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Planning Proposal at 300 Manchester Rd, Auburn - Ecological Impact Assessment

Dear Alex,

The purpose of this letter is to update an earlier (March 2016) assessment of potential impacts of a Planning Proposal at 300 Manchester Road, Auburn on threatened species, populations and ecological communities (TECs) listed under state and federal legislation, including the Grey-headed Flying-fox (*Pteropus poliocephalus*), Green and Golden Bell Frog (*Litoria aurea*) and River-flat Eucalypt Forest Endangered Ecological Community (EEC). This update has been prepared in order to address planning proposal submissions and in order to reflect a revised Planning Proposal. It has also been updated to include any species listed under state and federal legislation since the earlier (March 2016) Ecological Impact Assessment.

1. Background

Payce (the proponent) is proposing to rezone approximately 14 hectares (ha) of industrial land at 300 Manchester Road, Auburn, to permit mixed uses including residential and industrial. The land subject to the Planning Proposal has a total area of 14.12 ha and is legally described as Lot 11 DP 1166540 and Lot 12 DP 1166540 (hereafter referred to as the 'subject site').

1.1 Site Location and Context

The subject site is located within the suburb of Auburn and is positioned halfway between the Clyde and Auburn Railway Stations, approximately 1 km west of Auburn Town Centre within the Cumberland Council Local Government Area (LGA). The subject site fronts Manchester Road to the south (approximately 645 m), Manchester Road and Duck River to the west (approximately 560 m) and land owned by Rail Corporation NSW to the north and east (approximately 850 m).

Contextually, the subject site is situated on the edge of the Clyburn Industrial Precinct, which is characterised by industrial uses to the north and east (railway uses) and residential areas to the south and west (**Figure 1** of **Appendix A**).

Although the subject site falls within the Clyburn Industrial Precinct, it is largely cut-off from the Precinct due to the railway lines to the north.

1.2 Description of Environment

The subject site was formally part of the Clyde Marshalling Yards and continues to be used as an active industrial site. In the western half of the subject site, there exist several large warehouses, stockpiling yards and car parks. The eastern half of the subject site is remediated and vacant land.

The subject site has been entirely cleared of native vegetation and no remnant woodland or forest remains on the site. Low numbers of urban plantings are retained around buildings and in the eastern portion of the site, large bare areas have been established with exotic grasses, presumably for soil stabilisation.

The subject site is separated from the Duck River riparian corridor to the west by Manchester Road. Any plantings existing on the subject site are completely disconnected from any canopy vegetation in the Duck River corridor.

1.3 The Planning Proposal

The Planning Proposal will facilitate the urban development of the subject site and will provide for a number of commercial/retail and residential apartment buildings ranging between three to 12 storeys. The residential buildings will provide for approximately 1,800 apartments. Other features of the development may include:

- Community facilities, including a childcare centre;
- A neighbourhood centre;
- Dedicated public parks and pocket parks;
- Pedestrian and cycle links;
- Pedestrian, cycle and car bridge over Duck River;
- Underground carpark spaces for retail/commercial and community use; and
- External improvement works.

As part of the future development of the subject site, the proponent is also proposing to implement a restoration program addressing a section of the Duck River. Such restoration works will include revegetation and weeding, and are intended to improve the condition of the river banks and riparian vegetation for fauna habitat and stream health. It is likely that such

restoration efforts will complement restoration work being undertaken elsewhere along Duck River (e.g. Dragonfly Environmental, 2014).

The draft conceptual Master Plan that was provided in the original ecological assessment has been revised, and an updated Landscape Plan (see **Figure 2**) is provided in **Appendix A** to illustrate how the subject site may be developed. The current Landscape Plan is very similar to the previous plan, and key ecological components such as the bridge across the Duck River and the upgrade to the river are still being proposed. Key changes include increased employment zone and relocation of Central Park nearer to the river.

1.4 Environmental Planning Policies

State Environmental Planning Policy 19 Bushland in Urban Areas (SEPP 19) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) is relevant to the Planning Proposal as the proposed parks, pedestrian cycle links and bridge are located in urban bushland.

Under SEPP 19 bushland zoned or reserved for public open space purposes may not be disturbed without the consent of the council. However development consent for the disturbance of bushland may be provided for the purpose of facilitating recreational use of the bushland in accordance with a Plan of Management. Under Clause 6.4 of SEPP 19 a consent authority shall not consent to the carrying out of development unless:

- it has made an assessment of the need to protect and preserve the bushland having regard to the aims of the SEPP;
- it is satisfied that the disturbance of the bushland is essential for a purpose in the public interest and no reasonable alternative is available to the disturbance of that bushland; and;
- it is satisfied that the amount of bushland proposed to be disturbed is as little as possible and, where bushland is disturbed to allow construction work to be carried out, the bushland will be reinstated upon completion of that work as far as is possible.

For land which adjoins bushland zoned or reserved for public open space purposes the consent approval shall not grant the approval or development consent unless it has taken into account:

- the need to retain any bushland on the land,
- the effect of the proposed development on bushland zoned or reserved for public open space purposes and, in particular, on the erosion of soils, the siltation of streams and waterways and the spread of weeds and exotic plants within the bushland, and
- any other matters which, in the opinion of the approving or consent authority, are relevant to the protection and preservation of bushland zoned or reserved for public open space purposes.

It is likely that the Planning Proposal would meet the requirements of SEPP 19. However Cumberland Council are required to specifically assess whether the Planning Proposal addresses these requirements. Note that Cumberland Council may consider it necessary for a Plan of Management to be prepared consistent with the aims and requirements of Section 8 of SEPP 19.

2. Scope of Assessment

At the commencement of the ecological study, the former Auburn City Council noted that several native vegetation communities listed as TECs under the NSW *Threatened Species Conservation Act 1995* (TSC Act) are known to be present in the riparian corridor of Duck River. Council also noted that a Grey-headed Flying-fox colony is known to occur along the upper Duck River, to the immediate south of the railway pedestrian bridge and railway line. Grey-headed Flying-fox is a Vulnerable species listed under the NSW TSC Act and also under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Due to the proximity of the TECs and the Grey-headed Flying-fox colony, Council requested that Assessments of Significance prepared in accordance with Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) are provided with the Planning Proposal to assess the potential impacts on these matters from future residential development of the subject site. Council also indicated that the impacts of Grey-headed Flying-fox on the amenity of future residents should be discussed and mitigation measures proposed to minimise potential resident/colony conflicts.

A review of flora and fauna records within a 10 km radius of the subject site (i.e. the 'locality') was undertaken. Threatened species records were obtained from the Atlas of NSW Wildlife database, which is administered by the NSW Office of Environment and Heritage (OEH, 2015a). A list of nationally protected species predicted to occur within the locality was generated using the Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Search Tool (DoE, 2016a). Updated searches of both databases were undertaken on 22 September 2017 in order to identify any additional species that may have been listed since the earlier searches were undertaken. These records and species predictions were also duly considered and their likelihood of occurrence on the subject site assessed.

The Planning Proposal was on exhibition from 3 November 2015 to 30 November 2015. During this time, a number of submissions were provided in relation to the potential ecological impacts of the Planning Proposal on additional threatened species.

Based on comments from Council and other stakeholders, and on the results from the database assessment, the Ecological Assessment has been updated and the following entities are covered within the scope of this ecological assessment:

- Grey-headed Flying-fox;
- Green and Golden Bell Frog (*Litoria aurea*);
- Tadgell's Bluebell (*Wahlenbergia multicaulis*);

- Migratory wading (i.e. wetland) birds (listed under Section 209 of the *Environment Protection and Biodiversity Assessment Act 1999*, or EPBC Act); and
- Threatened ecological communities.

The assessment of each of the above is provided in the remainder of this letter. A table outlining how submissions from Council, the community and OEH have been addressed in this letter is provided in **Appendix D**.

3. Assessment of Grey-headed Flying-fox

3.1 Status

Grey-headed Flying-fox is listed as Vulnerable under both the TSC Act and the EPBC Act.

Grey-headed Flying-fox has a natural distribution all along the east coast of Australia (OEH, 2015d) and is considered to be one single interbreeding population that is spatially structured as colonies (DoE, 2015). Within the Sydney area, Grey-headed Flying-fox colonies reside in large camps at a number of urban sites, including Cabramatta Creek Flying-fox Reserve near the Sunnybrook Hotel (now the Holiday Inn), Botanic Gardens in Sydney, Parramatta River, Wolli Creek and Duck River near Clyde Railway Station.

Although the abundance of Grey-headed Flying-fox appears to have increased in metropolitan areas within the last two decades (DECCW, 2009), there is evidence that the overall population is generally in decline (DECCW, 2009).

3.2 Description

Grey-headed Flying-fox is a large fruit bat and is generally considered to be one of the largest bats in the world (DECCW, 2009). The species has a rusty reddish collar, grey head and hairy legs. The leg fur extends to the ankle and distinguishes the species from the Black Flying-fox (*Pteropus alecto*), which is also similar in size (DECCW, 2009).

3.3 Preferred Habitat and General Ecology

The distribution of Grey-headed Flying-fox is very much resource driven. Grey-headed Flying-fox relies primarily on trees and shrubs from the Myrtaceae family; these plants (such as eucalypt trees) have a well defined flowering season but will not always flower reliably every year. Grey-headed Flying-fox appears to respond to ephemeral and patchy foraging resources by being highly mobile, adopting seasonal or annual patterns of migration that are apparent on a regional scale (DoE, 2015). On a local scale, colonies will also often move from camp to camp over time in an irregular fashion in response to variation in resource availability. For this reason, Grey-headed Flying-fox requires many areas of productive foraging habitats that are well connected by migration corridors or stopover habitats, and suitable roosting habitat within nightly commuting distance of foraging areas (approximately 50 km) (DECCW, 2009).

Camp sites are very important to the life cycle of a Grey-headed Flying-fox colony (DECCW, 2009; Dragonfly Environmental, 2014). Camp sites are used (DECCW, 2009; OEH, 2015d):

- As resting points during migration;
- As refugia during important phases of the annual life cycle such as mating, birth and lactation; and
- For social interactions and communications between individuals.

Camp sites generally contain vegetated habitat that is productive during the final weeks of gestation and during the weeks of birth, lactation and conception (September to May) (DECCW, 2009). The presence of foraging habitat around a Grey-headed Flying-fox camp site is also critical to sustaining a colony and so camp sites are typically located within 20-50 km of foraging habitat.

Camps are also typically fluid and will fluctuate in size. Whilst some camps are infrequently used, others may be regularly occupied during certain months of the year (Eby and Lunney, 2002; DECCW, 2009; Eby, 2012; DoE, 2015). Nevertheless, Grey-headed Flying-fox displays strong site fidelity and will often return to a camp over time (SEQ Catchments, 2010; Roberts *et al.*, 2011).

3.4 Known Occurrence within Locality: the Duck River (Clyde) Camp

The Grey-headed Flying-fox camp at Duck River near Clyde Railway Station is known to be a maternal colony that occupies an area of riparian habitat of approximately 0.26 ha to 0.8 ha (van der Ree and North, 2009). The camp site is currently surrounded by industrial, residential and commercial land uses and is approximately 225 m away from the north-western corner of the subject site; the majority of the subject site is located more than 225 m from the camp site (**Figure 3**). The colony has been recorded at this location since at least the mid-1800s (Dragonfly Environmental, 2014) but is not present every year. When present, the colony occupies both sides of Duck River.

Whilst the Duck River camp is considered to be significant, being a maternal camp and one of a small number of permanent camps that remain in the Sydney metropolitan area (Dragonfly Environmental, 2014), the camp is not considered to be nationally important. Nationally important Grey-headed Flying-fox camps are defined as those with a population size ≥ 10,000 in more than one year within the last 10 years, or have been occupied by more than 2,500 flying-foxes permanently or seasonally every year for the last 10 years (DoE, 2014). Although a permanent camp site, the Duck River colony is transitory in nature and occupies the camp site infrequently and irregularly.

The Duck River camp appears to be occupied in late spring and summer months, a time when young are typically born and raised at camp (SEQ Catchments, 2010). The camp is reported to have been occupied in 2000-2001 and was empty when the entire colony left in late 2007, possibly as a response to construction works commencing on the adjacent Railcorp land (van der Ree and North, 2009). The camp was repopulated in 2008-2009 over the summer period and was vacated again in April-May 2012 (Armistead, 2012). The camp was subsequently occupied between December 2013 and April 2014; population numbers recorded at that time varied between approximately 2,500-3,500 animals (Dragonfly Environmental, 2014). Based on

data held by OEH, the camp was occupied in the summer of 2014-2015. The camp has accommodated a population size of 8,000-10,000 at its peak but broadly averages 600-2,000 individuals when it is occupied (van der Ree and North, 2009).

The Duck River camp experiences noise disturbances from trains, trucks and industrial processes, which has not negatively affected the camp during its previous occupancies (Dragonfly Environmental, 2014). The camp site is also close to a foot bridge that experiences a reasonable level of pedestrian traffic. This does not appear to have negatively affected the camp in previous years. The noise effects from residential land use to the west (approximately 190 m away from the camp site) appear to be insignificant.

It is generally acknowledged that Grey-headed Flying-fox camps within urban matrices has been problematic, with damage of property and gardens, noise and smell cited as major concerns (e.g. Abitol, 2011; Zielinski, 2012; Barlass, 2013; East Gippsland Shire Council, 2013; Thompson, 2014a). These problems arise particularly where camps are located in very close proximity to residents. Currently, the surrounding industrial land, in combination with the irregular occupation of the camp, appears to be mitigating any human/bat conflicts (Dragonfly Environmental, 2014) and there does not appear to be problems with the residential land to the south and the west.

Observations within a 10 km radius of the Duck River camp over the 2013-2014 season indicated that there is no dominant fly-out direction (Dragonfly Environmental, 2014). Generally, the direction of dispersal at dusk for the species is strongly influenced by the location of abundant foraging resources, which can vary from year to year (van der Ree and North, 2009). On a very local scale, the flying-foxes are likely to use a fly-out path of "least resistance" immediately after take-off (Armistead, 2012), which is currently likely to be in the southerly direction from the camp along the river corridor.

3.5 Survey Methods

A desktop assessment was undertaken of the subject site and included a review of current aerial photography, regional vegetation mapping data, various reports relating to the Duck River reserve and studies of nearby sites.

The subject site was visited by two ecologists on 15 May 2015 to verify desktop information and to inspect the Duck River camp. The site visit involved a walk around the perimeter of the subject site and a visual inspection through the fence. Visual access from the site perimeter was adequate due to the flat topography and highly cleared nature of the site. A walk along the eastern bank of Duck River was also undertaken from the railway pedestrian bridge traversing south to Manchester Street to inspect the vegetation along the river. The camp site was inspected in order to assess:

- The location of the camp in relation to the subject site;
- The extent of the camp; and
- Fly-out patterns from the camp.

The survey was conducted between 1600 and 1800 hrs.

Additional targeted surveys of Grey-headed Flying-fox were undertaken by two ecologists on 28 and 29 January 2016; and 4 and 5 February 2016. These dates are well within the known breeding season for Grey-headed Flying-fox (DECCW, 2009; Dragonfly Environmental, 2014).

Evening surveys were undertaken just before dusk to monitor for bat activity and to listen for calls. The site of the known camp was inspected from the bridge at the rail line and also from various points along Manchester Road, using binoculars to observe the tree line for flying bats and/or movements in the canopy. Other indicators of bat activity were also targeted, including bat smells and evidence of recent tree defoliation.

3.6 Survey Findings

The Duck River camp was unoccupied when the subject site was visited in May 2015. When the subject site was revisited in late January and early February 2016, no Grey-headed Flying-fox or evidence of Grey-headed Flying-fox activity was observed at the known camp site. No Grey-headed Flying-fox or evidence of Grey-headed Flying-fox activity was observed in the immediate upstream sections of the Duck River. Fly-out patterns could not be observed and assessed further.

During the survey, the general condition of the camp site was noted to be very poor, with native riparian vegetation over-run by riparian weeds and weedy trees. The presence of Australian White Ibis (*Threskiornis molucca*) was also noted during survey; this species is known to directly compete with Grey-headed Flying-fox for roosting and nesting habitat (DECC, 2008; Thompson, 2014b).

Nevertheless, the current location of the Duck River camp meets favourable conditions for refuge, socialising and breeding. Although weedy, the vegetation structure contains exposed roosting spots and is multi-layered, providing a range of micro-climates that buffer the colony from extreme weather conditions (Dragonfly Environmental, 2014). Evidence of regular camp use was noted in the form of defoliated trees and broken branches at the time of survey. It is highly likely that the camp will be occupied again by Grey-headed Flying-fox in the future.

3.7 Impact Assessment

i. Known Threats to Grey-headed Flying-fox

The primary threat to a colony of Grey-headed Flying-foxes is acknowledged to be habitat loss at the camp site and loss of surrounding foraging habitat (DECCW, 2009). Other factors that can disrupt camps and result in temporary dispersal from a camp site include visual and acoustic stimuli such as construction noise and high foot traffic in the immediate vicinity of the camp (van der Ree and North, 2009; Roberts *et al.*, 2011). Prolonged disruption of a camp leading to longer term dispersal from the camp site may have adverse impacts on the health of individuals and may lead to longer term effects such as decline in reproductive success, or decline in foraging resources in the locality due to disruption of the species' pollinator function (Hall and Richards, 2000; Dragonfly Environmental, 2014; OEH, 2015b).

Despite the above, it is commonly known that Grey-headed Flying-fox exhibits strong site fidelity and can be very resistant to camp displacement (SEQ Catchments, 2010; Roberts *et al.*, 2011). The Grey-headed Flying-fox relocation programs implemented to date (including the relocation at the Royal Botanic Gardens in Sydney and Melbourne) have been highly controversial, lack long term data and require consistent management to continually discourage re-establishment (Jones, 2012; Gupta, 2014; Johnson, 2014). Thus, the success of permanent displacement is still debatable. For this reason, the main disruption to a colony is likely to be habitat loss at the camp site.

ii. Loss of Foraging and Roosting Habitat

The Planning Proposal will not directly destroy roosting habitat at the camp site and will not destroy foraging habitat within the vicinity of the camp site. The Planning Proposal is therefore unlikely to have an adverse effect on the life cycle of the species such that a viable population is likely to be placed at risk.

iii. Noise Impacts

The Planning Proposal is unlikely to lead to significant increases in noise levels that will adversely impact the colony. As aforementioned, the Duck River camp currently experiences considerable noise disturbances from trains, trucks and industrial processes, which has not negatively affected the camp during its previous occupancies (Dragonfly Environmental, 2014). In addition to this, considering that the residential land to the west of the camp site is more proximate to the camp site compared with the subject site (approximately 190 m vs. approximately 225 m, with the majority of the subject site located at a distance of more than 225 m from the camp site) and that the noise effects from such residential land use appear to be insignificant, it is unlikely that the future residential use of the subject site will have adverse noise impacts on the colony during periods when the camp is occupied.

Construction noise during the future development of the subject site can be timed as required to avoid critical birthing and pup-rearing phases of the Grey-headed Flying-fox life cycle and is expected to be manageable.

iv. Impacts on Fly-out Patterns

The future development of residential apartments on the subject site is set back from the camp site by a minimum of 225 m and is also unlikely to interrupt the Duck River corridor. It is therefore likely that the current fly-out paths will remain available to the colony. As flight paths are known to vary seasonally and with changes in food abundance, it is unlikely that the future development of the subject site will significantly impact the fly-out patterns of the species.

v. Exacerbation of Australian White Ibis Population

The Planning Proposal is unlikely to significantly increase the population of Australian White Ibis currently present within the Duck River habitat. Current measures to manage Australian White Ibis are included in the Duck River Grey-headed Flying-fox Camp Management Plan (Dragonfly Environmental, 2014).

vi. Exacerbation of Weed Impacts on Habitat

The future development of the subject site may have potential to increase the current weed impacts on the riparian corridor and thus further degrade foraging habitat within 20 km of the camp site if surface run-off and other offsite impacts on the catchment are not managed. The future development of the subject site is likely to involve detailed erosion, surface water and sewerage management plans and it is expected that the risks will be manageable. Furthermore, the proponent is proposing to undertake restoration activities along Duck River, which will also mitigate the potential impacts on riparian vegetation and improve foraging habitat for the species.

vii. Conflicts with Future Residents

The risk of potential conflicts with future residents are considered to be low based on knowledge of current levels of interactions with the existing residents to the west and to the south. Potential impacts on residents from noise, odour and faecal droppings are considered to be manageable and can be minimised through the detailed design phase of the development of the subject site by implementing well-considered building designs. Some recommendations are provided at the end of this report in **Section 8**.

A formal Assessment of Significance is provided in **Appendix B**. As the Grey-headed Flying-fox is a nationally listed Vulnerable species, assessment against the EPBC Act significant impact guidelines for Vulnerable species is also provided. These assessments indicate that no significant impact is predicted to occur to the Grey-headed Flying-fox as a result of the proposal.

4. Assessment of Green and Golden Bell Frog

4.1 Status

Green and Golden Bell Frog is listed as Vulnerable under the EPBC Act and Endangered under the *Threatened Species Conservation Act 1995* (TSC Act).

Green and Golden Bell Frog was once a commonly encountered species across eastern Australia, including the Sydney region. It is a species that has undergone a significant decline in numbers and distribution, primarily due to predation by Mosquito Fish (*Gambusia holbrooki*) and amphibian chytridiomycosis, a disease caused by chytrid fungus (DEC, 2005).

Today, the species can still be found in various small pockets of semi-natural and artificial habitat within developed areas and has a tendency to occur in highly disturbed sites (such old industrial sites and quarry areas). The species is known to occur at places such as Homebush Bay, which is near the locality of the proposed development. For this reason, this species needed to be considered in relation to the Planning Proposal and is assessed in detail in the following sections.

4.2 Description

Green and Golden Bell Frog is a relatively large, stout frog, ranging in size from approximately 45 mm to approximately 100 mm snout to vent length. Distinguishable features of this species are a gold or creamish white stripe running along the side, extending from the upper eyelids almost to the groin, with a narrow dark brown stripe beneath it, from nostril to eye. The species also has blue or bluish-green colour on the inside of the thighs. The colour of the body varies but is usually a vivid pea-green, splotched with an almost metallic brassy brown or gold. The backs of some individuals may be almost entirely green; in others golden-brown markings may dominate. The hind toes are almost fully webbed but the fingers of the front feet lack webbing. Green and Golden Bell Frog also has a distinct tympanum (DoE, 2009b; OEH, 2015c).

4.3 Preferred Habitat and General Ecology

Green and Golden Bell Frog requires various habitat types for foraging, breeding, over-wintering and dispersal. The species will also use different habitats or habitat components depending on seasonality. Ideal habitats will comprise one or more water bodies surrounded by grassy areas with low vegetation (no higher than woodland vegetation) for daytime sheltering (DoE, 2009b; OEH, 2015c).

Water bodies used by Green and Golden Bell Frog include marshes, farm dams, stream-sides (e.g. creek lines and irrigation channels), particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water bodies that are unshaded and free of predatory fish such as Mosquito Fish. For this reason, ephemeral water bodies are important habitat for the species, especially since their flooding can trigger breeding or provide 'stepping stone' habitat for dispersal between periodically disconnected water bodies. The species can occur in disturbed areas, provided that these habitat components are available and unaffected by Mosquito Fish or chytrid fungus (DoE, 2009b; OEH, 2015c).

The species is generally active by day and usually breeds in summer when conditions are warm and wet (OEH, 2015c). The species has a distinctive call that is readily detected; males are generally heard calling between September and January although frogs will take advantage of favourable conditions outside these times and be heard calling (NPWS NSW, 2003).

4.4 Known Occurrence within Locality

The former distribution of Green and Golden Bell Frog ranged from the NSW north coast near Brunswick Heads southwards along the NSW coast to Victoria, where it extended into East Gippsland and west to Bathurst, Tumut and the ACT. In the 1960s, the species was considered widespread, abundant and commonly encountered. Today, the species exists as a series of isolated populations within its former range and include the metropolitan areas of Sydney, Shoalhaven and mid north coast (DECC, 2007; OEH, 2015c).

Within the Parramatta area, three key populations have been identified as (DECC, 2007):

- Homebush Bay key population - taking in the Sydney Olympic Parklands area;
- Clyde/Rosehill key population - taking in the Camellia peninsula; and

- Merrylands key population - taking in the Holroyd Gardens and Walpole Street Park along A' Becketts Creek at Holroyd.

The subject site is located to the south east and south west of the Merrylands and Clyde/Rosehill key populations respectively although it does not overlap with the extents of any of the identified key populations (see **Diagram 1**).

The Altas of NSW Wildlife (OEH, 2015a) holds records of threatened species from several NSW government agency sources, including the National Parks and Wildlife Service NSW (NPWS NSW), Forest NSW, Royal Botanic Gardens and Domain Trust and Australian Museum.

Based on database information, records within the locality of the subject site (i.e. within 10 km of the subject site as measured from the subject site boundary) date back to 1965. Of these there are no records for Green and Golden Bell Frog within the subject site or within the immediate vicinity of the subject site. The closest records to the subject site were made in 1966. All Green and Golden Bell Frog records submitted within the last five years (2011-2015) in the locality are located within the Homebush Bay key population (OEH, 2015a).

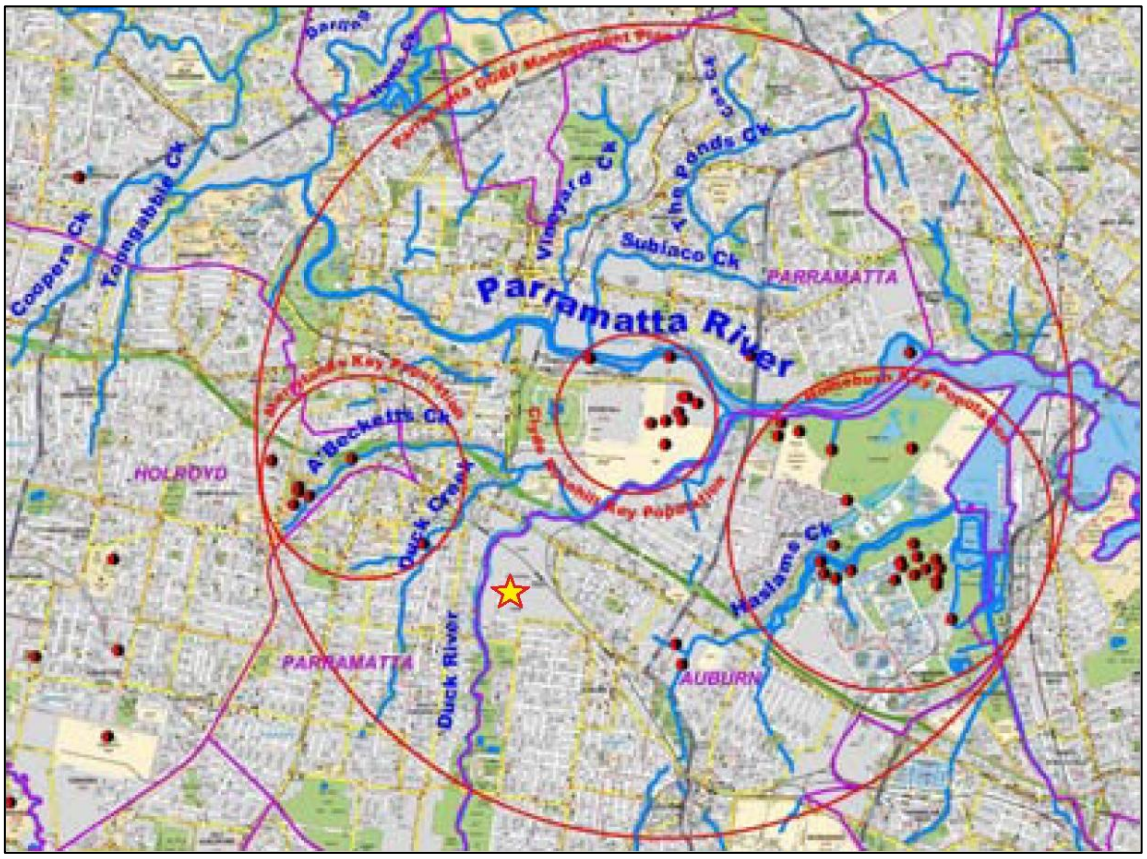

Diagram 1 **Map of Parramatta area indicating the extent of the three key Green and Golden Bell Frog populations (red circles) in relation to the subject site as marked by the star (from DECC, 2007)**

4.5 Survey Methods

Targeted surveys of Green and Golden Bell Frog were undertaken by two ecologists on 28 and 29 January 2016; and 4 and 5 February 2016.

A diurnal inspection was undertaken of the subject site and adjacent Duck River to identify suitable frog habitat, with a particular focus on the in-stream and fringing vegetation associated with Duck River. Features targeted include: in-stream vegetation such as *Typha* spp. that are not overshadowed by tall woody vegetation; areas of grassy tussocks where animals can forage and shelter; groundcover debris such as rocks and timber; areas of standing water, including detention basins, drains or any scrapes and depression where water pools.

Evening spotlighting surveys were undertaken for an hour from dusk to monitor for frog activity and to listen for calls. The prevailing weather conditions during survey were considered to be suitable for detection of frogs, being clear and warm following preceding days of rainfall (BOM, 2016).

4.6 Survey Findings

The Green and Golden Bell Frog was not detected during the recent surveys of the subject site and the adjacent section of the Duck River corridor. None are considered likely to occur.

At the time of survey, the vacant eastern half of the subject site contained areas of standing water that pooled after recent rains (**Photograph 1**, **Appendix C**). These areas of water are unlikely to contain Mosquito Fish due to their ephemeral nature and so could potentially provide habitat for Green and Golden Bell Frog. The species could also potentially forage in the grassland habitat surrounding the pools of water but there were no tussock-forming grass species observed that could be used by the frogs to hide from predators. No other suitable sheltering or breeding habitat was recorded in this half of the subject site.

Striped Marsh Frog (*Limnodynastes peronii*) was recorded in one pool of water in the vacant lot. It is a hardy species that, unlike Green and Golden Bell Frog, is not readily susceptible to chytrid fungus. For this reason, Striped Marsh Frog is one of the most common frog species of the eastern coast of Australia and is well-adapted to urban environments. Its nocturnal habit also makes it less vulnerable than Green and Golden Bell Frog, which is active during the day.

A flock of Australian White Ibis (*Threskiornis moluccus*) was recorded during the surveys foraging in the grass within the vacant lot (**Photograph 2**, **Appendix C**). Australian White Ibis has a highly varied diet and will eat fish, crustaceans, frogs, snails, dragonfly larvae, small snakes, insects such as grasshoppers and beetles and worms. The presence of Australian White Ibis could inhibit the use of the vacant lot by Green and Golden Bell Frog.

Although Green and Golden Bell Frog was not detected, the riparian and aquatic habitat associated with Duck River provides some suitable habitat for Green and Golden Bell Frog in the downstream reaches where the water is not overhung by woody vegetation (**Photograph 3**, **Appendix C**). The upstream reach adjacent to the site is more shaded and thus less suitable to Green and Golden Bell Frog, despite the presence of fringing and in-stream vegetation.

Although no fish surveys were undertaken, it is highly likely that Mosquito Fish is present in the Duck River system, thus reducing the suitability of the available habitat observed. A population of Australian White Ibis is also present in the Duck River corridor.

The industrial areas of the subject site do not support foraging or breeding habitat, as it contains little to no woody vegetation or grassland areas (**Photograph 4**, **Appendix C**) and hence is highly unlikely to support Green and Golden Bell Frog. The industrial areas of the subject site are separated from the riparian corridor by a road. The extent of riparian vegetation along the adjacent section of Duck River to the west terminates at the roadside and thus there is no vegetated movement corridor from the river to the subject site. There is also a walled barrier separating the industrial section of the subject site from the vacant lot in the eastern portion of the subject site (**Photograph 5**, **Appendix C**). If Green and Golden Bell Frog was present, the industrialised western half of the subject site would most likely inhibit the movement of the frogs from the river in the west to the vacant grassland lot to the east.

Due to the condition of the available habitats and the lack of connectivity between the subject site and river system, the overall habitat is considered to be generally unsuitable for Green and Golden Bell Frog and it is considered that there is a low likelihood that a population of Green and Golden Bell Frog is present on the subject site.

4.7 Impact Assessment

On a precautionary basis, an Assessment of Significance has been prepared for Green and Golden Bell Frog in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The potential impacts of future urban development of the subject site on Green and Golden Bell Frog is also evaluated against the EPBC Act significant impact guidelines for Green and Golden Bell Frog (DoE, 2009a).

These assessments are provided in **Appendix B** and indicate that the Planning Proposal is unlikely to cause a significant impact on Green and Golden Bell Frog.

5. Assessment of Tadgell's Bluebell (*Wahlenbergia multicaulis*)

5.1 Status

The Tadgell's Bluebell population in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield is listed as Endangered under the TSC Act. Tadgell's Bluebell populations are not listed under the EPBC Act.

5.2 Description

Tadgell's Bluebell (*Wahlenbergia multicaulis*) is a small, perennial, tufted herb. It is typically few-stemmed and grows to approximately 10 - 75 cm high. The plant is hairless or sometimes has few hairs. The leaves are mostly long and thin with smooth edges or with small serrations. The flowers are blue, with the petals 2 - 10 mm long and forming a tube, with a corolla. The styles are deeply constricted less than a third of the way down (OEH, 2012).

5.3 Preferred Habitat and General Ecology

Tadgell's Bluebell can be found in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and along the edges of watercourses and wetlands. The species is known to occur in damp, disturbed sites (with natural or human disturbance of various forms) among other herbs, rather than in the open. It usually flowers throughout the year, although a late spring/early summer peak has been observed at some locations.

Tadgell's Bluebell is typically a perennial species, particularly in protected situations which provide greater protection during the summer months. However, in more exposed situations, the species may be more annual in its life cycle due to exposure and/or lack of soil moisture.

The species responds favourably to disturbance of soil in some situations with high exposure to sunlight. However, too much disturbance can eventually exhaust the seedbank and lead to local extinctions (OEH, 2012).

5.4 Known Occurrence within Locality

There are 13 sites where Tadgell's Bluebell is known to occur, two of which are in northern Sydney (Thornleigh and Mt Ku-Ring-Gai) with the remainder in western Sydney (Rookwood, Chullora, Bass Hill, Bankstown, Georges Hall, Campsie, South Granville and Greenacre).

Within the locality of the subject site, there are approximately 70 records dating from 1990; one recorded occurrence was noted in 1953. Almost all of the records are from or closely adjacent to Rookwood Cemetery, with outliers in Bass Hill, Bankstown and Punchbowl. Based on atlas data obtained from the Office of Environment and Heritage (OEH) atlas database, there are no records within the vicinity of the subject site (OEH, 2015a).

It is noted from the OEH submission that individuals of the endangered population of Tadgell's Bluebell have been recorded in the vicinity of the proposal, along Duck River near the Australia Post Mail Centre (on the western side of Duck River).

5.5 Survey Methods

Targeted surveys of Tadgell's Bluebell were undertaken by two ecologists on 28 and 29 January 2016; and 4 and 5 February 2016.

A detailed inspection on foot was undertaken of the subject site to identify potential areas of habitat and to search for the occurrence of the species. The vacant lot in the eastern portion of the subject site was a particular focus due to the presence of large areas of grassland.

The section of riparian vegetation on the eastern bank of Duck River running adjacent to the subject site was inspected during the site visit.

5.6 Survey Findings

The species was not detected during the surveys of the subject site. Given the disturbed, highly altered nature of the subject site, the species is considered highly unlikely to occur.

A high proportion of the subject site is built up with hard surfaces and has no habitat for native plants. In other areas, much of the subject site has recently been remediated and is covered by exotic grassland in which no native plants were detected (**Photograph 6**, **Appendix C**).

Common and abundant plant species recorded on the subject site include but are not limited to the species listed in the following table. These species represent exotic grasses and weedy forbs that spread prolifically and can aggressively exclude other small herb species, including Tadgell's Bluebell.

Table 1 Weeds recorded in the riparian understorey along Duck River

Species	Latin Name
African Lovegrass	*Eragrostis curvula*
Barnyard Grass	*Echinochloa* spp.
Carpet Grass	*Axonopus affinis*
Cobbler's Pegs	*Bidens pilosa*
Common Couch	*Cynodon dactylon*
Fennel	*Foeniculum vulgare*
Fleabane	*Conyza bonariensis*
Kikuyu	*Pennisetum clandestinum*
Moth Vine	*Araujia sericifera*
Paspalum	*Paspalum dilatatum*
Purpletop	*Verbena bonariensis*
Rhodes Grass	*Chloris gayana*
White Clover	*Trifolium repens*

The riparian vegetation along Duck River is dominated by Forest Red Gum (*Eucalyptus tereticornis*) and Swamp Oak (*Casuarina glauca*). The understorey is almost completely dominated by problematic riparian weed species including Balloon Vine (*Cardiospermum grandiflorum*), Cobbler's Pegs, Morning Glory (*Ipomoea indica*) and Fleabane. The occurrence of small native herbs and forbs in the riparian understorey was low to absent.

Although Tadgell's Bluebell is known to occur in damp and disturbed sites among other herbs, the high degree of weed cover indicates that Tadgell's Bluebell is not likely to be present along the section of riparian vegetation adjacent to the subject site (**Photograph 7**, **Appendix C**).

5.7 Impact Assessment

No significant impact is considered likely to Tadgell's Bluebell.

With regards to occurrences of Tadgell's Bluebell on the western side of Duck River, the development of the subject site is unlikely to have a direct impact on the riparian corridor or any occurrences within it. Assuming overstorey, midstorey and groundcover vegetation is similar to the eastern bank; the current shading due to such vegetation would be expected to be quite high and thus would not be exacerbated by the presence of future buildings within the subject site. Notwithstanding, the mid-winter shadow studies undertaken for the Planning Proposal (refer to Appendix A of the Response to Submission documentation) illustrate that there is minimal overshadowing along the Duck River Corridor prior to 9:00am and no overshadowing after 9:00am.

6. Assessment of Migratory Wetland Bird Species

6.1 Status

A range of migratory wetland bird species occur in Sydney that are listed under the EPBC Act, comprising:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and
- Native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

6.2 Survey Methods

A list of potential migratory species that are predicted to occur in the locality based on habitat was obtained using the Department of the Environment Protected Matters Search Tool (DoE, 2016a).

Surveys of the subject site were undertaken by two ecologists on 28 and 29 January 2016; and 4 and 5 February 2016. Any wetland birds observed or heard calling were recorded. The value of any wetland habitat on the subject site was assessed and included consideration of habitat features such as fringing vegetation, frequency and amount of inundation, availability of exposed muddy flats or bare earth, and presence of water plants.

Results are discussed below.

6.3 Results

The grassed remediated portion of the subject site contained pools of water from recent rains at the time of the survey and Australian White Ibis were observed feeding in this area. However, no other bird species were detected.

The majority of the migratory wetland birds predicted to occur in the locality are coastal species that utilise estuarine, intertidal or coastal habitats such as inlets, bays, harbours, estuaries and coastal lagoons. These habitats are not present within the vicinity of the subject site. The remainder of the predicted migratory birds require reasonably significant (but not neccesarily large) wetland habitat, either ephemeral or permanent, often with fringing wetland vegetation and/or surrounding bare, wet muddy flats. These habitats include creeks and shallow dams, ephemeral drainages, swamps and flooded grasslands and are typically wet sites with very slow drainage, such that even during dry periods, the vegetation is characterised by wetland plants such as algae, sedges, rushes and water plants.

A high proportion of the subject site is built up with infrastructure or hard surfaces and has no habitat for migratory wetland birds.

In the remediated area of the subject site, much of the land is covered by low, exotic grassland. The grassland vegetation could provide foraging habitat for migratory wetland birds; however, it is noted that some species, such as Cattle Egret (*Ardea ibis*), prefer moist, low-lying poorly drained pastures with an abundance of high grass and will avoid low grass pastures. It was also noted that only the western-most areas of the remediated lot was sufficiently low-lying so as to contain pooled water. The eastern-most part of the remediated lot was dry.

The rainwater pools in the remediated area of the subject site are ephemeral and would have come into existence recently. These pools of water do not represent significant wetland habitat as they are small, lack aquatic or fringing vegetation (which will typically persist between rain events in more substantial ephemeral drainages and wetlands) and are likely to dry out reasonably quickly.

A table outlining the habitat requirements of the migratory wetland bird species predicted to occur in the locality is provided in the following table.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Actitis hypoleuca	Common Sandpiper	The Common Sandpiper utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks.
Ardea alba (syn. *Ardea modesta)*	Great Egret, White Egret, Eastern Great Egret	The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. Eastern Great Egrets exhibit a diverse array of complex foraging behaviours. In simple terms, they mostly forage by wading through shallow to moderately deep water, by standing in water and capturing prey that wanders nearby, or by walking over shore or dry ground. They typically secure their prey by abruptly 'stabbing', or by probing or pecking, with the bill. Prey is taken from water and vegetation but not from sediments.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Ardea ibis	Cattle Egret	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora.
Arenaria interpres	Ruddy Turnstone	Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral. It has occasionally been sighted in estuaries, harbours, bays and coastal lagoons, among low saltmarsh or on exposed beds of seagrass, around sewage ponds and on mudflats.
Calidris acuminata	Sharp-tailed Sandpiper	Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. They may be attracted to mats of algae and water weed either floating or washed up around terrestrial wetlands, and coastal areas with much beachcast seaweed.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Calidris canutus	Red Knot, Knot	Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps.
Calidris ferruginea	Curlew Sandpiper	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwater.
Calidris melanotos	Pectoral Sandpiper	The Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Calidris ruficollis	Red-necked Stint	The Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They sometimes use flooded paddocks or damp grasslands. They have occasionally been recorded on dry gibber plains, with little or no perennial vegetation. The Red-necked Stint mostly forages on bare wet mud on intertidal mudflats or sandflats, or in very shallow water; mostly in areas with a film of surface water and mostly close to edge of water.
Calidris tenuirostris	Great Knot	The species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Great Knot rarely occurs on inland lakes and swamps.
Charadrius bicinctus	Double-banded Plover	The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks.
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	The species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Charadrius mongolus	Lesser Sand Plover, Mongolian Plover	This species usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves.
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	The Latham's Snipe usually inhabits open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies).
Gallinago megala	Swinhoe's Snipe	The Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams. The species is also known to occur in grasslands, drier cultivated areas (including crops of rapeseed and wheat) and market gardens.
Gallinago stenura	Pin-tailed Snipe	The Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species is also found in drier, more open wetlands such as claypans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands
Heteroscelus brevipes	Grey-tailed Tattler	The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Limosa lapponica	Bar-tailed Godwit	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips.
Limosa limosa	Black-tailed Godwit	The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. The use of habitat often depends on the stage of the tide. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, saltflats, river pools, swamps, lagoons and floodplains.
Numenius madagascariensis	Eastern Curlew	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves.
Numenius minutus	Little Curlew, Little Whimbrel	The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Numenius phaeopus	Whimbrel	The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. It has been infrequently recorded using saline or brackish lakes near coastal areas.
Pandion haliaetus	Osprey	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range.
Philomachus pugnax	Ruff (Reeve)	In Australia the Ruff is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. They are occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds. They have been observed on sand spits and other sandy habitats including shingles. The Ruff forages on exposed mudflats, in shallow water and occasionally on dry mud.
Pluvialis fulva	Pacific Golden Plover	Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks. They are less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet claypans, especially those with muddy margins and often with submerged vegetation or short emergent grass.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Tringa brevipes	Grey-tailed tattler	The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves. Inland records for the species are rare with sightings on river banks and the edges of rock pools. The Grey-tailed Tattler usually forages in shallow water, on hard intertidal substrates, such as reefs and rock platforms, in rock pools and among rocks and coral rubble, over which water may surge. It has also been recorded foraging on exposed intertidal mudflats, especially with mangroves and possibly seagrass nearby. Occasionally it forages on intertidal sandflats, around banks of seaweed or protruding rocks or lumps of coral. The Grey-tailed Tattler usually roosts in the branches of mangroves or, rarely, in dense stands of other shrubs, or on snags or driftwood. Where mangroves are not present, it roosts on rocks that are sometimes partly submerged. It is also known to roost on beaches and reefs.

Table 2 Migratory wetland bird species predicted by the PMST database to occur in the locality

Scientific Name	Common Name	Habitat Requirements[1]
Tringa nebularia	Common Greenshank, Greenshank	The Common Greenshank occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. It was once recorded with Black-winged Stilts (*Himantopus himantopus*) in pasture, but are generally not found in dry grassland. The species is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh. It will occasionally feed on exposed seagrass beds.
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes. The Marsh Sandpiper usually forages in shallow water at the edge of wetlands. They probe wet mud of mudflats or feed among marshy vegetation. The Marsh Sandpiper has been recorded roosting or loafing on tidal mudflats, near low saltmarsh, and around inland swamps

[1] *Information from (DoE, 2016b)*

It is considered highly unlikely that migratory bird species of conservation significance would have occurred on or immediately surrounding the subject site in the past decades, with the possible exception of within riparian habitats along the Duck River. However, as indicated below, there is little likelihood that the Duck River will be negatively impacted by the proposed development.

6.4 Impact Assessment

No significant impact is considered likely to migratory birds.

7. Assessment of Threatened Ecological Communities

The Protected Matters Search Tool indicates that the following TECs are likely to occur in the locality:

- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion;
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest;
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion; and
- Subtropical and Temperate Coastal Saltmarsh.

The western portion of the subject site is built up with hard surfaces and does not provide habitat for native vegetation. In the eastern portion of the subject site, the land has been remediated and is covered by exotic grassland. Thus, no remnant native vegetation occurs within the subject site and none of the above TECs are present. The Duck River corridor to the west of the subject site contains a mixture of native riparian vegetation communities and weedy exotics which does not correspond to these TECs. Regional mapping data (OEH, 2013a) indicates that the riparian corridor directly adjacent to the subject site includes:

- Coastal Freshwater Wetland;
- Cumberland Riverflat Forest;
- Cumberland Swamp Oak Riparian Forest; and
- Areas dominated by weeds and exotics.

The native communities listed above are all closely related vegetation communities occupying the coastal floodplain environment. The distribution of these communities is shown in **Figure 4** of **Appendix A**. Each of the vegetation communities along the assessed portion of Duck River conform to a TEC listed under the TSC Act. These TECs, which are summarised in the table below, are all listed as Endangered Ecological Communities. None of these communities are listed under the EPBC Act.

Table 3 Relevant remnant vegetation communities in the Duck River corridor and their conforming Threatened Ecological Community

Vegetation Community	Threatened Ecological Community	TSC Act Status	EPBC Act Status
Coastal Freshwater Wetland	Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered	Not listed
Cumberland Riverflat Forest	River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Endangered	Not listed
Cumberland Swamp Oak Riparian Forest	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered	Not listed

River-flat Eucalypt Forest is a riparian woodland/forest community that is associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. The community generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically these forests and woodlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (OEH, 2013b).

While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include Forest Red Gum, Cabbage Gum (*Eucalyptus amplifolia*) and Rough-barked Apple (*Angophora floribunda*). The understorey species include various paperbark species (*Melaleuca* spp.) and Oaks (*Casuarina* spp.). The groundcover is composed of abundant forbs, scramblers and grasses; however, more disturbed areas of this vegetation may have a substantial component of exotic shrubs, grasses, vines and forbs (OEH, 2013b).

River-flat Eucalypt Forest is closely associated with Swamp Oak Floodplain Forest. Swamp Oak Floodplain Forest is a community that occurs on very low elevations, typically as forest fringing water bodies or gallery forests lining creeks and streams. It is associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, in waterlogged or periodically inundated habitats (OEH, 2014b). The canopy is dominated by Swamp Oak (*Casuarina glauca*).

River-flat Eucalypt Forest and Swamp Oak Floodplain Forest both intergrade with Freshwater Wetlands. Freshwater Wetlands vary from sedgelands and reedlands to herbfields, and woody plants are generally scarce. Typically these wetlands form mosaics with other floodplain

communities, and often they include or are associated with ephemeral or semi-permanent standing water (OEH, 2014a).

7.1 Survey Methods

A desktop assessment was undertaken of the subject site and included a review of current aerial photography, regional vegetation mapping data, various reports relating to the Duck River reserve and studies of nearby sites.

The subject site was visited by two ecologists on 15 May 2015, and 28 and 29 January 2016 to verify desktop information and assess the condition of the vegetation. The site visit involved a walk around the perimeter of the subject site and a visual inspection through the fence. Visual access from the site perimeter was adequate due to the flat topography and highly cleared nature of the site. A walk along the eastern bank of Duck River was also undertaken from the railway pedestrian bridge traversing south to Manchester Street to inspect the vegetation along the river. The section of riparian habitat where the proposed pedestrian and cycle path is likely to cross the Duck River was inspected in particular.

7.2 Survey Findings

The vegetation mapping shown in the *Upper Duck River Wetlands and Riparian Plan of Management* (Applied Ecology Pty Ltd., 2012) is generally consistent with the regional mapping (OEH, 2013a). However, the management plan also shows that the level of degradation along the riparian zone is very high, such that areas dominated by weeds and exotics are almost devoid of native plant species and remnant areas are also highly degraded by dense occurrences of weedy vines, shrubs and groundcovers (**Figure 5**). Remnant areas were noted to be lacking natural tree regeneration (evidence of seedlings and saplings less than 1 m tall), which was confirmed during the present survey. Large areas of the riparian corridor, such as the downstream areas to the north of the subject site (near the railway pedestrian bridge), are almost entirely dominated by problematic riparian weeds, including:

- Lantana (*Lantana camara*);
- Bull Rush (*Typha orientalis*);
- Castor Oil Plant (*Ricinus communis*);
- Crofton Weed (*Ageratina adenophora*);
- Cobbler's Pegs (*Bidens pilosa*);
- Morning Glory (*Ipomoea indica*);
- Balloon Vine (*Cardiospermum grandiflorum*);
- Green Cestrum (*Cestrum parqui*);
- Large-leaved Privet (*Ligustrum lucidum*);

- Small-leaved Privet (*Ligustrum sinense*);
- Weeping Willow (*Salix babylonica*); and
- Camphor Laurel (*Cinnamomum camphora*).

In the section of Duck River where the proposed cycle and pedestrian crossing has been conceptually located, the canopy of the riparian vegetation is dominated by Forest Red Gum trees that are mature but relatively young in age and typically have a diameter at breast height (DBH) of less than 40 cm. Co-occurring trees include Swamp Oak (*Casuarina glauca*). The understorey is almost completely dominated by problematic riparian weed species including Balloon Vine (*Cardiospermum grandiflorum*), Cobbler's Pegs, Morning Glory (*Ipomoea indica*) and Fleabane.

The degradation of the Duck River riparian corridor was likely to have taken place gradually and over a long period of time. The key factors can be attributed to the intensification of land use in the catchment area since European settlement and include the following changes (Applied Ecology Pty Ltd., 2012):

- Extensive urbanisation/industrialisation in the catchment;
- Land clearing;
- Channelisation and creek lining;
- Construction of weirs along the Duck River; and
- Introduction of agricultural, urban and sewage pollution.

The changes would have resulted in impacts such as larger runoff volumes, increased channel erosion and sedimentation, higher nutrient loads and increased sunlight.

Restoration efforts for the upper Duck River riparian corridor have commenced and are to be coordinated under an overarching vegetation management action program prepared by Parramatta and Auburn City Councils (Applied Ecology Pty Ltd., 2012).

7.3 Impact Assessment

The TECs present in the adjacent Duck River corridor forms a complex of forested wetland and treeless wetland communities found throughout the coastal floodplains of NSW. These TECs may adjoin or intergrade with each other and the boundaries between such communities are dynamic and will often shift in response to changes in hydrological regimes (OEH, 2013c; OEH, 2014a; OEH, 2014b).

The historical extent of the TECs present in the adjacent Duck River corridor have greatly declined since European settlement due to agricultural, residential and industrial land clearing and channel drainage works. Land clearing continues to threaten these TECs and remaining

stands are severely fragmented. Further threats to remaining stands include (NSW Scientific Committee, 2004a; NSW Scientific Committee, 2004b; NSW Scientific Committee, 2004c):

- Flood mitigation and drainage works;
- Land-filling and earthworks associated with urban and industrial development;
- Pollution and eutrophication from urban and agricultural runoff;
- Weed invasion;
- Overgrazing;
- Trampling and other soil disturbance by domestic livestock and feral animals including pigs;
- Activation of 'acid sulfate soils'; and
- Rubbish dumping.

Most areas of remaining areas of the TECs are heavily affected by weeds.

The Planning Proposal is unlikely to result in a direct impact on TECs. No TECs occur within the subject site and no vegetation loss within the adjacent Duck River corridor is proposed as part of the planned future residential development of the subject site.

The Planning Proposal may exacerbate indirect threatening processes that can continue to degrade the TECs in the adjacent Duck River corridor. Pollution from urban runoff and higher density occupation of the subject site may increase weed impacts on the riparian zone. However, the development of the subject site is likely to involve detailed erosion, surface water and sewerage management plans and it is expected that the risks will be manageable. Furthermore, the proponent is proposing to undertake restoration activities along Duck River, which will also mitigate the potential impacts on riparian vegetation and facilitate the recovery of the TECs.

The proposed pathways and river crossings along Duck River is currently part of a preliminary concept design, with detailed design to be developed for specific development applications at a future stage. The nature and configuration of the existing riparian vegetation provides opportunities to take advantage of natural spaces between canopy trees such that the need for clearing native vegetation can be avoided. The understorey of the riparian vegetation is highly weedy and it is highly unlikely that native understorey will be impacted for the construction of a future bridge over the Duck River. Furthermore, it is our understanding that a pedestrian and vehicle bridge can be constructed with minimal disturbance to any understorey, regardless of its condition. Refer to **Photograph 7**, **Appendix C**.

Further targeted assessment of detailed designs will be commissioned at a future time for specific development applications, at which time opportunities to avoid and/or mitigate

foreseeable impacts to remnant native vegetation along the river will be considered and evaluated.

For these reasons, it is unlikely that the Planning Proposal will have a significant adverse impact on the TECs within the Duck River corridor. A formal Assessment of Significance is provided in **Appendix B**.

8. Recommendations

The Planning Proposal is unlikely to have a significant impact on TECs and Grey-headed Flying-fox. However, to manage the risks on TECs and the nearby flying-fox colony, and to minimise the risk of human conflicts with the colony, a number of measures are recommended for consideration during the construction and post-construction phases of future development.

Recommended measures include:

- Maintaining a buffer of at least 100 m between the camp and any residential land use, as recommended in the *Duck River Grey-headed Flying-fox Management Plan* (Dragonfly Environmental, 2014);
- Implementing a well-considered landscape management plan that does not attract large numbers of flying-foxes to the residential areas to feed, thus reducing interactions with residents and potential damage to property;
- Implementing detailed erosion, surface water and sewerage management plans to minimise the offsite impacts on the TECs and Grey-headed Flying-fox habitat in the adjacent Duck River corridor;
- Considering a number of design potentials to minimise resident/bat conflicts such as:
    - Underground parking spaces to limit potential damage to vehicles from bat excrement;
    - Double glazing of windows facing the camp;
    - Appropriate sound insulation in the building;
    - Limiting the number of windows facing the camp, or requiring non-opening windows;
    - Installing of air conditioners; and
    - Outdoor areas, including balconies and courtyard gardens, positioned away from the river/camp
- Undertaking acoustic testing during construction phases as required to monitor and manage noise levels affecting the camp site;

- Timing construction works as required to avoid critical birthing and pup-rearing phases of the species' life cycle;
- Timing restoration works in the Duck River corridor (especially approaching the specific camp site area) to avoid critical birthing and pup-rearing phases of the species' life cycle;
- Facilitating community awareness of Grey-headed Flying-fox to encourage better understanding of the species' behaviours and options available to reduce risk of disturbance to residents;
- Approaching restoration works in the Duck River corridor in a manner that will maintain structural layers at any point in time and not cause further harm to the colony (i.e. retaining exotic trees and understorey cover until replanted vegetation can develop sufficiently to provide shelter for the colony);
- Approaching restoration works in the buffer between the camp and any residential land, so as not to result in expansion of the bat colony. This will include considering the use of plants that are not preferred flying-fox habitat species in landscaping plans, or limiting works to bank stabilisation and weed control as required; and
- Avoid clearing native trees and shrubs for the construction of the river crossing by making use of natural gaps between trees to locate infrastructure.

In addition, Council has indicated that a study is required to assess issues around the presence of the Grey-headed Flying-fox colony and to identify potential mitigation measures. This study will require approval by the Office of Environment and Heritage prior to implementation.

Council may also require preparation of a Plan of Management for urban bushland areas consistent with the requirements of SEPP 19.

9. Conclusion

9.1 Threatened Ecological Communities

The Planning Proposal unlikely to result in a direct impact on TECs. No TECs occur within the subject site and no vegetation loss within the adjacent Duck River corridor is proposed as part of the planned future residential development of the subject site.

The Planning Proposal may exacerbate indirect threatening processes that can continue to degrade the TECs in the adjacent Duck River corridor. Pollution from urban runoff and higher density occupation of the subject site may increase weed impacts on the riparian zone. However, the development of the subject site is likely to involve detailed erosion, surface water and sewerage management plans and it is expected that the risks will be manageable.

Furthermore, the proponent is proposing to undertake restoration activities along Duck River, which will also mitigate the potential impacts on riparian vegetation and facilitate the recovery of the TECs.

The proposed pedestrian and cycle bridge may have a very minor impact upon River-flat Eucalypt Forest but the impact is unlikely to be significant and can be minimise simply by designing a footbridge to avoid the need to clear trees.

It is concluded that the Planning Proposal is unlikely to result in a significant impact on TECs. As such, no Species Impact Statement is required.

9.2 Threatened Species

No threatened flora or fauna species were found or considered likely to occur on the subject site other than Grey-headed Flying-fox, which camp nearby in the Duck River riparian corridor. No migratory species are considered to make significant use of the subject site.

No Grey-headed Flying-fox were found to be using the camp at the time the site was surveyed. Fly-out patterns could not be observed and assessed further.

Notwithstanding, the main threat to any Grey-headed Flying-fox colony is likely to be from loss of habitat at the camp site, or loss of foraging habitat within 20-50 km of the camp site (which would reduce the suitability of the camp for prolonged periods of roosting and breeding).

At the Duck River site, the indirect impacts to a colony due to noise, heat, interactions with humans and altered fly-out patterns are not likely to be a significant issue.

The Planning Proposal will not remove roosting or foraging habitat within 20-50 km of the camp site. The potential impacts from interactions with future residents, change in noise levels and possible offsite effects on the quality of the riparian vegetation along Duck Creek are not expected to be significant and are likely to be manageable. The proponent is also proposing to implement a restoration program for the riparian vegetation along a section of Duck River upstream of the camp site, which will improve foraging habitat and the suitability of the camp site for roosting.

It is concluded that the Planning Proposal is unlikely to result in a significant impact on Grey-headed Flying-fox. As such, no Species Impact Statement and no EPBC Act referral are required. Further and more detailed studies of flying foxes will be made during later stages of the planning and design process to ensure that negative resident and flying-fox interactions will be minimised.

If you would like to discuss this matter further, please contact me on 9868 1933.

Yours sincerely,

David Robertson

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Director
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Appendix A

Figures

Legend

Subject Site

Watercourse

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 200 300 m

I:\...\17161\Figures\Letter 3\20170927\Figure 1. Site Location

Figure 1. Site location

2.1 Landscape Concept Plan

Figure 2. Draft Landscape Concept Design

Image Source: Conxtext, Manchester Road Landscape Context, 17560, Issue A (Draft), Oct 2017

I:\...\17161\Figures\Letter 3\20171013\Figure 2. Draft Landscape Concept Design

Legend

- Subject Site
- Grey-headed Flying-fox Camp
- Watercourse

Data Source:
Dragonfly Environmental (2014)
Duck River Grey-headed Flying-fox Camp Management Plan

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 25 50 100 150 200 m

I:\...\17161\Figures\Letter 3\20170927\Figure 3. Location GHFF Camp

Figure 3. Location of the Grey-headed Flying-fox Camp at Duck River

Legend

- Subject Site
- Section of Duck River relevant to study
- Watercourse

Vegetation Community

- S_FoW06: Cumberland Riverflat Forest
- S_FoW07: Cumberland Swamp Oak Riparian Forest
- S_FoW08: Estuarine Swamp Oak Forest
- S_FrW03: Coastal Freshwater Wetland
- S_SW01: Estuarine Mangrove Forest
- S_SW02: Estuarine
- Urban_E/N: Urban
- Weed_Ex: Weeds and Exotics

Data Source:
OEH (2016). The Native Vegetation of the Sydney Metropolitan Area. Office of Environment and Heritage NSW.

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 25 50 100 150 200 m

I:\...\17161\Figures\Letter 3\20170927\Figure 4. Vegetation Communities

Figure 4. Vegetation Communities along Duck River

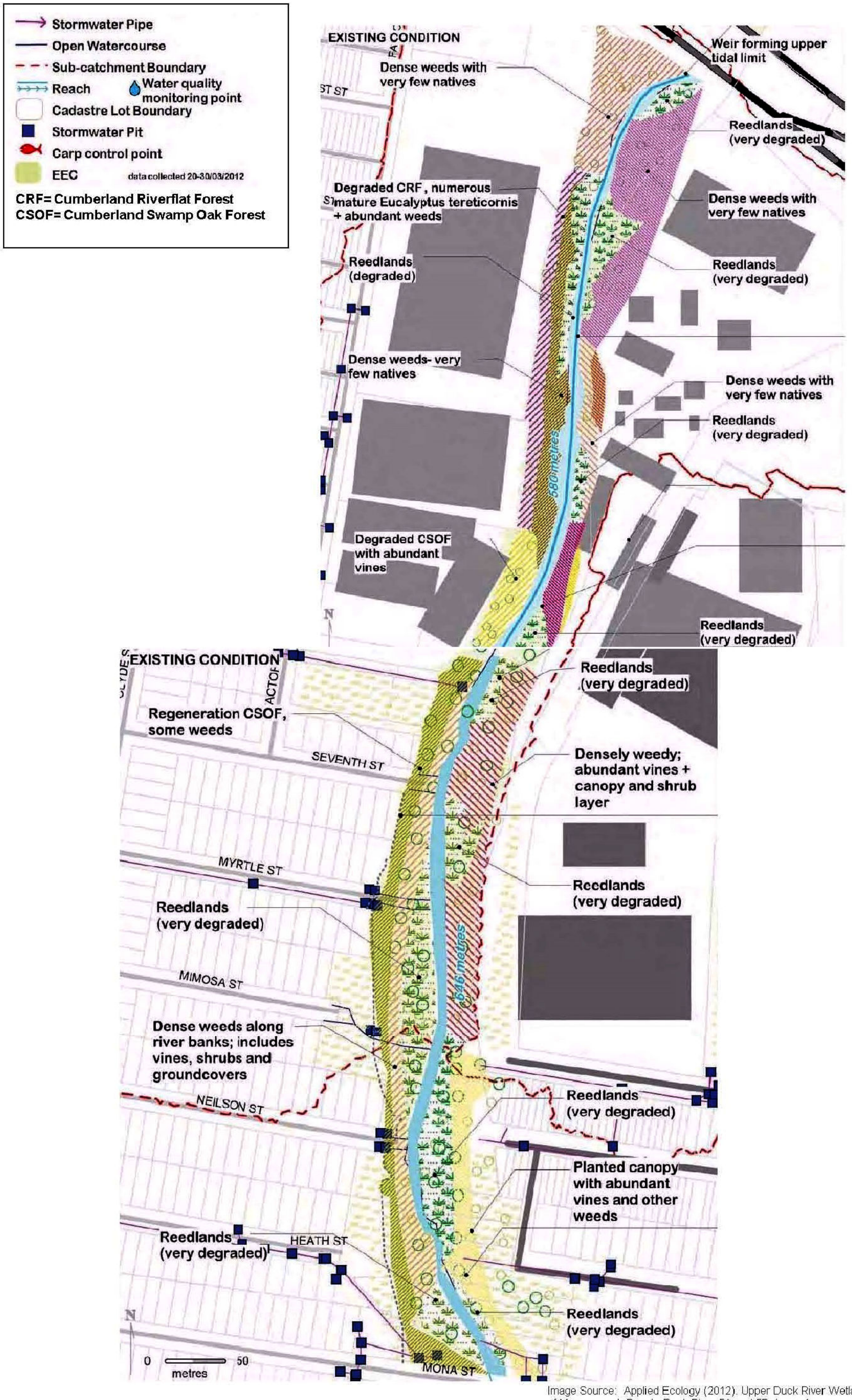

Image Source: Applied Ecology (2012). Upper Duck River Wetlands & Riparian Plan of Management. Reach: Duck River 5A and 5B. Issue 1.

I:\...\17161\Figures\Letter 3\20170927\Figure 5. Existing Condition Duck River

Figure 5. Existing Condition of Duck River

Appendix B

Assessments of Significance

Grey-headed Flying-Fox

TSC Act Section 5A: Significant effect on threatened species, populations or ecological communities, or their habitats

Grey-headed Flying-fox is a highly mobile, nomadic species that migrates long distances in response to ephemeral and patchy foraging resources (DoE, 2015). Notwithstanding, the species form colonies that roost in aggregations at locations referred to as camps. Colonies will often move from camp to camp over time in an irregular fashion in response to variation in resource availability. However, whilst some camps are infrequently used, others may be regularly occupied during certain months of the year (Eby and Lunney, 2002; DECCW, 2009; Eby, 2012; DoE, 2015).

Camp sites are very important to the life cycle of a Grey-headed Flying-fox colony (DECCW, 2009; Dragonfly Environmental, 2014). The camp sites are typically located within 20-50 km of foraging habitat and are used as resting points during migration; as refugia during important phases of the annual life cycle such as mating, birth and lactation; and for social interactions and communications between individuals (DECCW, 2009; OEH, 2015d).

The primary threat to a colony of Grey-headed Flying-foxes is habitat loss at the camp site and loss of surrounding foraging habitat (DECCW, 2009). Other factors that can disrupt camps and result in temporary dispersal from a camp site include visual and acoustic stimuli such as construction noise and high foot traffic in the immediate vicinity of the camp (van der Ree and North, 2009; Roberts *et al.*, 2011). Prolonged disruption of a camp leading to longer term dispersal from the camp site may have adverse impacts on the health of individuals and may lead to longer term effects such as decline in reproductive success, or decline in foraging resources in the locality due to disruption of the species' pollinator function (Hall and Richards, 2000; Dragonfly Environmental, 2014; OEH, 2015b). However, it is commonly known that Grey-headed Flying-fox exhibits strong site fidelity and can be very resistant to camp displacement (SEQ Catchments, 2010; Roberts *et al.*, 2011). Thus, the main disruption to a colony is likely to be habitat loss at the camp site.

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(2) The following factors must be taken into account in making a determination under this section:

> *(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The Planning Proposal will facilitate the development of a residential area near the Duck River camp. Although the camp is currently vacated, it is likely that the camp will be reoccupied in the foreseeable future. Nevertheless, the future residential development of the subject site will not destroy roosting habitat and is unlikely to discourage the future use of the camp site.

The camp site is surrounded by existing industrial land and is very close to the rail line; it is therefore currently subjected to high noise levels from trains, trucks and industrial processes.

The camp site is also close to a foot bridge that experiences a reasonable level of pedestrian traffic. It is unlikely that the future residential development of the subject site will significantly increase these impacts above current levels. The proposed pedestrian/cycle paths are unlikely significantly or permanently affect the flying-fox colony in the long term. There are examples where other comparable flying-fox colonies have adapted to persist in proximity to pedestrian and cycle traffic, including at the Sydney Royal Botanic Gardens, Parramatta Park along the Parramatta River, Burdekin Park in Singleton and Bicentennial Park in Tamworth along the Peel River.

The colony is likely to use a fly out path of "least resistance" when occupying the Duck River camp and is therefore likely to fly-out in the southerly direction from the camp (Armistead, 2012). The future development of residential apartments on the subject site is set back from the camp site by a minimum of 225 m and is also unlikely to interrupt the Duck River corridor. It is therefore likely that the current fly-out paths will remain available to the colony. It is unlikely that the future development of the subject site will significantly impact the fly-out patterns of the species.

The Planning Proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable population is likely to be placed at risk.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed; and

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The subject site does not support any native vegetation that would constitute foraging or roosting habitat for Grey-headed Flying-fox. The subject site does not contain non-native vegetation that would constitute valuable foraging habitat for the species. Therefore, the Planning Proposal and future development of the subject site will not directly remove, modify, fragment or isolate roosting and foraging habitat that is important for the long-term survival of the Grey-headed Flying-fox.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat for Grey-headed Flying-fox has been declared under Sections 53-55 of the TSC Act and thus none are listed on the Register of Critical Habitat.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A draft national recovery plan for Grey-headed Flying-fox is currently on exhibition (DECCW, 2009). The draft recovery plan contains the following specific objectives:

- Objective 1. To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range;
- Objective 2. To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes;
- Objective 3. To identify roosting habitat critical to the survival of Grey-headed Flying-foxes;
- Objective 4. To protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes;
- Objective 5. To substantially reduce deliberate destruction of Grey-headed Flying-foxes in fruit crops;
- Objective 6. To reduce negative public attitudes toward Grey-headed Flying-foxes and reduce conflict with humans;

- Objective 7. To increase public awareness and understanding of Grey-headed Flying-foxes and the recovery program, and to involve the community in recovery actions, where appropriate, to reduce the threat of negative public attitudes and conflict with humans;

- Objective 8. To monitor population trends in Grey-headed Flying-foxes so as to monitor the species' national distribution and status;

- Objective 9. To assess and reduce the impact on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and on barbed-wire;

- Objective 10. To improve knowledge of the demographics and population structure of Grey-headed Flying-foxes in order to increase understanding of the ecological requirements of the species;

- Objective 11. To increase the effectiveness and efficiency of recovery initiatives for Grey-headed Flying-foxes by working cooperatively with conservation and management programs with overlapping objectives to remove or reduce the impact of threatening processes on the species; and

- Objective 12. To maintain an effective Grey-headed Flying-fox National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan to remove or reduce the impact of threatening processes on the species.

A number of the above objectives are not applicable to the Planning Proposal (e.g. 1,3,5,8,10,12).

The Planning Proposal may be inconsistent with objective 6 and 7 if conflicts between residents and the colony occur. However, the risk of potential conflicts with future residents are considered to be low based on knowledge of current levels of interactions with the existing residents to the west and to the south. Noise from the colony is likely to be highest during the day when the colony is roosting and lowest at night when the colony is dispersed for foraging. The set back of the subject site is likely to minimise odour disturbance to residents. The set back of the subject site, in combination with the irregular occupation of the camp, is likely to continue mitigating the risk of conflict with future residents. Furthermore, measures to minimise and/or avoid conflicts have been recommended to mitigate this risk and it is considered that resident/colony conflicts will be manageable.

The proposal to restore riparian vegetation along the Upper Duck River will enhance the habitat value for the camp and is consistent with objectives 2 and 4.

The Planning Proposal is unlikely to be in conflict with the remaining objectives.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The draft recovery plan (2009) cites habitat loss as the highest priority threat for the species. For this reason, the following listed key threatening processes (OEH, 2015e) are relevant to the species:

- Clearing of native vegetation;
- Invasion and establishment of exotic vines and scramblers; and
- Invasion, establishment and spread of *Lantana camara.*

Other threats to Grey-headed Flying-fox include (OEH, 2015d):

- Electrocution on powerlines, entanglement in netting and on barbed-wire;
- Heat stress; and
- Conflict with humans.

In addition, impacts from Australian White Ibis (*Threskiornis molucca*) are also considered to be a threat to Grey-headed Flying-fox colonies. Australian White Ibis inhabit wetlands of inland Australia such as the Macquarie Marshes, where they breed in the thousands. Due to severe and prolonged drought conditions, Australian White Ibis have migrated to urban areas where they can congregate in large numbers (Thomas, 2007; Smith, 2009).

Australian White Ibis use Grey-headed Flying-fox roost trees as breeding sites and thus directly compete with Grey-headed Flying-fox. Ibis habitation of flying-fox camps are known to result in tree damage and loss of mid-storey vegetation. As up to 10 ibis nests can be found in a single canopy tree, valuable roost trees can be damaged and lost. Ibis faecal droppings are high in phosphorus and burn mid-storey vegetation, which can amplify the heat stress experienced by flying-foxes (DECC, 2008). It is known that the Cabramatta Creek colony of Grey-headed Flying-fox, which is a significant camp in the Sydney region (DoE, 2014), declined from 30,000 to 5,000 at the peak of Australian White Ibis occupancy at that site (DECC, 2008; Thompson, 2014b).

The Planning Proposal does not constitute the clearing of native vegetation, nor will it exacerbate the impacts of this key threatening process. The Planning Proposal is unlikely to significantly increase the population of Australian White Ibis currently present within the Duck River habitat. Current measures to manage Australian White Ibis are included in the Duck River Grey-headed Flying-fox Camp Management Plan (Dragonfly Environmental, 2014).

The future development of the subject site may have potential to increase the current weed impacts on the riparian corridor and thus further degrade foraging habitat within 20 km of the camp site if surface run-off and other offsite impacts on the catchment are not managed. The future development of the subject site is likely to involve detailed erosion, surface water and sewerage management plans and it is expected that the risks will be manageable.

Furthermore, the proponent is proposing to undertake restoration activities along Duck River, which will also mitigate the potential impacts on riparian vegetation and improve foraging habitat for the species.

CONCLUSION

Generally, the main threat to any Grey-headed Flying-fox colony is likely to be from loss of habitat at the camp site, or loss of foraging habitat within 20-50 km of the camp site (which would reduce the suitability of the camp for prolonged periods of roosting and breeding). At the Duck River site, the indirect impacts to a colony due to noise, heat, interactions with humans and altered fly-out patterns are not likely to be a significant issue.

The Planning Proposal will not remove roosting or foraging habitat within 20-50 km of the camp site. The potential impacts from interactions with future residents, change in noise levels and possible offsite effects on the quality of the riparian vegetation along Duck Creek are not expected to be significant and are likely to be manageable. The proponent is also proposing to implement a restoration program for the riparian vegetation along a section of Duck River upstream of the camp site, which will improve foraging habitat and the suitability of the camp site for roosting. It is concluded that the Planning Proposal is unlikely to result in a significant impact on Grey-headed Flying-fox. As such, no Species Impact Statement is required.

Grey-headed Flying-Fox

EPBC Act Significant Impact Guidelines 1.1: Impact Criteria for Vulnerable Species

For the purpose of assessing the species against the significant impact criteria below, an 'important population' is defined to be a population that is necessary for a species' long-term survival and recovery (pg 10, DoE, 2013). This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species range.

Specifically, nationally important Grey-headed Flying-fox camps are defined as those with a population size ≥ 10,000 in more than one year within the last 10 years, or have been occupied by more than 2,500 flying-foxes permanently or seasonally every year for the last 10 years (DoE, 2014).

The Duck River camp considered to be significant because it is a maternal camp and one of only a small number of permanent camps that remain in the Sydney metropolitan area (Dragonfly Environmental, 2014). However, it is not an important population as defined above.

An action is likely to have a significant impact on a vulnerable species listed under the EPBC Act if there is a real chance or possibility that it will:

(a) Lead to a long-term decrease in the size of an important population of a species.

The Duck River colony is not considered to be an important population. Notwithstanding, the Planning Proposal is unlikely to lead to a long-term decrease in the population size of Grey-headed Flying-fox at Duck River.

(b) Reduce the area of occupancy of an important population.

The Duck River colony is not considered to be an important population. Notwithstanding, the Planning Proposal is unlikely to reduce the area of occupancy of Grey-headed Flying-fox at Duck River.

(c) Fragment an existing important population into two or more populations.

The Duck River colony is not considered to be an important population. Notwithstanding, the Planning Proposal is unlikely to fragment the Grey-headed Flying-fox population at Duck River into two or more populations.

(d) Adversely affect habitat critical to the survival of a species.

There is no critical habitat currently listed for Grey-headed Flying-fox under the Register of Critical Habitat.

(e) Disrupt the breeding cycle of an important population.

The Duck River colony is not considered to be an important population. Notwithstanding, the Planning Proposal will not disrupt the breeding cycle of the Grey-headed Flying-fox population at Duck River.

(f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

The Planning Proposal will not modify, destroy, remove, isolate or decrease the availablility or quality of habitat to the extent that Grey-headed Flying-fox at Duck River will decline.

(g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.

The Planning Proposal is unlikely to introduce invasive species to the habitat of the Grey-headed Flying-fox colony at Duck River.

(h) Introduce disease that may cause the species to decline.

The Planning Proposal is unlikely to introduce disease that may cause Grey-headed Flying-fox to decline.

(i) Interfere substantially with the recovery of the species.

The Planning Proposal will not interfere substantially with the recovery of Grey-headed Flying-fox.

CONCLUSION

The Planning Proposal is not likely to lead to a significant impact on Grey-headed Flying-fox. As such, no Referral to the Department of the Environment for Commonwealth assessment is required.

Green and Golden Bell Frog

TSC Act Section 5A: Significant effect on threatened species, populations or ecological communities, or their habitats

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(2) The following factors must be taken into account in making a determination under this section:

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

There is no viable local population of Green and Golden Bell Frog known to occur in the study area (i.e. the subject site and immediate surroundings that could be impacted by future urban development of the subject site). The Planning Proposal will not facilitate development that is likely to have an adverse effect on the species such that a local viable population is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered populationsuch that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

Not applicable

(d) in relation to the habitat of a threatened species, population or ecological community:

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

Approximately six hectares of low quality habitat will be directly removed as part of the future urban development of the subject site. The low quality habitat comprises remediate land dominated by exotic grassland vegetation with potential to support ephemeral pools of water from time to time. This area of habitat is already isolated from other known areas of habitat and so the Planning Proposal is unlikely to fragment or further isolate the habitat. The habitat that will be removed in future is not considered to be important to the long term survival of the species as there continues to be no evidence for Green and Golden Bell Frog use of the subject.

The Planning Proposal will not facilitate urban development that will have significant indirect impacts on Duck River. The vegetation within the Duck River corridor currently does not support Green and Golden Bell Frog and is unlikely to support Green and Golden Bell Frog due to the likely presence of Mosquito Fish in the Duck River system.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

To date, Critical Habitat, as defined by the TSC Act, has not been declared for Green and Golden Bell Frog.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The specific objectives of the Draft Recovery Plan for Green and Golden Bell Frog (DEC, 2005) are to

- *increase the security of key GGBF populations by way of preventing the further loss of GGBF habitat at key populations across the species range and where possible secure opportunities for increasing protection of habitat areas (reservation / conservation status, Section 10);*
- *ensure extant GGBF populations are managed to eliminate or attenuate the operation of factors that are known or discovered to be detrimentally affecting the species (threat and habitat management, Section 11);*
- *implement habitat management initiatives that are informed by data obtained through investigations into the general biology and ecology of the GGBF through a systematic and coordinated monitoring program (research and monitoring, Section 12);*
- *establish, within more than one institution, self sustaining and representative captive populations (particularly 'at risk' populations) of the Green and Golden Bell Frog for the primary purpose of maintaining 'insurance' colonies for re-establishment and supplementation of populations of the species (captive breeding and translocation, Section 13; with research and educational purposes a secondary objective.); and*

- *increase the level of regional and local awareness of the conservation status of the Green and Golden Bell Frog and provide greater opportunity for community involvement in the implementation of this recovery plan (community education, awareness and involvement, Section 14).*

The Planning Proposal will not interfere with any of the objects of the recovery plan.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The key threatening processes for this species have been recognised to be:

- Loss, fragmentation or isolation of habitat;
- Predation by introduced fish (i.e. Mosquito Fish and European Carp *Cyprinus carpio*);
- A pathogenic chytrid fungal disease 'chytridiomycosis'; and
- Water quality issues.

CONCLUSION

The Planning Proposal will facilitate urban development that has potential to exacerbate all of the above key threatening processes. However, there is no viable local population of Green and Golden Bell Frog known to occur in the study area (i.e. the subject site and immediate surroundings that could be impacted by future urban development of the subject site). The Planning Proposal will not facilitate development that is likely to have an adverse effect on the species such that a local viable population is likely to be placed at risk of extinction.

Green and Golden Bell Frog

EPBC Act Policy Statement 3.19: Significant impact threshold for the green and golden bell frog

There is a possibility of a significant impact on the green and golden bell frog, and a referral under the EPBC Act should be considered, if the action results in:

1. the removal or degradation of aquatic or ephemeral habitat either where the green and golden bell frog has been recorded since 1995 or habitat that has been assessed as being suitable according to these guidelines. This can include impacts from chytrid, Gambusia originating off-site;

No Green and Golden Bell Frog has been recorded in any of the ephemeral pools of water on the subject site. No Green and Golden Bell Frog has been recorded in Duck River.

The site is unlikely to support occurrences of Green and Golden Bell Frog due to poor connectivity between the subject site and the river and due to the lack of sheltering habitats on the subject site.

Therefore, the Planning Proposal will not facilitate future development that will cause the removal or degradation of aquatic or ephemeral habitat either where Green and Golden Bell Frog has been recorded since 1995 or habitat that has been assessed as being suitable.

2. the removal or degradation of terrestrial habitat within 200 metres of habitat identified in threshold 1

There will be no removal or degradation of habitat aquatic or ephemeral habitat either where Green and Golden Bell Frog has been recorded since 1995 or habitat that has been assessed as being suitable (see response to threshold 1 above). Thus there will be no removal or degradation of habitat within 200 metres of habitat identified in threshold 1

3. breaking the continuity of vegetation fringing ephemeral or permanent waterways or other vegetated corridors linking habitats meeting the criteria in threshold 1.

The Planning Proposal will not facilitate future development that will break the connectivity of fringing wetland or riparian vegetation linking potential frog habitat. There is no wetland vegetation on the subject site. As discussed in the body of the letter, there is opportunity for a pedestrian and cycle bridge to be constructed without disturbing the riparian vegetation at Duck River.

Threatened Ecological Communities

TSC Act Section 5A: Significant effect on threatened species, populations or ecological communities, or their habitats

This Assessment of Significance has been prepared for the following Endangered Ecological Communities:

- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.
- River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

These communities are referred to as TECs in this assessment.

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(2) The following factors must be taken into account in making a determination under this section:

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The Planning Proposal unlikely to have an adverse effect on the extent of the TECs such that its local occurrence is placed at risk of extinction. No TECs occur within the subject site and no vegetation loss within the adjacent Duck River corridor is proposed as part of the planned future residential development of the subject site.

The Planning Proposal is unlikely to adversely modify the composition of the TECs such that its local occurrence is placed at risk of extinction. The TECs in the Duck River corridor are currently already degraded by weeds, historical channelisation and runoff. No modification of the existing TECs is proposed, such as for bushfire asset protection or for landscaping.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed; and

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality. The Planning Proposal will not remove or modify the existing TECs in the Duck River corridor.

The Planning Proposal will not further fragment or isolate the existing TECs in the Duck River corridor.

The Duck River corridor is an important habitat for the TECs because the historical extent of the TECs have greatly declined since European settlement and remaining occurrences are limited to riparian zones like the Duck River. These areas are under continued threat from agricultural, residential and industrial land clearing.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat for the TECs has been declared under Sections 53-55 of the TSC Act and thus none are listed on the Register of Critical Habitat.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Of the TECs assessed, only River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is covered by a recovery plan. The recovery objectives set out for this TEC is (DECCW, 2010):

- Objective 1: To build a protected area network, comprising public and private lands, focused on the priority conservation lands;
- Objective 2: To deliver best practice management for threatened species, populations and ecological communities across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with conservation;

- Objective 3: To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program; and

- Objective 4: To increase knowledge of the threats to the survival of the Cumberland Plain's threatened species, populations and ecological communities, and thereby improve capacity to manage these in a strategic and effective manner.

The Planning Proposal is not in conflict with these objectives.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The key threatening processes (OEH, 2015e) that are relevant to the TECs are:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;

- Anthropogenic climate change;

- Clearing of native vegetation;

- Invasion and establishment of exotic vines and scramblers;

- Invasion, establishment and spread of *Lantana camara*;

- 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; and

- Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*).

The Planning Proposal may exacerbate key threatening processes that can continue to degrade the TECs in the adjacent Duck River corridor. Pollution from urban runoff and higher density occupation of the subject site may increase weed impacts on the riparian zone by encouraging the spread of problematic weeds like *Lantana camara* and exotic vines.

However, the development of the subject site is likely to involve detailed erosion, surface water and sewerage management plans and it is expected that the risks will be manageable. Furthermore, the proponent is proposing to undertake restoration activities along Duck River, which will also mitigate the potential impacts on riparian vegetation and facilitate the recovery of the TECs.

CONCLUSION

The Planning Proposal is unlikely to result in a direct impact on TECs. No TECs occur within the subject site and no vegetation loss within the adjacent Duck River corridor is proposed as part of the planned future residential development of the subject site.

The Planning Proposal may exacerbate indirect threatening processes that can continue to degrade the TECs in the adjacent Duck River corridor. Pollution from urban runoff and higher density occupation of the subject site may increase weed impacts on the riparian zone. However, the development of the subject site is likely to involve detailed erosion, surface water and sewerage management plans and it is expected that the risks will be manageable.

Furthermore, the proponent is proposing to undertake restoration activities along Duck River, which will also mitigate the potential impacts on riparian vegetation and facilitate the recovery of the TECs.

It is concluded that the Planning Proposal is unlikely to result in a significant impact on TECs. As such, no Species Impact Statement is required.

Appendix C

Site Photographs

Photograph 1 **Wet areas in grassland on the eastern half of the subject site**

Photograph 2 **Australian White Ibis foraging in grass on the eastern half of the subject site**

Photograph 3 ***Typha*** **spp. habitat in the downstream reaches of Duck River, near the pedestrian bridge (looking south)**

Photograph 4 **The industrial western portion of the subject site**

Photograph 5 **Walled barrier separating the industrial lot from the vacant eastern lot**

Photograph 6 **Grassland vegetation in the vacant lot in the eastern portionof the subject site**

Photograph 7 **Riparian vegetation along Duck River at the approximate location of the proposed pedestrian and cycle bridge**

Appendix D

Issue/Response Table

Table 4 Response Table

Issue	Where addressed
COUNCIL SUBMISSION	
SEPP 19 Urban Bushland – This SEPP needs to be addressed	Section 1.4 has been added to the report to address this
Potential impact on Vegetation communities such as the Cooks River/Castlereagh Ironbark Forest etc.	Cooks River - Castlereagh Ironbark Forest is not mapped in the subject site, and component species were not observed. A paragraph has been added to Section 7 to outline why this and other TECs identified as 'likely to occur' in the PMST were not present.
Presence of Flying fox colony- A study is required to assess issue and identity potential mitigation measures. Measures need to be approved by the Office of Environment and Heritage prior to implementation.	The completion of such a study is recommended in Section 8
Proposed works on Duck River – could be situated on land not owned by applicant.	This is outside the scope of the Ecological Assessment
Impact of the bike track along the river on the flying fox camp has not been assessed.	Additional details have been added to tha Assessment of Significance to address this
Impact on Tadgell's Bluebell and the Green and Golden Bell Frog.	Impacts of Tadgell's Bluebell are addresssed in Section 5. No significant impact is considered likely to Tadgell's Bluebell. With regards to occurrences of Tadgell's Bluebell on the western side of Duck River, the development of the subject site is unlikely to have a direct impact on the riparian corridor or any occurrences within it. Assuming overstorey, midstorey and groundcover vegetation is similar to the eastern bank; the current shading due to such vegetation would be expected to be quite high and thus would not be exacerbated by the presence of future buildings within the subject site. The Assessment of Significance (Appendix B) addresses impacts on the Green and Goldern Bell Frog. There is no viable local population of Green and Golden Bell Frog known to occur in the study area (i.e. the subject site and immediate surroundings that could be impacted by future urban development of the subject site). This assessment indicated that the Planning Proposal will not facilitate development that is likely

Table 4 Response Table

Issue	Where addressed
	to have an adverse effect on the species such that a local viable population is likely to be placed at risk of extinction.
COMMUNITY SUBMISSIONS	
The study is inadequate and improper and has not been assessed properly.	This is a very general statement - there is no detail in this comment as to which aspects of the study are 'inadequate' or 'improper' or have not been assessed properly. Project impacts are fully assessed through a 7 Part Test (Assessment of Signficance) under the Environmental Planning and Assessment Act 1979
The “bat colony” needs to be preserved.	The future residential development of the subject site will not destroy roosting habitat and is unlikely to discourage the future use of the camp site by Grey-headed Flying-fox
Insufficient space for amenities proposed in the Duck River Park.	This is outside the scope of the Ecological Assessment
Building the park will be harmful to the existing ecosystem.	The park is proposed to be built on current industrial land and degraded weed infested areas. It is unclear how this would be harmful to the existing ecosystem.
Masterplan ignores significant environmental issues.	This comment is very general and does not provide specifics as to what issues have supposedly been ignored. As such this commment cannot be addressed further.
Issues require further consideration such as:	
Remnant vegetation and EEC	Endangered Ecological Communities are addressed in Appendix B - with Assessments of Signficance provided for three EECs listed under the TSC Act noted to be present along the Duck River Corridor. This assessment indicated that the Planning Proposal is unlikely to result in a significant impact on these EECs
Impacts of shading on the river and riparian area and on current restoration efforts.	The mid winter shadow studies undertaken to support the Manchester Road Planning Proposal illustrates that there is minimal overshadowing along the Duck River Corridor prior to 9:00am and no overshadowing after 9:00am.

Table 4 Response Table

Issue	Where addressed
Impacts of light and motion pollution on native fish.	It is known that artificial light at night (light pollution) interferes with several physiological processes in fish. The latest Planning Proposal has most residential buildings located away from the Duck River with areas closer to the river containing parklands. Any additional light pollution is therefore likely to be filtered through parklands and through existing riparian vegetation. The proposed car bridge will cause additional light pollution (through car lights) in a localised area. It is noted that existing light pollution is potentially caused by major roads located downstream such as Parramatta Road and the Western Motorway and the Mona Street bridge upstream.
Ecotoxicology	It is unclear what this submission specifically refers to. Ecotoxicology is the study of the effects of toxic chemicals on biological organisms, especially at the population, community, ecosystem, and biosphere levels. The current use of the subject site is as an industrial site. Remediation of the site and redevelopment is not expected to result in the introduction or release of toxic chemicals. Some elevated nutrient levels are likely in stormwater run-off as is the case in most urban areas.
Effects on migratory wading birds.	An assessment of migratory wetland bird species (including waders) listed under the EPBC Act is addressed in Section 6 of the EIA. This has been updated to include two additional migratory wetlands listed under the EPBC Act.
Impact on endangered animal Population	Impacts on both the Green and Golden Bell Frog and the Grey-headed Flying-fox are both addressed - note the Assessments of Significance included in Appendix B. No other threatened animal species or populations were detected during surveys, nor were they considered likely to be present.
Survey of threatened species was inadequate.	The surveys involved targetted surveys based on species predicted as occurring in the locality based on desktop searches. It is unclear from this comment how these searches/surveys were inadequate
Proposed paths along the river would negatively affect the flying fox colony.	The camp site is also close to a foot bridge that experiences a reasonable level of pedestrian traffic. It is unlikely that the future residential development of the subject site will significantly increase these impacts above current levels. The proposed Pedestrian/cycle paths are unlikely significantly or

Table 4 Response Table

Issue	Where addressed
	permanently affect the flying-fox colony in the long term. There are examples where other comparable flying-fox colonies have adapted to persist in proximity to pedestrian and cycle traffic, including at the Royal Botanic Gardens, Parramatta Park along the Parramatta River, Burdekin Park in Singleton and Bicentennial Park in Tamworth along the Peel River.
Statement that the colony is transitory is untrue.	The permanency of the camp site is acknowledged. It is stated that 'Although a permanent camp site, the Duck River colony is transitory in nature and occupies the camp site infrequently and irregularly'. The statement in the EIS that the colony is transitory refers to the intermittent and seasonal use of the camp site. Based on the Duck River Grey-headed Flying-fox Management Plan, the camp appears to be occupied during the warmer months and vacated outside of the breeding season.
Proposed bridge will have a significant impact on "ecological connectivity for Aquatic and riparian species."	The proposed bridge is unlikely to significantly impact on aquatic species as these would continue to be able to move in water under the bridge. The bridge will not impede on water flow. Any riparian bird species would be able to fly over the bridge. It is unclear what other riparian species this comment refers to for which ecological connectivity is likely to be significantly impacted.
High embankments – driving piers into wetlands impacting on river banks.	The area where the bridge is to be located contains very degraded reedlands, and dense weeds including vines shrubs and ground covers. Impacts of driving piers into such vegetation are likely to be minor. Impacts on bank stability would need to be assessed by an engineer.
Upgrading Mona Street Bridge is preferable to the proposed bridge.	This is outside the scope of the Ecological Assessment
Duck River corridor- limited human access to maintain wildlife habitat.	It is unclear how the proposal will prevent access to adjcent riparian areas alond Duck Creek for the purposes of maintaining wildlife habitat . The proposed pathway/cycleway would only improve access to adjacent bushland areas along Duck Creek.
Park is in proposed flood prone area – maintenance burden on the community.	The proposed riverside park is located in an area that is currently industrial land, much of which contains concrete hard surfaces. Creation of a park reduces flood risk by creating softer soil surfaces

Table 4 Response Table

Issue	Where addressed
	that can absorb floodwater. It is unclear what additional maintenance requirements the park supposedly creates. Some flood debris would require removal following a flood event, but this is not likely to be a considerable maintenance burden to the community.
Park prevents ongoing restoration conducted by Auburn and Parramatta Council.	It does not appear that the park would prevent access to adjcent riparian areas alond Duck Creek for the purposes of restoration activities. The proposed park is located on industrial land and its creation would only improve access to adjacent bushland areas along Duck Creek.The Planning Proposal currently proposes parklands along the river as part of a Concept design. As discussed by Context, the amenities proposed in the park are minimal and include two exercise stations, park seating and shelters, which will be located predominantly in areas adjacent to the proposed shared path. The proposed bushland regeneration along the river front will be developed in consultation with the Duck River Regeneration Group but will largely comprise assisted regeneration of the riparian vegetation, namely through weeding.
Office of Environment and Heritage guidelines -30m riparian corridor with no development including paths, within 15m of the river.	It is assumed that this refers to the DPI Office of Water 'Guidelines for riparian corridors on waterfront land'. These Guidelines state that cycleways or paths no wider than four metres total disturbance footprint can be built in the outer 50 per cent of the vegetated riparian zone which for a third order stream is 30m width from the high bank. While we have not been able to assess this fully, it would appear that most of the proposed cycle way is located more than 15m from the high bank of Duck Creek, and is unlikely to be more than 4m in width.
· Removal of vegetation – will increase storm-water run-off and soil erosion.	The removal of hard surfaces and replacement with parkland will is likely to reduce stormwater run-off.The subject site has been entirely cleared of native vegetation and no remnant woodland or forest remains on the site. Low numbers of urban plantings are retained around buildings and in the eastern portion of the site, large bare areas have been established with exotic grasses, presumably for soil stabilisation. The removal of this weedy vegetation could increase soil erosion. Areas of maintained parklands would however be less prone to erosion while not increasing run-off. Further a restoration

Table 4 Response Table

Issue	Where addressed
	program is proposed addressing a section of the Duck River. Such restoration works are intended to improve the condition of the river banks and riparian vegetation for stream health.
OEH SUBMISSION	
1. Conflict between Grey Headed Flying Foxes and residents of the proposed site is most significant concern.	Acknowledged. Recommendations to address such conflicts are provided in Section 8.
2. Likely to receive ongoing complaints from residents were development is to proceed.	Acknowledged. Residents moving into the development will need to be aware that the Grey-headed Flying-fox camp was located where it is before the residential development. Future residents need to be advised of the noises and smells to be expected as a result of living in close proximity to a flying-fox camp.
3. OEH will receive requests for dispersal of the flying fox camp-proven difficult, expensive etc	As above. Residents moving into the development will need to be aware that the Grey-headed Flying-fox camp was located where it is before the residential development. Future residents need to be advised of the noises and smells to be expected as a result of living in close proximity to a flying-fox camp.
4. Reducing bat/human conflict – appropriate planning is needed.	As above. Residents moving into the development will need to be aware that the Grey-headed Flying-fox camp was located where it is before the residential development. Future residents need to be advised of the noises and smells to be expected as a result of living in close proximity to a flying-fox camp.
5. Ecological assessment submitted to council has a major limitation – carried on a day with no flying foxes.	This is noted, both in reference to the original survey in May 2015, and the follow-up survey in early 2016. The Duck River camp was unoccupied when the subject site was visited in May 2015. When the subject site was revisited in late January and early February 2016, no Grey-headed Flying-fox or evidence of Grey-headed Flying-fox activity was observed at the known camp site. No Grey-headed Flying-fox or evidence of Grey-headed Flying-fox activity was observed in the immediate upstream sections of the Duck River. Fly-out patterns could not be observed and assessed further. That

Table 4 Response Table

Issue	Where addressed
	notwithstanding, the presence of flying foxes is assumed and considered fully in the assessment.
6. The camp is permanent not transitory – should be located at least 300m away from human habitation.	The permanency of the camp site is acknowledged. The statement in the EIS is that 'Although a permanent camp site, the Duck River colony is transitory in nature and occupies the camp site infrequently and irregularly'. This statement refers to the intermittent and seasonal use of the camp site. Based on the Duck River Grey-headed Flying-fox Management Plan, the camp appears to be occupied during the warmer months and vacated outside of the breeding season. Cumberland Ecology does not have access to the records referred to by OEH and so cannot comment on this. It is also noted that the 300 metre recommendation is a guideline and that it is not an absolute requirement. The Planning Proposal provides a Concept plan for the site and it is expected that further design will be undertaken at the DA stage. Opportunities to maximise the buffer between the camp and residential buildings will be assessed at that stage.
7. Difficult to predict impact on the camp.	This is noted, however a conservative approach to impact assessment has been adopted and it is considered that the impacts to the camp are adequately considered.
8. Any buffer between camp and development should not create additional habitat for flying foxes.	Planting plans and landscaping designs will consider the use of plants that are not preferred flying-fox habitat species.
9. Odour associated with camps are common complaints.	It is acknowledged that camp odour impacts are common sources of complaint. Based on the distance of the camp site from existing residential development to the west, which is approximately 190 metres away, potential future development at the Manchester Road site (which is greater than 190 metres away) could be designed to minimise odour impacts on future residents so that it is not exacerbated above levels currently experienced by existing residents to the west. Further measures to reduce potential conflicts can be investigated as part of the detailed design phase.
10. 230m buffer is not adequate.	The need for a buffer to the flying fox camp is acknowledged, but it is noted that the 300m separation distance is a guideline and not an absolute requirement. The Manchester Road Planning Proposal is

Table 4 Response Table

Issue	Where addressed
	supported by a preliminary concept plan. As the project progresses, there will be an opportunity for design development that can optimise the buffer between the camp and residential buildings.
11. Council should consider adopting Sunshine Coast Council specifications for building near camps.	This is outside the scope of the Ecological Assessment
12. Restoration of riparian vegetation will likely increase roosting areas for bats.	The proposed bushland regeneration along the river front would be consistent with recovery objectives for both the flying-fox and EECs. The proposal would rely upon assisted regeneration of the riparian vegetation, namely through weeding. It is acknowledged that even without active planting, improvement of native riparian vegetation will increase the attractiveness of the habitat to flying-foxes. The proponent is willing to review the proposal to restore vegetation along the river, e.g. limit works to bank stabilisation as required, etc.
13. Currently fly-out patterns are likely to be affected.	No significant impacts are anticipated to flying-fox flight paths as a result of the proposed buildings. Also, it is understood that flying foxes flight paths will vary seasonally and with changes in food abundance. Further and more detailed studies of flying foxes will be made during later stages of the planning and design process.
14. Removal of vegetation of an Endangered Ecological Community should be avoided if possible.	The proposed pathways and river crossings along Duck River is currently part of a Concept design, within which there is opportunity to avoid and/or mitigate foreseeable impacts to remnant vegetation and EECs along the river during the detailed design of the site. As per information provided by Context, the bridge will be sited so that no threatened ecological communities are removed. The bridge itself will span from upper creekbank to upper creekbank in a single span so as to avoid disturbance to aquatic habitat. Further targeted assessment of detailed designs will be commissioned at a future time for specific DAs.
15. Overshadowing of river is not considered.	The mid winter shadow studies undertaken to support the Manchester Road Planning Proposal illustrates that there is minimal overshadowing along the Duck River Corridor prior to 9:00am and no

Table 4 Response Table

Issue	Where addressed
	overshadowing after 9:00am.
16. Impact of bike track along the river on the flying fox camp has not been addressed.	Pedestrian paths would not significantly or permanently affect the flying-fox colony in the long term. There are examples where other comparable flying-fox colonies have adapted to persist in proximity to pedestrian and cycle traffic, including at the Royal Botanic Gardens, Parramatta Park along the Parramatta River, Burdekin Park in Singleton and Bicentennial Park in Tamworth along the Peel River.
17. Impact on Tadgell's Bluebell and the Green and Golden Bell Frog has not been addressed.	Impacts of Tadgell's Bluebell are addresssed in Section 5. No significant impact is considered likely to Tadgell's Bluebell. With regards to occurrences of Tadgell's Bluebell on the western side of Duck River, the development of the subject site is unlikely to have a direct impact on the riparian corridor or any occurrences within it. Assuming overstorey, midstorey and groundcover vegetation is similar to the eastern bank; the current shading due to such vegetation would be expected to be quite high and thus would not be exacerbated by the presence of future buildings within the subject site. The Assessment of Significance (Appendix B) addresses impacts on the Green and Goldern Bell Frog. There is no viable local population of Green and Golden Bell Frog known to occur in the study area (i.e. the subject site and immediate surroundings that could be impacted by future urban development of the subject site). This assessment indicated that the Planning Proposal will not facilitate development that is likely to have an adverse effect on the species such that a local viable population is likely to be placed at risk of extinction.
18. RailCorp's preparation of a restoration for Duck River has not been mentioned.	The Manchester Road Planning Proposal proposes to review the (Railcorp/Pacific National/Asciano) restoration plan for Duck River in the next stages of the planning process.

Legend

Subject Site

Watercourse

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 200 300 m

I:\...\17161\Figures\Letter 3\20170927\Figure 1. Site Location

Figure 1. Site location

Legend

- Subject Site
- Grey-headed Flying-fox Camp
- Watercourse

Data Source:
Dragonfly Environmental (2014)
Duck River Grey-headed Flying-fox Camp Management Plan

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 25 50 100 150 200 m

I:\...\17161\Figures\Letter 3\20170927\Figure 3. Location GHFF Camp

Figure 3. Location of the Grey-headed Flying-fox Camp at Duck River

Legend

- Subject Site
- Section of Duck River relevant to study
- Watercourse

Vegetation Community

- S_FoW06: Cumberland Riverflat Forest
- S_FoW07: Cumberland Swamp Oak Riparian Forest
- S_FoW08: Estuarine Swamp Oak Forest
- S_FrW03: Coastal Freshwater Wetland
- S_SW01: Estuarine Mangrove Forest
- S_SW02: Estuarine
- Urban_E/N: Urban
- Weed_Ex: Weeds and Exotics

Data Source:
OEH (2016). The Native Vegetation of the Sydney Metropolitan Area. Office of Environment and Heritage NSW.

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 25 50 100 150 200 m

I:\...\17161\Figures\Letter 3\20170927\Figure 4. Vegetation Communities

Figure 4. Vegetation Communities along Duck River

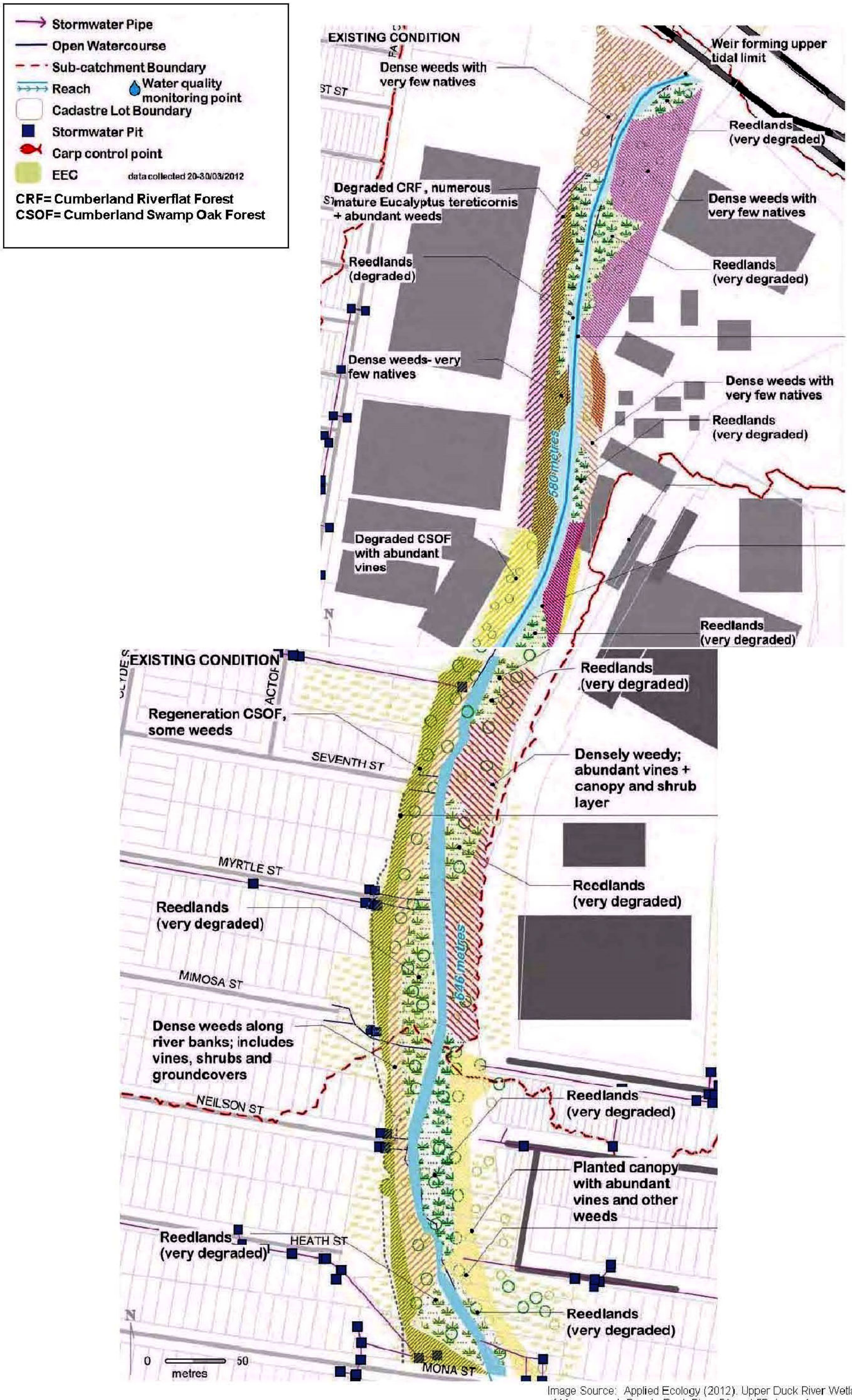

Image Source: Applied Ecology (2012). Upper Duck River Wetlands & Riparian Plan of Management. Reach: Duck River 5A and 5B. Issue 1.

I:\...\17161\Figures\Letter 3\20170927\Figure 5. Existing Condition Duck River

Figure 5. Existing Condition of Duck River