Faecal Droppings

The faeces dropped by Flying-foxes are important for seed dispersal as they contain seeds of plants they have been eating over long distances. If the seed laden faeces

land in an appropriate area they can germinate and grow into trees and potentially forests.

Flying-foxes often defecate during flight and can leave droppings on most surfaces, from laundry hung out to causing damage to the duco of cars. Most worrying for residents is the runoff from the roof into their water tanks. NSW Health (2014) states that many animals droppings may end up on roofs and can contaminate water tanks. The best method if the water is for drinking purposes is to install a first-flush diverter. Whilst touching or coming into contact with Flying-fox faeces and urine will not transmit Lyssavirus or Hendra, all animal faeces and urine contain micro-organisms that can be harmful to humans. There are fact sheets about diseases from bats available on the NSW Health website: www.health.nsw.gov.au .

2.6.4 Perceived Health Risks

There is several health concerns associated with flying foxes and these are reported by the media and causes some ill-informed panic for residents. Health risks are discussed bellow:

Hendra Virus – (HeV) is a zoonotic (transfer from animals to people) disease that was first seen in Hendra Queensland in 1994. Hendra can be transmitted from horses to humans but there is no evidence that it can be transferred directly from Flying-foxes to humans. Flying-foxes carry Hendra and do not show any signs of illness. The virus is detected in the blood, urine, faeces, placental tissue, aborted foetuses and birthing fluids of Flying-foxes (DPI 2013c).

At the time of writing there is no property under quarantine due to Hendra. September 2013 saw the last confirmed cases of Hendra and these were found on two properties near Macksville and two properties near Kempsey. Four horses and one dog were affected (DPI 2014). There have been two dogs infected with Hendra reported (DPI 2013a).

In 2011 ten horses on 8 properties died due to infection and were located in Wollongbar, Lismore, Mullumbimby, Ballina and Macksville. Since 1994, four out of seven people who contracted Hendra have died, all from Queensland (DPI 2014).

Australian Bat Lyssavirus (ABL) – is a rabies type virus. It is a fatal disease that can only be transmitted to humans via saliva from an infected Flying-fox via penetrating bite or scratch first identified in Australia in 1996 (DPI 2013b).

At the time of writing three people have died from ABL in Australia the latest in 2013 and were all in Queensland and wildlife carers. There is a vaccination and post exposure treatment for ABL (DPI 2014).

In January 2014 a GHFF was found entangled in a barbed wire fence at Tomago and was taken to the vet, it was tested and came back positive to ABL, See Appendix B for media story.

Menangle Virus (Bat Paramyxovirus 2) – discovered after an outbreak of reproductive disease in a Piggery near Menangle, NSW in 1997. Two piggery workers became sick after exposure to the sick pigs, no loss of life has been recorded and no further Menangle Virus outbreaks have been reported (DPI 2013a)

Histoplasmosis – refers to an infection of the lungs caused by the *Histoplasma capsulatum* fungus found in soil enriched with bird and bat droppings. The disease is rare in Australia and only been associated with overseas travellers and cavers from endemic areas (Qld Health 2014).

2.6.5 Reduced Amenity

Reduced amenity of Newbury Park is caused by, not only the odour and faecal droppings, but defoliation of vegetation and increased weed infestations.

Severe defoliation of roost trees occurs as a result of prolonged occupation and large numbers of Flying-foxes. Little Red Flying-foxes are known to cause the most damage due to their clumping style behaviour when roosting and arriving in large numbers. The weight of these animals can break limbs of roost trees. Grey-headed and Black Flying-foxes have the greater impact on the outer, smaller branches. When a camp is smaller, where roost space is limited, the trees become defoliated and do not have a chance to recover. In larger camps the core camp can change location within the site to allow for regeneration.

The loss of structure to roost trees results in canopy gaps, allowing increasing light penetration resulting in weed proliferation. This is exasperated when vine weeds cover the canopy trees and the weight can cause trees to break resulting in more canopy gaps. Flying-foxes eat a range of fruiting weed species and contribute to weed dispersal. Congregation of faecal matter in the camps leads to increased soil nutrients.

For overall camp management, tougher weed management regimes are required to combat the presence of weeds that colonise and flourish from disturbances, thus intensifying and exacerbating the impacts of Flying-fox camps.

2.7 Activities to assist Flying-foxes at Newbury Park

- Undertake restoration including bush regeneration and revegetation
- Promote public involvement in restoration activities.
- Protect habitat by minimising further clearing of the Park.
- Promote native regeneration
- Extensive weed control.
- Promote the positive aspects of Flying-fox behaviour.
- Have the closest residents involved, either by discussion, bush regeneration group or giving them information as this will give them a sense of place and in turn help protect the camp from unauthorised disturbances.
- Interpretative signage stating the importance of the camp, survival of the species and the importance of Flying-foxes.

2.8 Fauna – Other Species

Although several onsite surveys have been carried out none specifically targeted fauna. Any fauna observed was documented. The main fauna other than Flying-foxes were birds, insects and reptiles. The reserve supports areas of significant habitat features that would support other significant and non-significant fauna, these would include:

- Aquatic habitat in the associated drainage lines would provide potential forage and roosting habitat for some species of water fowl and frog species. In 1973 a Green and Gold Bell Frog was found in an adjacent park. Frogs were heard onsite.
- The Park supports a range of species that would provide potential foraging sources for frugivores.
- Several Yellow-tailed Black Cockatoos have been seen within the park as too several parrot species (Rosellas and Lorikeets).and Kookaburras.
- Birds of prey have been sighted circling above the Flying-fox camp and have been roosting in the taller emergent trees.

- Within the understorey, skinks have been sighted and a dead Blue-tongued Lizard found. Parts of bird wings have been found and this may suggest an owl foraging at night although no trees on the reserve would support any hollows.
- The park forms part of a fragmented biodiversity corridor that runs through Raymond Terrace from the Hunter River through to the Tomago Sandbeds. This would allow for local movement of mobile species and a stepping stone link for fauna movements across the landscape. This unfortunately will include feral and domestic species.

The Park vegetation may provide habitat to opportunistic foraging species and potential roosting species for the following threatened fauna (under TSC & EPCB Acts) whose' habitat is either known or predicted to occur within a 10km radius:

- Wallum Froglet (*Crinia tinnula*)
- Green and Golden Bell Frog (*Litoria aurea*)**
- Superb Fruit-Dove (*Ptilinopus superbus*)
- Spotted Harrier (*Circus assimilis*)
- Square-tailed Kite (*Lophoictinia isura*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)*
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Swift Parrot (*Lathamus discolour*)**
- Turquoise Parrot (*Neophema pulchella*)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (*Tyto novaehollandiae*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)**
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Little Bentwing-bat (*Mini*opterus australis)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Southern Myotis (*Myotis macropus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- New Holland Mouse (*Pseudomys novaehollandiae*)*

*denotes listing only under EPCB Act
**denotes listing under both EPCB and TSC Acts

2.9 Management Issues – Threats

This vegetation management plan aims to enhance the habitat of the park for the GHFF through weed management and the flying-fox issues discussed in Sections 2.5, 2.6 and 2.7. Feral predators such as foxes (known den 300-400mts from the camp – (A. Marchment pers comm.), domestic cats and dogs frequent the urban park and therefore pose a threat to many potentially occurring threatened species.

3.0 Cultural Environment

3.1 History

Newbury Park is contained within the traditional lands of the Worimi people. There has been no known archaeological surveys carried out on the Park to date. The OEH Aboriginal Heritage Information Management System (AHIMS) database shows there are no significant sites within 500mts of Newbury Park. Anecdotal evidence suggests the hilly area surrounding Boomerang Park (approx 400m away from Newbury park) was used as an informal meeting/gathering place during times of floods

Lieutenant Raymond, a member of Lieutenant John Shortland's party, who explored the area, were the first known European's to arrive in the Raymond Terrace area whilst exploring the upper reaches of the Hunter River in 1797. Lieutenant Raymond described the terraced appearance of the tree line in the area. Cedar-getters were the first Europeans to settle in the area around 1812. The township of Raymond Terrace became a growing port of call as paddle streamers began to reach the upper Hunter River near Morpeth in the 1830's. The town was gazetted in 1837 with warehouses and shops on the eastern bank. The development of the agricultural industry during the 1820's is likely to have coincided with the broad-scale clearing of much of the floodplains and foothills around the Hunter River floodplain.

In 1979 Mr Newbury applied to have his land subdivided into 38 lots with lot 38 being created as a public reserve in the original plans. There is little information about how lots 36 and 37 became public land under Council's ownership and management. Today Newbury Park consists of Lots 36, 37 and 38 of the original development plan. Lot 35 is a reserved as a future (maybe) road.

3.2 Land Use

The Park is used as a drainage reserve and a public recreation area, mainly as a thoroughfare between the residential areas to the main part of town.

There is no existing infrastructure apart from drainage culverts and protection rockwork where the stormwater drains into the reserve.

The only management activities currently undertaken by PSC are regular mowing of the grassland area and maintenance of the stormwater infrastructure. There has been limited weed control.

3.3 Urban Land

There is urban land to the south in Thomas Street, west in Adelaide Street and to the east along Hillside Close, approximately 20 houses backing on to Newbury Park. This area would have first been used in 1909 when a continuous road route (North Coast Road) was available from Hexham to Tweed Heads. This later became the Pacific Hwy in 1931. In the early 1960's farmland was subdivided with the Thomas Street residential area, followed through the late 70's into the early 1980's the Hillsdale/Riverview area.

4.0 Legislation & Policy

4.1 National Parks and Wildlife Act 1974 & Regulation 2002

All three species of flying-fox (Grey-headed, Black and Little Red) found in Newbury Park are protected under Section 98 of the *National Parks and Wildlife Act 1974* (NPW Act)

The Director General may issue a general licence under Section 120 of the NPW Act to harm protected fauna. The Director-General may issue a scientific licence under Section 132c of the NPW Act to harm, pick or damage protected fauna for scientific educational or conservation purposes.

The *National Parks and Wildlife Regulation 2002* exempts Aboriginal people from restrictions imposed by the NPW Act on hunting protected animals and gathering certain plants.

4.2 Threatened Species Conservation Act 1995

The Grey-headed Flying-fox is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act). All actions must be assessed under the TSC Act to determine if the activity is likely to result in harming or picking threatened species, population or ecological community, or damage to their habitat. Where there is considered to be a likelihood of a significant impact then a species impact statement must be prepared.

4.3 Environmental Protection and Biodiversity Conservation Act 1999

The Grey-headed Flying-fox is listed as Vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPCB Act requires an assessment of actions which may significantly impact upon matters of national environmental significance. Proponents of activities that significantly impact GHFF or their habitat may need to submit a referral to the Australian Government.

4.4 Environmental Planning and Assessment Act 1979

Impacts on protected and threatened species are to be considered when assessing and approving proposals under Part 3A, 4 or 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). A seven part assessment of significance in accordance with Section 5A of the EP&A Act is also required to determine if a proposed activity is likely to have a significant impact on a threatened species, population, ecological community or their habitat.

4.5 Port Stephens Local Environment Plan 2013

The Park is located within the PSC LGA and covered under the Port Stephens Local Environment Plan 2013 (LEP). The Park is zoned RE1 Public Recreation (Figure 14). The objectives of this zoning are:

- To enable land to be used for public open space or recreational purposes.
- To provide a range of recreational settings and activities and compatible land uses.
- To protect and enhance the natural environment for recreational purposes.

Adjoining land to the east and south is R2 Low Density Residential.

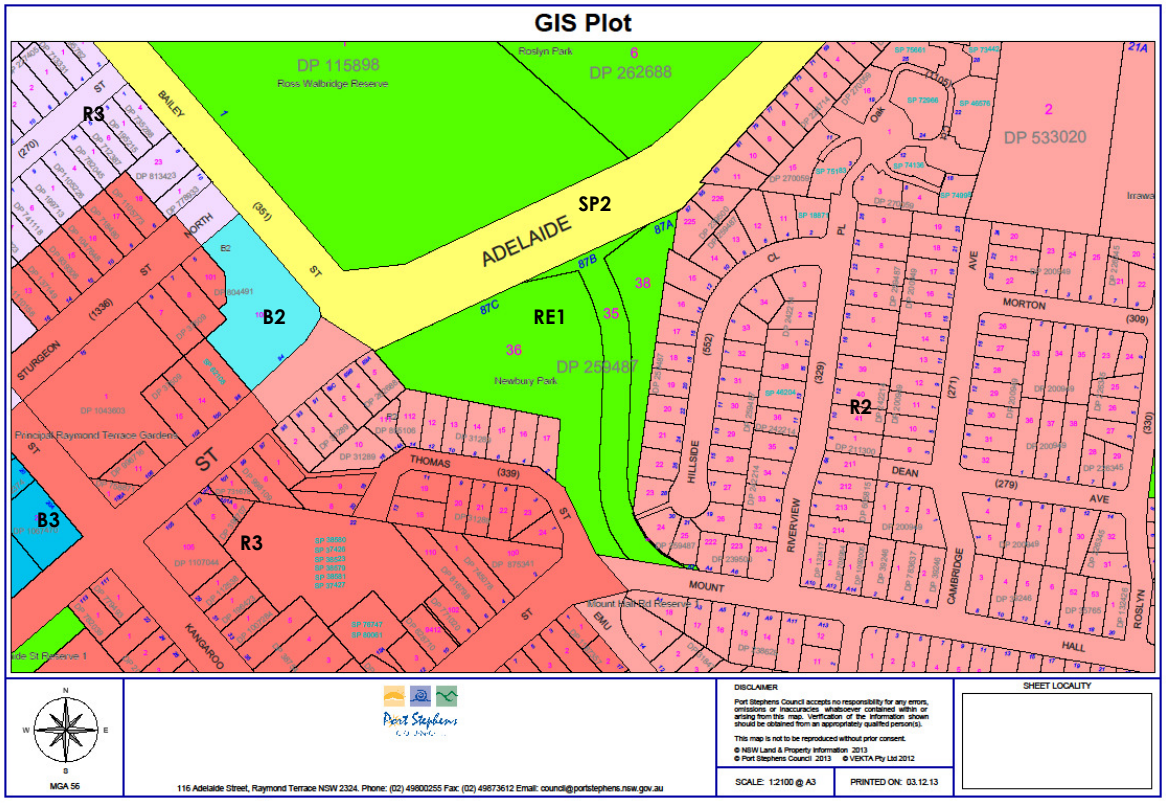

Figure 14 – PSLEP 2013 Zoning

4.6 Local Government Act 1993

The approvals provisions of the *Local Government Act 1993* (LG Act) is applicable to Newbury Park. Section 68 of the Act sets out requirements relating to a range of activities, generally focused on the provision of infrastructure.

4.7 DECCW (OEH) Flying-fox Camp Management Policy

The main policy provisions outlined within the *Flying-fox Camp Management Policy* prepared in 2007 by Department of Environment and Climate Change (DECC), now OEH, are summarised below.

DECC will:

- Encourage the conservation of flying-fox camps on public and private land and will protect and manage flying-fox camps on lands administered by DECC.
- Generally **not** support disturbing a flying-fox camp to force the animals to desert a camp, or to try and relocate a camp.
- Not support disturbing camps under the following circumstances:
  - From when females are heavily pregnant until the young can fly independently.
  - When there are adverse climatic conditions.
  - When daytime temperatures are extremely high.

        - When DECC considers it likely that, due to proximity, flying-foxes disturbed from a camp will join camps in nearby towns, compounding problems at those sites.
    - Support camp management options that aim to retain flying-foxes in-situ.
    - Require preparation and implementation of a strategic plan to manage a camp in-situ before consideration of any proposal to relocate a camp.
    - Assess the level of compliance with the '*Procedure for developing a flying-fox camp relocation proposal*' when assessing applications for a licence under s.91 of the TSC Act.
    - Require submission of a report assessing whether an attempt to relocate a flying-fox camp has been successful following all relocation attempts licensed by OEH.
    - Require any person wishing to harm flying-foxes or damage their habitat obtain appropriate licences, including for cultural purposes under the TSC and NPW Acts.
    - Encourage research into the ecology of flying-foxes and their use of camps, including research into camp selection criteria. Support for national population estimates will continue as a method of monitoring population trends and identifying new camps.
    - Support bushland restoration activities that improve the quality, quantity and integrity of habitat in flying-fox camps and maintain camp function.
    - Support licensed wildlife carers' use of best practice to rehabilitate and release flying-foxes that have suffered as a result of extreme weather.
    - Coordinate the preparation and implementation of an education and communication strategy in partnership with other agencies or organisations that share responsibility for addressing community needs and concerns.
    - Provide access to information on flying-fox camp locations.
    - Respond to public complaints about flying-fox camps promptly, courteously and efficiently.
    - Liaise with the relevant authorities to develop joint strategies and actions where flying-fox camps are located near airports.
    - Encourage local government to protect flying-fox camps through local environmental planning controls.
    - Encourage local government to consider the location of flying-fox camps early in strategic planning processes, particularly when planning for proposed residential areas, schools and similar infrastructure.
    - Encourage local government to prepare plans of management for flying-fox camps on council land, and on land under councils' care and control.
    - Encourage consideration of the location of flying-fox camps and the provision of spatial separation between camps and hazard reduction activities in the planning and implementation of bushfire hazard reduction activities.
    - _ Encourage consent authorities for native vegetation clearing and approval authorities for property vegetation plans under the *Native Vegetation Act 2003*, and organisations responsible for infrastructure development under various legislation, to identify and protect camps and provide for their expansion when undertaking strategic and site planning.

This policy also outlines legal responsibilities regarding Flying-fox management, outlines how to appropriately conserve and manage flying-fox camps in NSW and manage public complaints about flying-foxes. It outlines strategies for flying-fox education and communication, provides guidelines to assist in forward planning, so conflicts caused by locating inappropriate land uses near flying-fox camps are avoided or mitigated, provides guidelines and recommended procedures for relocating flying-fox camps and informs those wishing to relocate flying-fox camps how to obtain and meet the conditions of an appropriate licence.

4.8 Draft National Recovery Plan for Grey-headed Flying-fox

The Draft National Recovery Plan for the Grey-headed Flying-fox developed by DECCW in partnership with Victoria, Queensland and the Australian Government was placed on public exhibition in 2009 with submissions closing in 2010. The plan is now being finalised in the light of these submissions and to reflect current issues in flying-fox management. The draft plan considers the conservation requirements throughout the species' range, sets objectives for recovery and identifies actions to be undertaken to reverse decline and ensure long-term viability.

The overall objectives of recovery of Grey-headed Flying-foxes are to:

- Reduce the impact of threatening processes.
- Arrest decline throughout their range.
- Conserve their functional roles in seed dispersal and pollination of native plants.
- Improve the comprehensiveness and reliability of information available to guide recovery.

Specific objectives relevant to the five year duration of the recovery plan aim to:

- Identify, protect and enhance key foraging and roosting habitat.
- Substantially reduce deliberate destruction associated with commercial fruit crops.
- Reduce negative public attitudes and conflict with humans.
- Involve the community in recovery actions where appropriate.

Further objectives aim to address the impact on the species of artificial structures such as powerlines, loose netting and barbed wire fences; and to improve knowledge of demographics and population structure.

Actions to meet these objectives incorporate principles of sustainable development and promote procedures to minimise significant adverse social and economic impacts, such as the use of environmental incentive schemes and equitable cost-sharing arrangements.

The draft recovery plan identifies foraging habitat critical to the survival of Grey-headed Flying-fox as:

- Productive during winter and spring, when food bottlenecks have been identified (Parry-Jones and Augee1991, Eby *et al*. 1999).
- Known to support populations of >30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult).
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May).
- Productive during the final stages of fruit development and ripening in commercial crops affected by
- Grey-headed Flying-foxes (months vary between regions).
- Known to support a continuously occupied camp.

The draft recovery plan identifies roosting habitat critical to the survival of the Grey-headed Flying-fox as:

- Is used as a camp either continuously or seasonally in >50% of years;
- Has been used as a camp at least once in 19 years (beginning in 1995) and is known to have contained >10,000 individuals, unless such habitat has been used only as a temporary refuge, and the use has been of limited duration (i.e. in the order of days rather than weeks or months); and/or
- Has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained>2,500 individuals, including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May).

As mentioned in **Section 2.4**, Newbury Park constitutes roosting habitat critical to the survival of the Grey-headed Flying-fox, while the broader locality contains foraging habitat critical to the survival of Grey-headed Flying-fox

4.9 NSW State Plan

The 2010 NSW State Plan (investing in a better future) is the NSW Government's plan to achieve promised results over the medium to long term across seven broad areas of activity: better transport and liveable cities, supporting business and jobs, clever state, healthy communities, green state, stronger communities and keeping people safe.

This VMP contributes to meeting the 2010 NSW State Plan objectives as set out in Chapter 5 – Green State. The target is to *protect our native vegetation, biodiversity, land, rivers and coastal waterways*. The action is to *increase the extent and improve the condition of native vegetation and habitats.*

4.10 Grey-headed Flying-fox Management Strategy for the Lower Hunter

The Grey-headed Flying-fox Management Strategy for the Lower Hunter is part of the Australian Government's Sustainable Regional Development (SRD) program, facilitated under the EPBC Act 1999 to protect matters of national environmental significance where high demand for growth and development is expected.

This strategy aims to identify how to improve or maintain habitat and ecological processes critical to the GHFF's and how future development and growth can proceed without affecting the current and future use of the Lower Hunter by foraging and roosting GHFF.

The purpose of the strategy is to:

- identify habitat critical for the survival of the GHFF in the Lower Hunter;
- analyse the current status of this habitat within the Lower Hunter and assess the likely impacts of development on the GHFF;
- identify areas of GHFF habitat that are not adequately protected;
- identify strategic areas for protection, enhancement or restoration;
- identify situations for biodiversity offsetting that would benefit the GHFF; and
- identify other management strategies for the protection of the GHFF and its habitat within the Lower Hunter.

A broad and proactive approach to the management of the GHFF is proposed through this management strategy, as a mechanism to support sound impact assessment, appropriate consideration of cumulative impacts of habitat loss, sound decision-making with regard to regional and site-based planning decisions, and the management and protection of this complex species in the Lower Hunter, given the area's projected growth and development needs. It is intended to be a living document that is updated as further studies and research contribute to an improved understanding of the GHFF in the Lower Hunter, and more effective management tools for foraging and roosting habitat conservation and conflict resolution.

The Newbury Park (Raymond Terrace) camp is stated in this strategy, to be not critical to survival for the GHFF (at the time of publication the camp was a seasonal with <1500 GHFF) and could function as an important refuge for the GHFF during food shortages, or as shifts in climate patterns occur. **The status of this camp should be reviewed prior to undertaking any management decisions**.

5.0 Site Assessment

5.1 Methods

Two field inspections (ground truthing) were conducted, the first on the 4 October 2013 and the second 5 December 2013. These field inspections involved a traverse of the entire site and documentation of the occurrence of plant communities, native plants, introduced species, threatened flora and the identification of impacts affecting the components of the Park's vegetation.

Native and introduced plant species were identified and listed in Appendix C. The location and extent of native vegetation was assessed and work zones were identified and mapped (Figure 15). Landuse issues were identified and incorporated into the management assessment. Landuse impacts, including the extent of retention ponding area, illegal dumping, both household items and garden waste, were noted during the inspections.

5.2 Vegetation Description

Five distinct work zones were identified within the park these include:

- Zone 1 – Residential Buffer
- Zone 2 – Core Flying-fox camp
- Zone 3 – Tree enhancement area
- Zone 4 – Weeding and enhancement area
- Zone 5 – Flying-fox camp protection buffer

Vegetation type was not used to identify work zones as the vegetation was quite uniform throughout the park. The main vegetation was grouped around the stormwater drainage line down the middle of the park, with a vegetative perimeter. The interior is domestic grassland that is maintained.

5.2.1 Zone 1 – Residential Buffer

Structure and Floristic Composition

Upper Storey – the main species in this area are low to mid dense <25m tall exotic tree species and consist of Slash Pines (*Pinus elliottii* var. *elliottii*) Camphor Laurels (*Cinnamomum camphora*), several Coral Trees (*Erythrina sp.*) and a Red-tip Photinia (*Photinia fraseri*). A solitary Bangalay (*Eucalyptus botryoides)* stands between the Camphour Lauels and Slash Pines.

Mid-storey – comprises of dense weeds from 3 to 10m, namely Banana trees (*Musa sp.*), Camphor Laurel (*Cinnamomum camphora*), Small Leaf Privet (*Ligustrum sinense*), Broad Leaf Privet (*Ligustrum lucidum*), Willow (*Salix sp.)* Silky Oak (*Grevillea robusta*) and Cottonwood (*Tilapariti tiliaceum*).

Understorey – comprises of a mid to dense layer of introduced and native species to a height of 2m. Species include: Oleander (*Nerium oleander*), Tobacco Bush (*Solanum mauritianum*), Maderia Vine (*Anredera cordifolia*), Japanese Honesuckle (*Lonicera japonica*), Papyrus (*Cyperus papyrus*), Lantana (*Lantana camara*) Caster oil (*Ricinus communis*) and a *Callistemon sp*.

Groundcover – comprises of medium density species <0.5m. Species include: exotic grasses (mown), Wandering Jew (*Tradescantia fluminensis*), *Abutilon sp.*, Black-eyed Susan (*Rudbeckia hirta*), Nasturtium (*Tropaeolum majus*), Canna Lily (*Canna indica*), Elderberry (*Sambucus nigra*), Water Moss (*Funaria hygrometrica*), Asthma Weed (*Parietaria judaica*), Budding Club Rush (*Isolepis prolifera*), English Ivy (*Hedera helix*), a dense blanket of vine weeds and a wide range of exotic seedlings.

Condition of Vegetation

The vegetation community in Zone 1 is in very poor condition with a drastically altered structure and low floristic diversity with 95% of the vegetation being introduced species (Figure 16a & b). There is a large area of dumped garden waste and lawn clippings directly behind the residences which may have, over time, contributed to the extensive weed infestation of the area. The area closest to the fence line has been mowed.

Conservation Status

This zone does not contain any vegetation that would be representative of conserving. The Bangalay (*Eucalyptus botryoides*) will be retained.

Figure 16a – Looking into the overflow area from. Thomas Street

Figure 16b - showing vegetation in zone 1
Photos: PSC

5.2.2 Zone 2 – Core Flying-fox Camp

Structure and Floristic Composition

This zone's range of species is representative of Swamp Oak Floodplain Forest EEC. Key species denoted with an asterisk (*) and key indicator species with a cross (+)

Upper Storey – comprises of tree species up to 20m. Species present include: Casurina species* (*Casurina glauca*+ & *Casuarina cunninghamiana*), Broad-leaf Paperbark (*Melaleuca quinquenervia**), Silky Oak (*Grevillea robusta*), Cheese Tree (*Glochidion ferdinandi**+), Tuckeroo (*Cupaniopsis anacardioides**), Swamp Mahogany (*Eucalyptus robusta*), Camphor Laurel (*Cinnamomum camphora*), Red Ash (*Alphitonia excelsa*) and Willow (*Salix sp.*).

Mid Storey – comprises mid to dense taller trees and shrubs from 5 – 10m in height. Species include: Magenta Lilli Pilli (*Syzygium paniculatum*), Sweet Pittosporum (*Pittosporum undulatum*), Small Leaf Privet (*Ligustrum sinense*), Broad leaf Privet (*Ligustrum lucidum*), African Olive (*Olea europaea ssp. Cuspidate*), Green Cestrum (*Cestrum parqui*), Senna (*Senna sp.*), Maderia Vine (*Anredera cordifolia*), Japanese Honesuckle (*Lonicera japonica*), Tobacco Bush (*Solanum mauritianum*), Silk Pod (*Parsonsia straminea**+), Loquat (*Eriobotrya japonica*), Bleeding Heart (*Homalanthus populifolius**) and White Cedar (*Melia azedarach*)

Understorey – comprises of a mid to dense layer of introduced and native species to a height of 2m. Species include: Golden Cane Palm (*Dypsis lutescens*), Blackberry

(*Rubus fruticosus*), Japanese Honesuckle (*Lonicera japonica*), Maderia Vine (*Anredera cordifolia*), Lantana (*Lantana camara*) and Caster oil (*Ricinus communis*).

Groundcover – comprises of mid to dense layer of introduced and native species between 0.2 and 0.5 m in height. Species include: Boneyard Grass (?), *Paspalum sp., Persicaria sp.,* Common Reed (*Phragmites australis**+), Rushes (*Juncus sp.**), Broad-leaf Cumbungi (*Typha orientalis*), Dirty Dora (*Cyperus difformis*), Purpletop (*Verbena bonariensis*), Rag Weed (*Ambrosia sp.*), Budding Club Rush (*Isolepis prolifera*), Ochna (*Ochna serrulata*), Curled Dock (*Rumex crispus*), Common Bracken (*Pteridium esculentum*), Taro (*Colocasia esculenta*), *Abutilon sp.,* Sickle Fern (*Pellaea falcate*), Swamp Lily (*Crinum pedunculatum**), Lomandra (*Lomandra longifolia**) Knotweed (*Persicaria decipiens**), Soft Bracken (*Calochlaena dubia*), hard fern (*Blechnum sp.*), Asthma Weed (*Parietaria judaica*), Native Wandering Creeper (*Commelina cyanea**+), Prickly Rasp Fern (*Doodia aspera*), Water Moss (*Funaria hygrometrica*) and Bulrush (*Typha latifolia*).

Condition of Vegetation

The vegetation community in zone 2 is representative of poor quality Swamp Oak Floodplain Forest EEC due to the extensive weed infestation. The floristic structure of this community has been dramatically reduced (Figure 17a & b).

It is likely that this community has been subject to an extensive range of impacts including direct clearing.

Conservation Status

This community closely corresponds to the Threatened Species Conservation Act 1995 listed Endangered Ecological Community, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions. This zone is also home to the protected GHFF.

Figure 17a & b - Core camp area looking south Photo: PSC

5.2.3 Zone 3 – Tree Enhancement Area

Structure and Floristic Composition

This zone is representative of grassland and is maintained as parkland (figure 17a & b).

Mid Storey – comprises of small juvenile <5m Willows (*Salix sp.*) with extensive vine weed infestation of both Japanese Honesuckle (*Lonicera japonica*) and Maderia Vine (*Anredera cordifolia*).

Understorey – comprises of a dense layer of introduced woody vine species to a height of 1m. Main species is Blackberry (*Rubus fruticosus*).

Groundcover – comprises of common exotic grass species <0.2m.

Condition of Vegetation
The vegetation here is predominately exotic species with no structure, just a few sporadic juvenile willows covered in vine weeds with a thick carpet of blackberry backing onto a large grassed area that is maintained by mowing.

Conservation Status
This area presently has no conservation status and will be cleared of all weed species and will be the main area for rehabilitation of the EEC. This zone will become part of the core camp and will be planted with Flying-fox friendly EEC roost trees to be used in years to come.

Figure 17a & b – Zone 3 – weed infested are to be enhanced for extra roost space – Photo PSC

5.2.4 Zone 4 - Weeding and Enhancement Area

Structure and Floristic Composition
This zone's (like zone 2) range of species is representative of Swamp Oak Floodplain Forest EEC. Key species denoted with an asterisk (*) and key indicator species with a cross (+)

Upper Storey – comprises of tree species up to 20m. Species present include: Casurina species* (*Casurina glauca*+ & *Casuarina cunninghamiana*), Broad-leaf Paperbark (*Melaleuca quinquenervia**), Silky Oak (*Grevillea robusta*), Cheese Tree (*Glochidion ferdinandi**+), Tuckeroo (*Cupaniopsis anacardioides**), Swamp Mahogany (*Eucalyptus robusta*), Sydney Blue Gum (*Eucalyptus saligna*), Camphor Laurel (*Cinnamomum camphora*), Red Ash (*Alphitonia excelsa*), Bleeding Heart (*Homalanthus populifolius**) and White Cedar (*Melia azedarach*), Willow (*Salix sp.*) and a Fig (*Ficus rubiginosa*).

Mid Storey – comprises of mid-dense taller trees and shrubs from 5 – 10m in height. Species include: Magenta Lilli Pilli (*Syzygium paniculatum*), Sweet Pittosporum (*Pittosporum undulatum*), Maple (*Acer negundo*), Small Leaf Privet (*Ligustrum sinense*), Broad leaf Privet (*Ligustrum lucidum*), African Olive (*Olea europaea ssp. Cuspidate*), Green Cestrum (*Cestrum parqui*), Senna (*Senna sp.*), Maderia Vine (*Anredera cordifolia*), Japanese Honesuckle (*Lonicera japonica*), Tobacco Bush (*Solanum mauritianum*), Silk Pod (*Parsonsia straminea**+), Loquat (*Eriobotrya japonica*) Bleeding Heart (*Homalanthus populifolius**), and White Cedar (*Melia azedarach*)

Understorey – comprises of a mid to dense layer of introduced and native species to a height of 2m. Species include: Golden Cane Palm (*Dypsis lutescens*), Blackberry (*Rubus fruticosus*), Japanese Honesuckle (*Lonicera japonica*), Maderia Vine (*Anredera cordifolia*), Lantana (*Lantana camara*) and Caster oil (*Ricinus communis*).

Groundcover – comprises of mid to dense layer of introduced and native species between 0.2 and 0.5 m in height. Species include: Boneyard Grass (?), *Paspalum sp.,*

Persicaria sp., Common Reed (*Phragmites australis**+), Rushes (*Juncus sp.**), Broad-leaf Cumbungi (*Typha orientalis*), Dirty Dora (*Cyperus difformis*), Purpletop (*Verbena bonariensis*), Rag Weed (*Ambrosia sp.*), Ochna (*Ochna serrulata*), Curled Dock (*Rumex crispus*), Common Bracken (*Pteridium esculentum*), Elderberry (*Sambucus nigra*), Nasturtium (*Tropaeolum majus*) Taro (*Colocasia esculenta*), *Abutilon sp.,* Budding Club Rush (*Isolepis prolifera*), Sickle Fern (*Pellaea falcate*), Swamp Lily (*Crinum pedunculatum**), Lomandra (*Lomandra longifolia**) Knotweed (*Persicaria decipiens**), Soft Bracken (*Calochlaena dubia*), hard fern (*Blechnum sp.*), Native Wandering Creeper (*Commelina cyanea*+*), Asthma Weed (*Parietaria judaica*), Prickly Rasp Fern (*Doodia aspera*), Water Moss (*Funaria hygrometrica*) and bulrush (*Typha latifolia*).

Condition of Vegetation

The vegetation community in zone 4 is representative of poor quality Swamp Oak Floodplain Forest EEC due to the extensive weed infestation. The floristic structure of this community has been dramatically reduced. The zone 4 area is elongated and thus more susceptible to edge effects of exotic weed infestations.

It is likely that this community has been subject to an extensive range of impacts including direct clearing.

Conservation Status

This community closely corresponds to the Threatened Species Conservation Act 1995 listed Endangered Ecological Community, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions. This zone is also an overflow roost area to the protected GHFF.

5.2.5 Zone 5 – Flying Fox Camp Protection Buffer

Structure and Floristic Composition

This zone is representative of grassland (between 0.2 and 0.5 m in height and 100% cover) and is maintained regularly by way of slashing. It is the edge of the vegetated EEC area (zone 2 and some of zone 4).

Groundcover – comprises of common grass species.

Condition of Vegetation

The vegetation is exotic common grass, herb, vine weed and woody weed species with extensive regrowth of weed species.

Conservation Status

This area presently has no conservation status and will be cleared of all weed species and will become the buffer area for rehabilitation of the EEC. This zone will be the outer perimeter (visual buffer) of zone 2 and 4 and will be planted with Flying-fox un-friendly EEC low shrubs to deter roosting. This will be the native buffer between the maintained area of the park and the EEC to provide a visual and protective buffer for park users and residents for the Flying-fox camp.

Figure 15 – Work Zones for Rehabilitation

6.0 Management Strategy Work Zone Recommendations

The overarching objective is to establish an environment that the vegetation communities are self sustaining and will need minimal future weed control maintenance, whilst continuing to provide roosting habitat for Flying-foxes. All weed management works musty take into consideration the flying-fox values of the Park. Works must adhere to:

- Ways of minimising disturbances to the Flying-fox colony whilst undertaking works in and around the core camp,
- Maintaining the existing microclimate that is suitable for roosting Flying-foxes. It is known that in many occupied camps the weeds in the understorey layers help maintain a microclimate. Weed works in the core camp areas must be staged in smaller areas rather than on a broad scale.
- Camphor Laurel and Willows provide key roosting habitat for Flying-foxes at the Park and removal of any tree that is 10cm (DBH) or greater must not be undertaken until a mature native EEC species have been established.
- Revegetation must not oversimplify an ecosystem but be as close approximation to the original bushland.

Control of weed species will be undertaken using the methods outlined in *Noxious and Environmental Weed Control handbook – a guide to weed control in non-crop, aquatic and bushland situations* – Department of Primary Industries (2011) and Chapter 18 of *Restoring Natural Areas in Australia - Robin Buchanan (2009)*. Any works undertaken, must ensure compliance with best practice techniques and maximise efficiency efforts.

6.1 Zone 1 – Residential Buffer

The primary vegetation management issue is the exotic tree species used as an overflow Flying-fox roost and the proximity of these trees to residential properties in Thomas Street. The source of the weed trees is believed to be in the 1980's when they were planted and the growth of garden escapees from dumped garden waste. The native Bangalay may have been regenerated from soil seed stock and the Grevillia has been planted. The area has been under scrubbed and mowed regularly by unknown person/s.

This zone is to be cleared of all exotic vegetation and trees to create a non-roosting residential buffer to protect the adjacent residences.

Revegetation of this zone will be species characteristic of Swamp Oak Floodplain Forest EEC and Swamp Sclerophyll (in the wet retention area). There will be no upper storey (potential roost trees) and a thin mid storey consisting of bushy shrubs. The main strata will be understorey and groundcover of mixed species listed in the Characteristic Species List in the *Identification Guidelines for Endangered Ecological Communities – Swamp Oak Floodplain Forest (2007)* and *Swamp Sclerophyll Forest on Coastal Floodplain (2007)* both produced by DECC.

Within this zone there will be 3 subzones these are:

- Subzone 1 – grassland maintained APZ (asset protection zone)
- Subzone 2 – shrubs to 2m
- Subzone 3 – shrubs and small trees to 5m

6.1.1 Subzone 1 – Grassland

This subzone will be used as an Asset Protection Zone (APZ) for the residential properties along Thomas Street. This subzone will be maintained by way of mowing. Grass species will be allowed to grow. There will be ongoing maintenance of weed occurrence which provide weed propagule sources for the adjacent forest.

6.1.2 Subzone 2 – Shrubs to 2m

This area will be the start of the protection buffer. This area crosses into the retention ponding area. Main species to be planted in this subzone include but not limited to:

- Lomandra (*Lomandra longifolia*)
- Commelina (*Commelina cyanea*)
- Blue Flax Lily (*Dianella caerulea*)
- Swamp Club-sedge (*Isolepis nodosa*)
- Swamp Lily (*Crinum pedunculatum*)
- Rushes (*Juncus sp.*)

6.1.3 Subzone 3 – Shrubs and Small Trees

This zone will lie adjacent to zone 4 on the eastern side with zones 2 and 3 along the northern side. Subzone 3 will be similar to Zone 5 in composition, acting as a visual protection buffer. This area will be representative of smaller bushier shrubs that Flying-foxes normally do not roost in. The main species planted in this zone include but not limited to will be:

- Magenta Lilli Pilli (*Syzygium paniculatum*)
- Lilli Pilli (*Acmena Smithii*)
- Cheese Tree (*Glochidion ferdinandi*)
- Tantoon (*Leptospermum polygalifolium* subsp. *polygalifolium*)
- Flaxleaf Paperbark (*Melaleuca linariifolia*)
- Sweet Willow Bottle-brush (*Callistemon salignus*)
- Bleeding Heart (*Homalanthus populifolius*)
- Silkpod (*Parsonsia straminea*)

6.2 Zone 2 - Core Flying-fox Camp

The main management issue in Zone 2 is exotic trees and a thick mid-storey and understory of weed species. The weed species are currently providing roost space and a preferred microclimate for the Flying-foxes. This zone is the most important with respect to management of the weed species and continued Flying-fox occupation and thus a mosaic approach should be taken for primary weed removal as this will allow the Flying-foxes to move between areas during regeneration. Overall there will be minimal weed maintenance of the camp area within the first 3-5 years until zone 3 can support the population.

During years 3 to 5 there will be limited weed removal but targeting the ground layer to encourage regeneration of native species, providing a thick understorey to control a Flying-fox preferred microclimate. There will be no tree removal during this stage as reducing tree species will encourage light to penetrate the understorey and would likely to increase weed growth. Native seedlings must be given time to establish and therefore the area should not be worked heavily. Small areas, starting on the eastern side of zone 2, should be weeded and planted, then left alone for

several months and follow-up weeding must be done to prevent weed competition with natives. This zone will take approximately 5-7 years to complete if Flying-foxes are present.

After the 5 year mark, exotic tree species can be poisoned but left in-situ continuing to provide roosting space. Mid-storey species such as privet should be removed last or until the native vegetation has regenerated, as they provide roost and shade for heat affected animals to use to cool down.

6.3 Zone 3 - Tree Enhancement Area

Zone 3 is the Flying-fox habitat regeneration area and the vegetation to be planted here will reflect Swamp Oak Floodplain Forest EEC. This area will provide an additional area to the core camp to be used as an overflow area when camp numbers seasonally increase.

Canopy species here will focus primarily on Swamp Oak (*Casurina sp.*) as this is the preferred roost tree within the Park. Casuarinas grow quickly and will provide roost space within 3 to 5 years.

Dependent on funding opportunities the aim is to plant semi-mature stock so that the area can be utilised within 3 years. Whilst it is unknown what the soil seed bank contains, this area will be revegetated manually according to current restoration techniques and guidelines in *Restoring Natural Areas in Australia - Robin Buchanan (2009)*.

6.4 Zone 4 - Weeding and Enhancement Area

The main management issue in Zone 4 will be the long term suppression of weed species including exotic trees. This zone surrounds the core camp area and will be managed in a similar way to Zone 2. This area will have adjunct planting with native species to replace any gaps left by weed removal. Enhancement and enrichment planting will be done in a mosaic fashion as required.

6.5 Zone 5 – Flying Fox Camp Protection Buffer

The main aim of Zone 5 is to provide an additional buffer to the entire Flying-fox camp. This will be additional area planted around the perimeter of the vegetated area of Newbury Park to reduce the surface area, thus reducing weed infiltration into the camp. This zone will be managed and planted in the same way as Zone 1, subzones 2 & 3. This area is not intended for FF roosting.

7.0 Recommendations

7.1 Project Establishment, Training and Liaison

All works should be undertaken by or under direct supervision of professional bush regenerators due to:

- Professionals have the plant identification skills necessary to identify native seedlings present onsite.
- They have the experience with establishment of monitoring plots and photo points
- Initial works are labour intensive and therefore the team must be able to undertake works efficiently and effectively.

Other points for consideration include:

- Liaison between all parties involved in the works to be undertaken to allow for a working relationship to occur between those coordinating the project and those undertaking the works.
- Opportunities to be sought to allow community members, members of licensed groups to undertake some work with the professional bush regenerators in the early stages of the project to allow knowledge transfer and to foster a sense of ownership and cooperation.
- Ongoing works and secondary and mature phase works, can be undertaken by skilled community groups with ongoing liaison and support from qualified, experienced bush regenerators throughout the duration of the works.
- Keep local residents informed of the progress and encourage them to become involved.

7.2 Monitoring and Work Stages

Monitoring should be undertaken to provide the means of evaluating and recording the progress of the rehabilitation works. Funding bodies require monitoring and recording to be undertaken as evidence that their funding has been used satisfactorily. The minimum recording effort required of this site should include the following parameters:

- Photo points - fixed points should be established over a number of locations and photos taken at agreed intervals.
- Recording of filed data – the species list provided in Appendix D is a starting point on which to build further information. A number of quadrats or transects should be established at the start of the works to gather baseline data. Repeat monitoring should be undertaken annually or biannually depending on the amount of work undertaken.

The following information should be recorded as a minimum:

- Species present
- Species abundance
- Growth stage
- Percentage cover of weeds
- Canopy cover

- Depth of leaf litter

Regular monitoring, follow-up treatments and work hints include:

- Complete work in each small work zone prior to initiating work in a new zone
- Understand regular inspections of previously worked sites to ensure reoccurring issues can be sorted out prior to starting more extensive work'
- Undertake repeat treatment as required in order to prevent small infestations or reshooting weeds taking hold.
- Avoid making large piles for composting purposes, it is better to spread cut vegetation over the site as a mulch (careful note some weed species must be taken from site to stop reinfestation)

7.3 Sourcing of Plants

Source plants from local, suitably qualified, experienced and licensed nurseries so that the genetic origin is suitable for the area. This will be most important for secondary and tertiary plantings. Ideally plants should be sourced from local provenance from seed sourced from natural wild population as close as possible to the site. Some forward planning with local nurseries may be required in order for seed to be sourced in a timely manner.

7.4 Threatened Plants

If any threatened plants are found onsite the following management measures should be taken into consideration:

- No additional planting should occur within 5mts of the threatened plant species to minimise the potential for disruption to the root zone
- Spraying should not occur within 2mts of the plant and all care should be taken to ovoid any wind-drift onto the plant.

7.5 Herbicide Usage Near Waterways

The site is located within a drainage reserve and flows through several ponds before reaching the Hunter River. Only herbicides registered for use within 5mts of the waterway should be used.

7.6 Licensing

All works within Newbury Park require a Section 96 Certificate under the *Threatened Species Conservation Act 1995* from OEH to harm, pick a threatened species, population or ecological community or damage habitat.

8.0 References

Blackmore KL & Goodwin ID (2010), *Historic and Projected Impacts of Climate Change on the CENTRAL Climatic Zone of the Hunter, Central and Lower North Coast. Hunter and Central Coast Regional Environment Management Strategy (HCCREMs)*, NSW

Buchanan RA (2009) *Restoring Natural Areas in Australia,* for Department of Industry and Investment, NSW.

Churchill, S. (2008) *Australian Bats*, second edition, Allen & Unwin Publishers

DECC (2007) *Flying-fox camp management policy*, Department of Environment and Climate Change NSW, Sydney

DECCW (2009) *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus.* Prepared by Dr Peggy Eb, Department of Environment, Climate Change and Water NSW.

DPI (2014) NSW Department of Primary Industries website [accessed 28 January 2014] http://www.dpi.nsw.gov.au/agriculture/livestock/horses/health/general/hendra-virus last updated September 2013.

DPI (2013a) *Bats and Health Risks,* Prime Facts Primefact #1069, 2nd edition November 2013

DPI (2013b) *Australian Bat Lyssavirus*, Prime Facts, Primefact #1291, 2nd edition September 2013

DPI (2013c) *Hendra Virus*, Prime Facts, Primefact#970, 8th edition August 2013

Eby, P. (1991) *Seasonal movements of Grey-headed Flying-foxes, Pteropus poliocephalus (Chiroptera: Pteropidae), from two maternity camps in northern NSW.* Wildlife Research **18:** 547-559

Eby, P (2013) Talk and presentation at the Flying-fox workshop run by OEH – Sydney October 13 2013.

Eby, P. & Law, B. (2008) *Ranking the feeding habits of Grey-headed flying-foxes for conservation management* – a report for the Department of Environment and Climate Change (NSW) and The Department of Environment, Water, Heritage and the Arts.

Hall, L & Richards, G. (2000) *Flying Foxes: Fruit and Blossom Bats of Australia*, UNSW Press, Sydney

HCCREMS (2010), *Potential Impacts of Climate Change on the Hunter, Central and Lower North Coast of NSW, Hunter Councils NSW.* Prepared by Marsden Jacob Associates, Camberwell, Victoria

Matthei, L.E. (1995) *Soil Landscapes of the Newcastle 1:100 000 Sheet* Report, Department Land & Water Conservation, Sydney.

NSW Health (2014) NSW Department of Health website [accessed 28 January 2014] http://www.health.nsw.gov.au/environment/factsheets/Pages/flying-foxes-questions.aspx

Pinson, D. (2009) *The Flying-fox Manual 2009*, second edition, Stickee Batz Publishing

Queensland Health (2014) Queensland Government Health website [accessed 28 January 2014] http://access.health.qld.gov.au/hid/InfectionsandParasites/FungalInfections/histoplasmosis_fs.asp

9.0 Appendices

Appendix A – Grey-headed Flying-fox Native Diet List – Eby & Law (2008)

Appendix B – Port Stephens Examiner – story of Grey-headed Flying-fox with ABL

Appendix C – List of Plants, native and non native, found onsite

Appendix D – Swamp Oak Floodplain Forest EEC species planting List

Appendix A - Grey-headed flying-fox native species diet list

Native species in the fruit diet of Grey-headed Flying-foxes confirmed by observations of feeding animals or by identification of faecal or spat material. source: Eby and Law (2008)

Family	*Species*	Common name
GYMNOSPERMAE		
Podocarpaceae	*Podocarpus elatus*	Plum Pine
ANGIOSPERMAE		
Anonaceae	*Rauwenhoffia leichardtii*	Zig Zag Vine
Apocynaceae	*Melodinus australis*	Southern Melodinus
Arecaceae	*Livistona australis*	Cabbage Palm
	Archontophoenix cunninghamiana	Bangalow Palm
Avicenniaceae	*Avicennia marina*	Grey Mangrove
Caprifoliaceae	*Sambucus australasica*	Yellow Elderberry
Cunoniaceae	*Schizomeria ovata*	Crabapple
Davidsoniaceae	*Davidsonia* spp.	Davidson's Plum
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony
Ehretiaceae	*Ehretia acuminata*	Koda
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong
	E. reticulatus	Blueberry Ash
	E. grandis	Blue Fig
Escalloniacae	*Polyosma cunninghamii*	Featherwood
Euphorbiaceae	*Mallotus discolor*	White Kamala
Icacinaceae	*Pennantia cunninghamii*	Brown Beech
Meliaceae	*Melia azedarach*	White Cedar
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry
Moraceae	*Ficus coronata*	Creek Sandpaper Fig
	F. fraseri	Sandpaper Fig
	F. macrophylla	Moreton Bay Fig
	F. obliqua	Small-leaved Fig
	F. rubiginosa	Rusty Fig
	F. superba	Deciduous Fig
	F. virens	White Fig
	F. watkinsiana	Strangler Fig
	Maclura cochinchinensis	Cockspur Thorn
Myrtaceae	*Acmena hemilampra*	Broad-leaved Lilly Pilly
	A. ingens	Red Apple
	A. smithii	Lilly Pilly
	Rhodamnia argentea	Malletwood
	Syzygium australe	Brush Cherry
	S. corynanthum	Sour Cherry
	S. crebrinerve	Purple Cherry
	S. luehmanii	Riberry
	S. oleosum	Blue Lilly Pilly
Passifloraceae	*Passiflora herbertiana*	Native Passionfruit sp.
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Rubiaceae	*Morinda jasminoides*	Morinda
Sapindaceae	*Diploglottis australis*	Native Tamarind
Sapotaceae	*Planchonella australis*	Black Apple

Family	*Species*	**Common name**
Solanaceae	*Solanum aviculare*	Kangaroo Apple
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree
	D. photinophylla	Shining-leaved Stinging Tree
Viscaceae	*Notothixos cornifolius*	Kurrajong Mistletoe
Vitidaceae	*Cissus hypoglauca*	Five-leaf Water Vine

Native species in the blossom diet of Grey-headed flying foxes confirmed by observations of feeding animals. source: Eby and Law (2008).

Family	*Species*	**Common name**
Fabaceae	*Castanospermum australe*	Black bean
Proteaceae	*Banksia integrifolia v. int*	Coast Banksia
	B. serrata	Old Man Banksia
	Grevillea robusta	Silky Oak
Myrtaceae	*Angophora costata*	Sydney Red Gum
	A. floribunda	Rough-barked Apple
	A. leiocarpa	
	Corymbia citriodora	Lemon-scented Gum
	C. gummifera	Red Bloodwood
	C. henryi	Large-lved Spotted Gum
	C. intermedia	Pink Bloodwood
	C. tessellaris	Carbeen
	C. trachyphloia	Brown Bloodwood
	C. variegata	Northern Spotted Gum
	Eucalyptus acmenoides	White Mahogany
	E. albens	White Box
	E. amplifolia	Cabbage Gum
	E. andrewsii	New England Blackbutt
	E. bancrofti	Orange Gum
	E. camaldulensis	River Red Gum
	E. campanulata	New England Blackbutt
	E. cloeziana	Gympie Messmate
	E. fibrosa	Broad-leaved Ironbark
	E. grandis	Flooded Gum
	E. longirostrata	Grey Gum
	E. major	Grey Gum
	E. melanophloia	Silver-leaved Ironbark
	E. melliodora	Yellow Box
	E. moluccana	Grey Box
	E. pilularis	Blackbutt
	E. planchoniana	Needlebark
	E. propinqua	Small-fruited Grey Gum
	E. pyrocarpa	Large-fruited Blackbutt
	E. resinifera	Red Mahogany
	E. robusta	Swamp Mahogany
	E. saligna	Sydney Blue Gum
	E. seeana	Narrow-leaved Red Gum
	E. siderophloia Grey	Ironbark
	E. sideroxylon	Mugga Ironbark
	E. tereticornis	Forest Red Gum
	M. quinquenervia	Five-veined Paperbark
	Syncarpia glomulifera	Turpentine

Appendix B – Port Stephens Examiner Flying-fox with ABL

Deadly bat virus detected

By SARAH PRICE

Jan. 14, 2014, 6:09 p.m.

HIDDEN DANGER: Erin Southgate rescued an injured bat.

A GREY-headed fruit bat which was treated at the Raymond Terrace Veterinary Clinic last week but later died has tested positive to the deadly Australian Bat Lyssavirus (ABLV) - a condition described as "rabies' first cousin".

It is the second case in less than a year according to the clinic's owner, veterinarian Jeff Titmarsh.

Mr Titmarsh said it was important residents did not approach injured bats. A Department of Primary Industries spokesman said ABLV affected the nervous system of bats and was spread in the saliva, but he estimated only 1 per cent of bats in Australia were infected.

"Infection occurs when a virus in saliva enters the body through breaks in the skin such as bites and scratches," he said.

"Infection in people and horses is very rare but because of the serious consequences it is extremely important for people to avoid handling live or dead bats."

A WINC (Wildlife In Need of Care) carer who is also on Mr Titmarsh's staff, Erin Southgate, rescued the bat off a fence in Tomago on Monday, January 6.

It died in care later that night and was sent to be tested. The positive test results came back on Wednesday, January 8, and Mr Titmarsh said the state government's protocol to address risk was implemented. He estimated only three or four qualified professionals, who were all vaccinated, had come into contact with the animal and none had skin broken from bites or scratches.

"Every so often we deal with bats and there are a couple of nasty things that happen to bats - Lyssavirus is one of those," Mr Titmarsh said.

But Ms Southgate said a bat's chance of contracting Lyssavirus did not make them "disgusting" or "vermin". It just meant precautions, including being vaccinated and wearing protective gear, needed to be taken when approaching the sick animal.

Hunter New England Health said the ABLV virus was unlikely to survive outside the bat for more than a few hours and that contact with bat faeces, urine or blood did not pose a risk, nor did living, playing or walking near bat areas.

Mr Titmarsh described the neurological effects of the virus on the bat as more docile than aggressive but said under no circumstances should residents try to save an injured bat.

"Leave it to those people who are vaccinated and qualified," he said.

Anyone who comes across an injured bat in Port Stephens should contact WIRES on 1300 946 295, the Native Animal Trust Fund 0418 628 483 or their closest vet clinic.

Anyone who is concerned about their health after coming in contact with a bat should call the Public Health Unit on 1300 066 055 or the closest doctor.

Appendix C – List of plants found onsite (native and non-native)

List of plant species found at Newbury Park	
Tree Canopy Species (>6m)	
Alphitonia excelsa	Red Ash
Casuarina glauca	Swamp Oak +
Casuarina cunninghamiana	Casurina
Grevillea robusta	Silky Oak
Eucalyptus botryoides	Bangalay
Eucalyptus robusta	Swamp Mahogany
Eucalyptus saligna	Sydney Blue Gum
Melia azedarach	White Cedar
Melaleuca quinquenervia	Broad leaved Paperbark
Cupaniopsis anacardioides	Tuckeroo
Ficus rubiginosa	Fig
Melaleuca ericifolia	Swamp Paperbark +
Photinia fraseri	Red-tip Photinia
Salix sp.	Willow
Cinnamomum camphora	Camphor Laurel
Erythrina sp.	Coral Trees
Pinus elliottii	Slash Pine
Small Trees / Shrub Species (1.5-6m)	
Syzygium paniculatum	Magenta Lilly Pilly
Callistemon salignus	Sweet Willow Bottlebrush
Tilapariti tiliaceum	Cottonwood
Glochidion ferdinandi	Cheese Tree +
Homalanthus populifolius	Bleeding Heart
Ligustrum sinense	Small Leaf Privet
Ligustrum lucidum	Broad Leaf Privet
Musa sp.	Banana Trees
Nerium oleander)	Oleander
Solanum mauritianum	Tobacco Bush
Lantana camara	Lantana
Ricinus communis	Caster Oil
Pittosporum undulatum	Sweet Pittosporum
Olea europaea ssp. Cuspidate	African Olive
Cestrum parqui	Green Cestrum
Senna sp.	Senna
Eriobotrya japonica	Loquat
Dypsis lutescens	Golden Cane Palm
Rubus fruticosus	Blackberry
Acer negundo	Maple

Groundcover Species (0-1.5m) & Vines/Scramblers	
Herbs / Ferns	
Alternanthera denticulata	Lesser Joyweed
Blechnum indicum	Swamp Water-fern
Commelina cyanea	Commelina +
Hypolepis muelleri	Harsh Ground Fern
Persicaria decipiens	Slender Knotweed
Persicaria strigosa	Prickly Smartweed
Blechnum indicum	Swamp Water-fern
Calochlaena dubia	Soft Bracken
Pteridium esculentum	Common Bracken
Tradescantia fluminensis	Wandering Jew
Abutilon sp.	
Rudbeckia hirta	Black-eyed Susan
Tropaeolum majus	Nasturtium
Canna indica	Canna Lily
Sambucus nigra	Elderberry
Funaria hygrometrica	Water Moss
Parietaria judaica	Asthma Weed
Hedera helix	English Ivy
Typha orientalis	Broad Leaf Cumbungi
Cyperus difformis	Dirty Dora
Ambrosia sp.	Rag Weed
Ochna serrulata	Ochna
Rumex crispus	Curled Dock
Colocasia esculenta	Taro
Pellaea falcate	Sickle Fern
Doodia aspera	Prickly Rasp Fern
Funaria hygrometrica	Water Moss
Verbena bonariensis	Purpletop
Rushes / Grasses	
Crinum pedunculatum	Swamp Lily
Isolepis inundata	Swamp Club-sedge
Juncus kraussii subsp. Australiensis	Sea Rush +
Juncus planifolius	A Rush
Juncus usitatus	Common Rush
Lomandra longifolia	Ribbon Grass
Maundia triglochinoides	Water Ribbons
Phragmites australis	Common Reed +
Typha orientalis	Bulrush
Paspalum sp.	
Persicaria sp.	
Isolepis prolifera	Budding Club Rush
Cyperus papyrus	Papyrus
Vines	
Parsonsia straminea	Common Silkpod +
Lonicera japonica	Japanese Honesuckle
Anredera cordifolia	Maderia Vine

Key indicator species
weed species

Appendix D – Swamp Oak Floodplain Forest EEC species planting List

List of Tree species to be planted at Newbury Park Swamp Oak Floodplain Forest EEC	
Tree Canopy Species (>6m)	
Alphitonia excelsa	Red Ash
Casuarina glauca	Swamp Oak +
Cupaniopsis anacardioides	Tuckeroo
Melaleuca ericifolia	Swamp Paperbark +
Melaleuca quinquenervia	Broad leaved Paperbark
Melaleuca linariifolia	Flaxleaf Paperbark
Melaleuca styphelioides	Prickly-leaved Tea Tree
Small Trees / Shrub Species (1.5-6m)	
Acmena smithii	Lilly Pilly
Syzgium paniculatum	Magenta Lilly Pilly
Callistemon salignus	Sweet Willow Bottlebrush
Glochidion ferdinandi	Cheese Tree +
Homalanthus populifolius	Bleeding Heart
Leptospermum polygalifolium subsp. polygalifolium	Tantoon
Myoporum acuminatum	Boobialla
Groundcover Species (0-1.5m) & Vines/Scramblers	
Herbs / Ferns	
Alternanthera denticulata	Lesser Joyweed
Blechnum indicum	Swamp Water-fern
Centella asiatica	Indian Pennywort +
Commelina cyanea	Commelina +
Enydra fluctuans	An Enydra
Hypolepis muelleri	Harsh Ground Fern
Lobelia anceps	Angled Lobelia
Persicaria decipiens	Slender Knotweed
Persicaria strigosa	Prickly Smartweed
Viola banksii	A Violet
Rushes / Grasses	
Baumea juncea	Bare Twig Rush
Carex appressa	Tall Sedge +
Cynodon dactylon	Sand Couch +
Crinum pedunculatum	Swamp Lily
Dianella caerulea	Blue Flax Lily
Entolasia marginata	Bordered Panic
Gahnia clarkei	Tall Saw-sedge
Imperata cylindrica var. major	Blady Grass
Isolepis inundata	Swamp Club-sedge
Juncus kraussii subsp. Australiensis	Sea Rush +
Juncus planifolius	A Rush
Juncus usitatus	Common Rush
Lomandra longifolia	Ribbon Grass
Maundia triglochinoides	Water Ribbons
Oplismenus imbecillis	Basket Grass
Phragmites australis	Common Reed +

Vines	
Parsonsia straminea	Common Silkpod +
Stephania japonica var. discolor	Snake Vine
Flagellaria indica	Whip Vine

Key indicator species for EEC