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ASSESSMENT OF KOALA ISSUES

FOR THE GILEAD, APPIN ROAD PLANNING PROPOSAL

OCTOBER 2018

A REPORT PREPARED FOR THE BRTICEVIC FAMILY

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Client Issue

Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
RW2	03/10/18	James Warren	JW	James Warren	JW
Rw3	04/10/18	James Warren	JW	James Warren	JW

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1 INTRODUCTION

1.1 Background

The Gilead, Appin Road Planning Proposal (MacroPlan 2018) seeks to amend (Rezone) Campbelltown Local Environmental Plan 2015 (CLEP2015) to allow for the development of approximately 505 new dwellings with public parks and local shopping facilities. The lands are approximately 600m south of the closest residential properties in Macarthur, being St Helens Park and is located directly to the east of the recently approved Mt Gilead development by Lend Lease.

It is noted that the request for rezoning relates to Lots 10, 11 and 12 of DP613878 and Lots 1, 2 and 3 of DP255351 Appin Road Gilead. The land is owned by the Brticevic Family and the Office of Strategic Lands (OSL) and is hereafter referred to as the 'subject site'.

The Gilead 'subject site' is a 61.3ha site in the combined ownership of 4 private landholders who own 3 separate lots (comprising 16ha) fronting Appin Road and an additional 45.3ha owned by the OSL, land locked and significantly constrained by bushland. The planning proposal only envisages development on existing cleared land (pasture).

The subject site is located within the Campbelltown Local Government Area (LGA) and is within the Greater Macarthur Priority Growth Area (GMPGA). **FIGURE 1** shows the subject site in a sub-regional context. **FIGURE 2** shows the subject site in a local context. **FIGURE 3** shows the proposed development of the subject site.

1.2 Brief

MacroPlan (Town Planners for Brticevic) have requested that James Warren & Associates prepare a short report which addresses the following matters:

- The key issue the DPE is trying to resolve is whether any of the cleared land east of Appin Road should be developed. That land is partly private, and partly Office of Strategic Lands (OSL). The primary concern is the private land, although there is an argument that the revenue that could be raised from development of the cleared land owned by the OSL could be used to acquire other private land that is more valuable koala habitat e.g. east of the Georges River.

- Fauna exclusion fencing will need to be installed along the eastern side of Appin Road regardless of whether development occurs on the eastern side. This fauna exclusion fencing will be required due to the large area of residential development to take place on the western side of Appin Road. The fauna exclusion fencing will prevent the east to west crossing of fauna (including Koalas) on Appin Road. Development on the eastern side of Appin Road i.e. the Brticevic site will require the fencing to be directed away from Appin Road to the east and

LEGEND

Subject Site

0 5km

SOURCE: MacroPlan Dimasi - Gilead Appin Rd Planning Proposal June 2018 Figure 1 SCALE: Approx. 1 : 175,000 @ A4 *James Warren & Associates PTY LTD Ecological Consultants*	CLIENT The Brticevic Family PROJECT Assessment of Koala Issues Gilead, Appin Road Planning Proposal Appin Road, Gilead NSW Campbelltown City Council LGA	**FIGURE 1** PREPARED: BW DATE: 03 October 2018 FILE: MacroPlan Fig1.cdr	TITLE **LOCATION PLAN**

LEGEND

Subject Site

0 300m

SOURCE: MacroPlan Dimasi - Gilead Appin Rd Planning Proposal June 2018 Figure 3

SCALE: Approx. 1 : 10 000 @ A4

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Ecological Consultants

CLIENT
The Brticevic Family

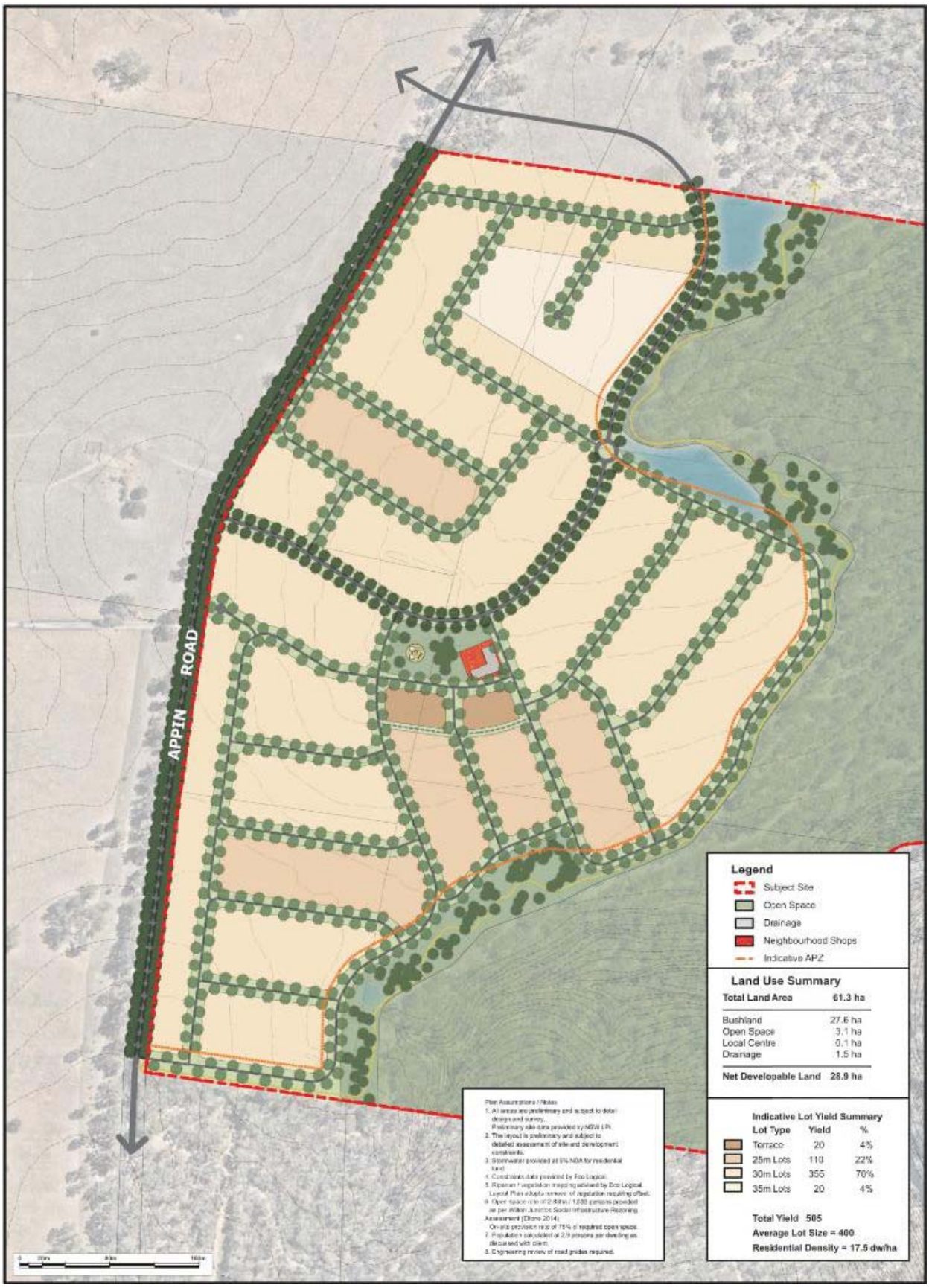
PROJECT
Assessment of Koala Issues
Gilead, Appin Road Planning Proposal
Appin Road, Gilead NSW
Campbelltown City Council LGA

FIGURE 2

PREPARED: BW
DATE: 03 October 2018
FILE: MacroPlan Fig3.cdr

TITLE

AERIAL PHOTOGRAPH



SOURCE: MacroPlan Dimasi - Gilead Appin Rd Planning Proposal June 2018 Figure 3

SCALE: Approx. 1 : 5000 @ A4

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Appin Road, Gilead NSW
Campbelltown City Council LGA

FIGURE 3

PREPARED: BW
DATE: 03 October 2018
FILE: MarcoPlan Fig2.cdr

TITLE

GILEAD MASTERPLAN

follow a path surrounding the Brticevic land when it will then be directed back to Appin Road on the southern side of the Brticevic development land. Therefore, is there any disadvantage in fauna exclusion fencing being installed around the edge of the bushland i.e. at the interface of the Brticevic land and the surrounding bushland rather than along Appin Road?

2 LITERATURE REVIEWED

In addition to relevant literature relating to Koala ecology, I have reviewed the following documents as part of my background preparation for this assessment:

(i) Daniel Lunney, Rob Close, Jessica Bryant, Mathew Crowther, Ian Shannon, Kylie Madden and Steven Ward (2010). The Koalas of Campbelltown, south-western Sydney: Does their natural history foretell of an unnatural future? In The Natural History of Sydney. Eds. D. Lunney, Pat Hutchings and Dieter Hochuli. Royal Zoological Society of NSW Mosman NSW Australia.

In this study, we examined the value of using multiple, independent data sets, generated from different methods, to establish the location of koalas in Campbelltown, and the surrounding area, to derive a more reliable distribution map for the population than those currently available. We undertook this approach to provide a test of the value of independent data sets to establish the location of a population of a peri-urban species, especially one that has had such an impact on the formal planning system as the koala. Further, this study gave us the ability to model koala habitat, establish population studies, enlist community support for koala conservation.

This report contains a number of plans directly relevant to the current assessment. These plans are attached in **APPENDIX 1** and include **FIGURES 8** and **10a**. These figures show the extensive areas of medium to high value habitat to the east (up to 20 km) of the subject site.

(ii) Tristan Lee, Kyall R. Zenger, Robert L. Close, Marilyn Jones and David N. Phalen (2010). Defining spatial genetic structure and management units for vulnerable koala (*Phascolarctos cinereus*) populations in the Sydney region, Australia. *Wildlife Research*, 37, 156–165. Published by CSIRO.

The objectives of the present study were to help guide management decisions aimed at conserving koala populations inhabiting the rapidly changing environment in the Sydney region. The paper seeks to use genetic information to define management units for koala conservation. Potential natural and anthropogenic barriers are also investigated with an aim to determine whether they impede gene flow.

(iii) NSW Office of Environment & Heritage (January 2018) Conserving koalas in Wollondilly and Campbelltown LGAs.

This report identifies high quality koala habitat, core koala habitat, koala movement corridors and roadkill hotspots in the Wollondilly and Campbelltown Local Government Areas (LGAs).

This report contains a number of plans directly relevant to the current assessment. These plans are attached in **APPENDIX 2** and include **FIGURE 4 (**Koala corridors across the Wilton and Greater Macarthur Priority Growth Areas)**, FIGURE 5** (Koala corridors), **FIGURE 6** (Comparison of the Generalised Linear Model of koala habitat/linkage and the new corridor map)**, FIGURE 9 (**Priority areas for restoration in the Wilton and Greater Macarthur Priority Growth Areas), **FIGURE 10 (**Recommended koala roadkill mitigation infrastructure that should be implemented in the Wilton and Greater Macarthur Priority Growth Areas**)** and **FIGURE 11** (Koala movement corridors post-revegetation and all recommended mitigation measures in the Wilton and Greater Macarthur Priority Growth Areas).

(iv) Phillips, S (2016) Campbelltown Comprehensive Koala Plan of Management. Prepared by Biolink for Campbelltown City Council.

The Campbelltown CKPoM's stated objective is to assist in the long-term maintenance and sustainable management of a permanent, free living koala population in the Campbelltown LGA.

Two of the key outcomes of the plan preparation are:

- *The historical records indicate that koalas have a long history of occupation in the Campbelltown LGA. The population appears to have been on a recovery trajectory over at least the last three koala generations.*

- *The recovery trend is well supported by analysis of changes in the key range parameters EoO and AoO. There have been progressive increases in the EoO leading up to the mid 1990s, with that for the, three last koala generations exceeding that of all generations before it. The current EoO for koalas in the Campbelltown LGA approximates an area of 14,000ha.*

EoO – Extent of Occupancy
AoO – Area of Occupancy

This report contains a number of plans directly relevant to the current assessment. These plans are attached in **APPENDIX 3** and include **FIGURES 2.1, 5.1, 5.3** and **APPENDIX C FIGURE 4.**

(v) **Mary O'Kane (December 2016) Report of the Independent Review into the Decline of Koala Populations in Key Areas of NSW. NSW Office of the Chief Scientist & Engineer.**

A low density peri-urban population Campbelltown LGA is situated in the south-west metropolitan area of Sydney and illustrates a case of a low density population that is persisting. The current population is estimated at between 100 and 150 individuals over an area of 31, 166 hectares, representing a low density population (Biolink, 2016). The current population within Campbelltown LGA is best described as stable or increasing, acknowledging that the population is low and always has been (Close, Ward, & Phalen, 2015). The Campbelltown case makes the point that a low density population does not lead to the conclusion that it is in decline or unviable. The Campbelltown koala population is the longest known koala population to Europeans in Australia, with the first sighting recorded in January 1798 (Lunney, Close, Bryant, Crowther, Shannon, Madden, & Ward, 2010). This population has persisted through early settler land clearance and a series of fires last century. Close et al. (2015) provide findings from a 20-year radio-tracking study showing that female koalas lived long lives and produced multiple offspring. The type and level of threat affecting a population can change over time and the present significant threats for this area are vehicle collision, domestic dog attack and habitat loss. Campbelltown currently has a draft CKPOM, which if approved, will provide support for data gathering on the koala population and define management strategies for their future.

(vi) Eco Logical Australia (April 2018) Terrestrial Ecology Constraints Assessment. Letter to the Brticevic Family.

This letter outlines the methods, results and recommendations of the preliminary desktop review and field survey of potential terrestrial biodiversity constraints within the land at Appin Road, Gilead. The study area comprises six lots, three with frontage to Appin Road (Lots 10, 11 and 12 of DP613878), three rear lots (Lots 1, 2 and 3 of DP255351).

The purpose of this letter is to highlight the key terrestrial biodiversity constraints which may affect future planning and development within the study area.

The Eco Logical Report is contained in **APPENDIX 4**.

3 RATIONALE

The most significant threats to long-term koala population viability in the Campbelltown LGA are habitat loss and fragmentation, wildfire, incidental mortalities due to vehicle-strike and domestic dog attack and habitat loss (Phillips 2016).

These issues can be mitigated by:

- legislating against loss of critical habitat;
- identifying, conserving and/or creating new core and corridor habitat;
- legislating against the use of fire for land management purposes;
- preparing fire management plans, establishing fire breaks etc.;
- preventing Koalas from access to highly dangerous road crossings;
- preventing/reducing the chances of, dogs and Koalas from coming into contact.

Each one of theses issues requires consideration when completing an assessment of the viability of developing the Subject site.

4 HABITAT LOSS AND FRAGMENTATION

Reed and Lunney (1988) (in a paper submitted for Koala Summit – Managing Koalas in New South Wales), identify habitat loss as the key problem for the long-term survival of Koalas. Loss of potential Koala habitat continues to contribute to population decline across the Koala's range (Phillips *et al*. 2011).

A 1986 survey of the distribution of Koalas revealed that the majority of Koalas occurred on the North Coast of New South Wales, although their distribution west of the Great Divide and in the southern portion of the state was extensive but highly fragmented (Reed *et al*. 1990). The relatively widespread distribution 'masks' the significant losses of Koala habitat since European settlement and reflects the preferential selection of tree species by Koalas. The preferred species typically are restricted to higher nutrient soils (Moore and Foley 2000) of which substantial portions have been converted to farmland and residential development.

The increase in urban development of the metropolitan areas of Greater Sydney has caused a habitat conflict with Koalas. The removal of high quality Koala habitat to accommodate development forces Koalas to occupy sub-optimal habitat, causes fragmentation of core populations and reduces dispersal options.

Along with overall habitat destruction, habitat fragmentation is also a significant problem associated with decreasing Koala numbers (Lunney *et al*. 2007; TSSC 2012a, 2012b). The influence of patch size, shape and connectivity are key factors determining the ability of

a landscape to support viable Koala populations (Phillips *et al*. 2011). Additionally, the chance of Koalas being present declines as patch sizes become smaller than ~150 ha. Koalas are more likely to occur in patches within ~100 m of one another compared to patches of vegetation that are more isolated. Small populations that are highly isolated tend to suffer higher extinction risks than populations that are connected to each other via animal movement. Immigration or recruitment into a population can provide a 'rescue' effect and can help maintain genetic diversity (McAlpine *et al*. 2007).

A significant result of this process of habitat loss and fragmentation is the increased likelihood of Koalas coming to the ground to access increasingly fragmented habitat.

The retention/creation of good quality habitat as corridor is vital in a fragmented landscape.

5 BUSHFIRE

Koalas are sedentary animals and not especially mobile and therefore stand little chance of surviving large-scale bushfires. Throughout the east coast of NSW, fire continues to threaten Koala populations and is increasingly being recognised as a key factor influencing long-term population viability (Phillips and Pereoglou 2004, Phillips and Hopkins 2012).

Wildfire has the potential to exacerbate Koala population decline by removing animals in a breeding population at a rate faster than the time required for the loss to be replaced by successive Koala generations (Starr 1990; Melzer *et al*. 2000). Regeneration of fire-affected areas is typically slow, so the food resource is reduced for the remaining Koalas not killed by fire. Widespread canopy scorch presumably results in starvation for the remaining animals (Melzer *et al*. 2000).

6 VEHICLE COLLISIONS

O'Kane (2016) notes *Roads can have a negative impact on koala populations due to increased competition for habitat, territorial disputes and increased stress levels (AMBS, 2011), and road-related injuries can be a major cause of mortality and entry into care for koalas (Lunney, Lemon, Crowther, Stalenberg, Ross, & Wheeler, 2012).*

Roads and Maritime Services (RMS) practice for new roads in koala habitat is to avoid (where possible), mitigate and offset impacts on koalas and koala habitat. Where required, RMS implements a range of mitigation actions including fauna movement structures to facilitate movement as well as koala grids and fencing to prevent road access at certain points and to redirect koalas to connectivity structures. RMS also undertakes pre-clearing processes to minimise risk to koalas during construction. These different methods have a range of costs, maintenance requirements and understanding of their effectiveness. Barrier and exclusion fencing is intended to reduce strike

mortality, however, creating barriers may exacerbate habitat fragmentation caused by road development (AMBS, 2011). Fauna movement structures include underpasses and overpasses. While commonly used worldwide, with a variety of taxa recorded to use them (AMBS, 2011), there is limited understanding of how they benefit koala populations.

The impact of motor vehicles on Koalas nation-wide is clearly significant although virtually impossible to quantify (Phillips 1990). The construction of roads through Koala habitat or between habitat areas forces Koalas to cross roads as part of their natural foraging or dispersal behaviours.

A recent ABC report by Greg Miskelly on August 2018 (http://www.abc.net.au/news/2018-08-13/nsw-government-road-kill-files-reveal-states-koala-plight/10088916) states that *According to the latest data, koala numbers in NSW have fallen over 25 per cent in two decades — from 45,000 to 36,000. Car strikes far outweigh dog attacks as the cause of accidental death. On Sydney's south west outskirts nine koalas have been killed on Appin Road, south of Campbelltown, out of a population where as few as 200 animals may survive. A spokesperson for the NSW Environment Minister said that $3.3 million in funding had been assigned to a program to fix priority hotspots around the state, including upgrades to fencing.*

Phillips (2016) notes that *The numbers of koalas being killed by vehicle-strike is also increasing commensurate with recovery of the Campbelltown koala population generally.*

7 DOG ATTACK

Koalas moving between habitat areas sometimes encounter domestic dogs. The incidence of Koala injuries and deaths resulting from altercations with dogs is growing and, in urban areas and adjoining forest habitat, uncontrolled dogs have a serious impact on Koala populations (Phillips *et al.* 2011; DECC 2008; Qld EPA 2006). The Australian Koala Foundation estimates that approximately 4000 Koalas are killed by dogs and cars each year (AKF undated). On average, approximately 110 koalas are attacked and killed by dogs each year in QLD (DERM 2009). No comparable data is available for NSW. Most dog attacks are fatal, making dog attacks the third most common cause of death after disease (relating to habitat loss) and vehicle strikes. However, not all dogs attack Koalas. Dogs over 10 kg are attributed to 96% of attacks on koalas (DERM 2009). Generally, the larger the dog, the greater the likelihood that it could be responsible for a fatal attack on a Koala.

8 ASSESSMENT

8.1 Habitat Loss and Fragmentation

The land proposed for development within the subject site is characterised by a generally cleared and grassed landscape utilised for cattle grazing purposes (MacroPlan 2018 and

Eco Logical Australia 2018). The proposed development of the site would not include removal of any substantively vegetated lands. Much of the intact vegetation occurs in the Office of Strategic Lands portions of the site.

Eco Logical (2018) note that the subject site is characterised by three (3) Plant Community Types (PCT's):

- Sydney Hinterland Apple-Blackbutt Gully Forest (PCT 1181);
- Sydney Hinterland Grey Gum Ridgetop Forest (PCT 1081); and
- Cumberland Shale-Sandstone Ironbark Forest (PCT 1395).

Of these three vegetation communities, Cumberland Shale-Sandstone Ironbark Forest corresponds with the threatened ecological community (TEC) Shale Sandstone Transition Forest in the Sydney Basin Bioregion. This ecological community is listed as Critically Endangered under the *Biodiversity Conservation Act 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This community is also considered to be High Quality Koala habitat (OEH 2018).

In order to protect ecological and aquatic values in the study area, Eco Logical Australia (**APPENDIX 1**) recommended the implementation of several key measures, including:

- Retaining the Shale Sandstone Transition Forest;
- Protection of Grey Gums recognised as core Koala habitat; and
- Limiting development to low constraint areas, being the parts of the site that are cleared and contain only exotic grasses.

It appears that the cleared land on the subject site would have been the TEC PCT 1395. Any rehabilitation of the cleared portions of the site would need to comprise species characteristic of this PCT.

MacroPlan (2018) note that *The mitigation measures proposed by Eco Logical have been incorporated into the masterplan and should be implemented as part of future development applications.*

It seems quite obvious when reviewing most plans provided in APPENDICES 1, 2 and 3 that the loss of isolated paddock trees and the grazing land on the subject site would not constitute a fragmentation of the landscape habitats.

Didham (2010) states that *Habitat fragmentation is an umbrella term describing the complete process by which habitat loss results in the division of large, continuous habitats into a greater number of smaller patches of lower total area, isolated from each other by a matrix of dissimilar habitats, and is not just the pattern of spatial arrangement of remaining habitat*.

Phillips (2016) and OEH (2018) provide a review and mapping of the wildlife (Koala) corridors they consider appropriate for the locality. I have provided comment on both documents as follows:

Phillips (2016)

Phillips shows a schematic illustration showing key koala Habitat Linkage Areas (HLA) within the Campbelltown LGA in Figure 5.3 of the Campbelltown CKPoM (**APPENDIX 3**). One of the Key HLA's in this plan is located immediately to the east of the subject site and appears to follow the Georges River in a north to south direction. This corridor seems to be consistent with the Georges River corridor shown in Figures 5 and 6 (**APPENDIX 2**) of the OEH (2018) report. This corridor is very wide (kms) when considering that the mapping in both reports only considers the extent to the eastern boundary of the Campbelltown LGA. A review of the plans contained in Lunney *et al* (2010) (**APPENDIX 1**) shows the extensive areas of protected habitat across Sutherland Shire to the east coast. It is understood that a lot of the habitat in Sutherland Shire is Secondary Class C habitat (**APPENDIX 3 – FIGURES 5.1 and 5.3**) with higher quality Koala habitat in the gullies. There are, however, koala records in these extensive habitats across to Sutherland Shire (**APPENDIX 2 FIGURE 5 and APPENDIX 3 – Appendix C FIGURE 4**).

OEH (2018)

The OEH (2018) corridor mapping as with the Phillips (2016) mapping considers only the Campbelltown LGA.

OEH (2018) note that *the most important corridor in terms of the amount of core koala habitat, the highest numbers of koala potentially supported, and largest and longest link across the GAs was the Nepean corridor (1,742.58 ha and 91 koalas, respectively). The Allen's Creek and Cataract corridors, which are key links between the Nepean corridor and the intact bushland to the east (towards the Cordeaux, Cascade, and Wallandoola-Cataract corridors), also contained large amounts of core koala habitat and potentially supported 64 and 20 koalas, respectively.*

Comment: Based on the above assertions it would seem that the most critical aspect of corridor conservation/rehabilitation should focus on the east to west linkages from the Georges River to the Nepean River (**APPENDIX 2 – FIGURES 5 and 6**). Embellishment of other corridor areas e.g. the robust Georges River corridor (**APPENDIX 2 – FIGURES 5 and 6**) would seem to be a secondary priority.

OEH (2018) also note that *Primary corridors, particularly to the east of Appin Road adjacent to the Greater Macarthur GA and in the south-east section of the Wilton GA, are currently mapped adjacent to cleared areas (see Figures 5 and 6). These cleared areas have been excised from the primary corridors as they do not currently support core koala habitat and koala records; they have been historically cleared of core koala habitat. Nevertheless, koalas will traverse cleared areas, and in this context, cleared areas adjacent to primary koala corridors could be informally considered part of primary corridors (outside of criteria used to categorise corridors).*

Comment: The OEH (2018) document contains a definition of Primary corridor i.e. ***Primary corridors****: are the most important linkages of koala habitat for the regional koala population in the local area around the Wilton and Greater Macarthur GAs. They contain patches of 'core' koala habitat which are contiguous (gaps between trees are less than 100 m) and together contain over 380 ha of core habitat. They are the most important koala habitat in which the bulk of koalas in the area live and breed. The breaking or weakening of primary corridors will have serious ramifications on the long-term viability of the koalas in the area, and thereby, the regional koala population.*

This definition does not provide for the inclusion of cleared areas adjacent to Primary corridor habitat to be included as Primary corridor.

OEH (2018) also note that *Regarding the Greater Macarthur GA, there are many high priority restoration areas. The most obvious areas are along the length of the eastern side of the GA, to the east of Appin Road, directly adjacent to the Georges River corridor (Figure 9). Other areas (not shown in Figure 9) include areas to the east of the Ousedale-Mallaty corridor to complete a corridor connection (on both ends) for a secondary corridor currently connected to a primary corridor at one end.*

Comment: It seems counterintuitive to be saying that *the most obvious areas are along the length of the eastern side of the GA…* From another perspective it seems obvious that the highest priority restoration areas should be the tenuous linkages between the Georges River and the Nepean River. Why add to an already robust Georges River corridor when it seems that the linkages through the Greater Macarthur GA are in critical need of restoration.

OEH (2018) states that *If cleared land was developed rather than restored, this would introduce significant threats and compromise the adjacent corridor values.*

Comment: The types of *significant threats* have not been described. Threatening processes, however, acting on Koalas and their populations are reasonably well known and have been described in this assessment report. The Campbelltown CKPoM has provided the strategies to be implemented in the LGA with future development. These strategies are well known and would not be accepted if it was considered that they would not mitigate impacts on the Campbelltown Koala population. Strategies such as provision of vegetated buffer zones, asset protection zones, fauna exclusion fencing, dog and cat control constitute ecological "best practice" with modern residential developments.

8.2 Bushfire

Residential development in hinterland bushland areas can lead to an increased risk of bushfire due to accident or arson. These risks can be managed in accordance with the recommendations from Phillips (2016) in their Comprehensive Koala Plan of Management i.e.

(i) Council will encourage all relevant authorities and landowners to adopt a 'minimal use of fire' policy within KMPs identified by the Plan by way of:
(a) undertaking bush fire hazard reduction using mechanical means
(b) extinguishing any bushfire at the first practical opportunity.
(ii) Council will ensure that maps indicating the location of core koala habitat areas within the Council LGA are made available to all RFS stations.
(iii) Council will instigate appropriate koala awareness training for RFS members, Council staff and others involved with the management of fire, assessment of DAs and provision of hazard reduction certificates.
(iv) Council will assist the RFS in conducting community education in respect to the processes required to manage bushfires and hazard reduction in KMPs.
(v) Council will assist in the preparation of protocols for land management agencies and the RFS to cooperate with the local

Phillips (2016) also notes that *While management of fire is outside of the control of Campbelltown Council, it is hoped that through the workings of the Plan, Council will be able to influence the management of fire to reduce the potential for negative impact, and effectively reduce habitat loss*

It could be argued that residential land along the eastern side of Appin Road would provide a break zone for the protection of assets (residential) on the western side of Appin Road.

8.3 Vehicle Collisions

The upgrade of Appin Road due to the high volumes of traffic to be generated by development on the western side of Appin Road in the near future will require the installation of infrastructure, utilised by RMS in other areas of New South Wales, to mitigate impacts on wildlife generally and in particular Koalas. These infrastructure developments will include fauna exclusion fencing along the eastern boundary of Appin Road. Normally these fences would funnel wildlife to either overpasses or underpasses. Obviously, these overpass/underpass structures would need to enable wildlife to safely disperse into established habitat/corridor habitat on the western side of the road.

It should be noted:

- The subject site contains little or no Koala forage value and would not be functioning as part of a local, sub-regional or regional corridor either for safe north-south or east-west movements.

- Koalas are likely to be currently accessing the subject site from east to west in dispersal movements. Koalas undertaking these movements will not be utilising the subject site for forage purposes but only for making unsafe dispersal movements across open ground. The Koalas will then be crossing Appin Road;

- The installation of fauna exclusion fencing along the eastern boundary of Appin Road would prevent Koalas from crossing Appin Road from east to west.

- There would be no reason for RMS to provide an overpass/underpass at the frontage to the subject site due to the subject sites lack of value as a local, sub-regional or regional corridor.

- The proposed use of the subject site for residential development will have no implications for the location of the fauna exclusion fencing. It will not matter whether the fencing is located along the eastern boundary of Appin Road or is located around the boundary of the subject site.

8.4 Dog Attack

Phillips (2016) has included the following measures in the Comprehensive Koala Plan of Management for Campbelltown:

> *(a) Either the keeping of domestic dogs on any new residential lots arising from the subdivision of land shall be prohibited by an effective restriction as to user on the title of the land or other suitable planning measure*
>
> *(b) Resulting residential lots must be the subject of a covenant, imposing a legal requirement to install a dog-proof yard, whether the prospective owner has the immediate intention of owning a dog or not. The yard must enclose a PKFT-free, minimum area of approximately 300m^2 around a residential dwelling or part thereof. Yard-fencing must be a minimum of 1.8 m high and either be partially buried or have an associated buried component to a minimum depth of 0.3m. All gates into the enclosed area must be of the same height and general structure as the yard-fence and must have minimum clearance above ground to allow for swinging of the gate, below which must be a solid barrier such as concrete to deter digging.*

The implementation of these recommendations is considered sufficient to ensure the impact of dog attacks on Koalas is substantially mitigated in any residential development within the LGA.

APPENDIX 2 (**FIGURES 10** and **11**) show the proposed location of fauna exclusion fencing along Appin Road. The diversion of this fencing in and around the proposed development in the subject site would effectively provide separation of Koala habitat from the residential development and domestic dogs.

9 CONCLUSIONS

I have completed a review and assessment of a number of documents relevant to the proposed rezone and future development of the Lots 10, 11 and 12 of DP613878 and Lots 1, 2 and 3 of DP255351 Appin Road Gilead. The land is owned by the Brticevic Family and the Office of Strategic Lands (OSL). In relation to the questions contained in my brief I conclude as follows:

The key issue the Department of Planning and Environment (DPE) is trying to resolve is whether any of the cleared land east of Appin Rd should be developed.

There appears to be no scientific reason why the Brticevic land could not be developed. I base this conclusion on the following:

- The subject site has been included in the Greater Macarthur Priority Growth Area;
- All threatening processes considered relevant to the Campbelltown Koala population e.g. habitat loss, provision of corridor habitat, vehicle collision, dog attack, fire management have been assessed in the Campbelltown CKPoM and detailed recommendations provided. All strategies are considered to be effective given that there will be long term maintenance of infrastructure.
- OEH have provided no scientific evidence to preclude development from the subject site. The scientific evidence they have provided, correctly, shows that an important corridor occurs along the Georges River and surrounding habitats. It is not sufficient to then state that it is obvious that all cleared areas in the vicinity should be classified as Primary corridor. Particularly as their own definition does not provide for the inclusion of cleared lands.
- It seems counterintuitive for OEH to be promoting the restoration of the lands east of Appin Road as the priority when it seems that the corridors linking the Georges and Nepean River i.e. crossing through the Greater Macarthur Priority Growth Area should be the priority.

Is there any disadvantage in fauna exclusion fencing being installed around the edge of the bushland i.e. at the interface of the Brticevic land and the surrounding bushland rather than along Appin Road?

- The subject site is characterised by cleared land with very little vegetation to be lost. All of the highest quality plant communities will be conserved.
- The installation of fencing around the perimeter of the subject site will perform the same function regardless whether it is installed around the perimeter of the

subject site or along the eastern boundary of Appin Road. If the fence is to be considered to be fulfilling a fauna exclusion function along Appin Road, it will perform the same function around the perimeter of the subject site. When viewed in a local and subregional context (**APPENDIX 1 – FIGURE 10A and APPENDIX 2 – FIGURES 5 and 6 and APPENDIX 3 – FIGURE 5.3**) it appears obvious that an incursion of fencing up to 600 metres east of Appin Road is insignificant.

- Regardless of the development of the subject site a fauna exclusion fence will be provided along the eastern boundary of Appin Road from St Helens Park to Gilead. The fence will pass the subject site. The fencing is proposed for further extension south in due course.

- There appears to be no scientific basis for preventing the exclusion fence from deviating east from Appin Road, traversing the perimeter of the subject site and then linking up with Appin Road again on the southern boundary of the subject site.

10 REFERENCES

AKF (undated) Australian Kola Foundation. Accessed online 14th April 2011: https://www.savethekoala.com/index.html

AMBS (2011) *Investigation of the Impact of Roads on Koalas*. Report prepared for the NSW Roads and Traffic Authority by Australian Museum Business Services, Sydney.

DECC (2008) *Approved Recovery Plan for the Koala (Phascolarctos cinereus)*. New South Wales Department of Environment and Climate Change.

DERM (2009) *Dogs and Koalas Fact Sheet*. Department of Environment and Resource Management Plan.

Didham R.K. (2010) Ecological Consequences of Habitat Fragmentation. University of Western Australia and CSIRO Ecosystem Sciences, Perth WA. Published online at: https:// doi.org/10.1002/9780470015902.a0021904

Eco Logical Australia (2018) *Terrestrial Ecology Constraints Assessment*. Letter to the Brticevic Family, April 2018.

Koala Summit: managing koalas in New South Wales: proceedings of the Koala Summit held at the University of Sydney, 7-8 November 1988 / edited by Daniel Lunney, Chris Ann Urquhart and Philip Reed.

Lunney, D., Close, R., Bryant, J., Crowther, M., Shannon, I., Madden, K. and Ward, S. (2010) 'The Koalas of Campbelltown, south-western Sydney: Does their natural history foretell of an unnatural future?' In *The Natural History of Sydney*. Lunney, D., Hutchings, P. and Hochuli, D. (Eds.) Royal Zoological Society of NSW Mosman NSW Australia.

Lunney, D., Gresser, S., O'Neill, L.E., Matthews, A. and Rhodes, J. (2007) The impact of fire and dogs on Koalas at Port Stephens, New South Wales, using population viability analysis. *Pacific Conservation Biology,* **13**:189-201.

Lunney, D., Lemon, J., Crowther, M.S., Stalenberg, E., Ross, K. and Wheeler, R., (2012) An ecological approach to koala conservation in a mined landscape, in *Proceedings Life-of-Mine 2012*, pp 343-352 (The Australasian Institute of Mining and Metallurgy: Melbourne).

MacroPlanDimasi (2018) *Gilead, Appin Road Planning Proposal*. Report prepared for The Brticevic Family. June 2018.

McAlpine, C.A., Rhodes, J., Peterson, A., Possingham, H.P., Callaghan, J., Curran, T., Mitchell, D. and Lunney, D. (2007) *Planning guidelines for koala conservation and recovery*. University of Queensland. Brisbane.

Melzer, A., Carrick, F., Menkhorst, P., Lunney, D., St. John, B. (2000) Overview, critical assessment, and conservation implications of koala distribution and abundance. C*onservation Biology* **14**:619–628.

Moore, B.D. and Foley, W.J. (2005) Tree use by koalas in a chemically complex landscape. *Nature* **435**:488-490.

NSW Office of Environment & Heritage (2018) *Conserving koalas in Wollondilly and Campbelltown LGAs*. January 2018.

O'Kane, M. (2016) *Report of the Independent Review into the Decline of Koala Populations in Key Areas of NSW*. NSW Office of the Chief Scientist & Engineer, December 2016.

Phillips, S. (2016) *Campbelltown Comprehensive Koala Plan of Management*. Prepared by Biolink for Campbelltown City Council.

Phillips, S., and Hopkins, M. (2012) *Byron Coast Koala Habitat Study*. Report to Byron Shire Council. Biolink Ecological Consultants.

Phillips, S., Hopkins, M., and Shelton, M. (2011) *Tweed Coast Koala Habitat Study. Report to Tweed Shire Council*. Biolink Ecological Consultants.

Phillips, S., and Pereoglou, F. (2004) *Kings Forest Draft Koala Plan of Management*. Unpublished report. Biolink Ecological Consultants.

Phillips, W. (1990) "Koalas The Little Australian We'd All Hate to Lose" Australian National TSC (2010). Companion Animals Management Plan Version 1.0 Tweed Shire council. Adopted by the Council at its meeting on 16th March 2010 minute No: 152.

Queensland Government - Environment Protection Authority (2006) *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016*. Queensland Government - Environment Protection Authority.

Reed, P. C., Lunney, D., and Walker, P. (1990) "A 1967-87 Survey of the Koala, *Phascolarctos cinereus* in New South Wales and an Ecological Interpretation of its Distribution". A Paper presented to the Third Symposium on the Biology of the Koala, Melbourne February 1988.

Starr, J. (1990) Management of koalas in an urban environment. In *Biology of the koala*. Lee, A.K., Handasyde, K.A., Sanson, G.D. (Eds) pp. 319–321 (Surrey Beatty and Sons: Sydney).

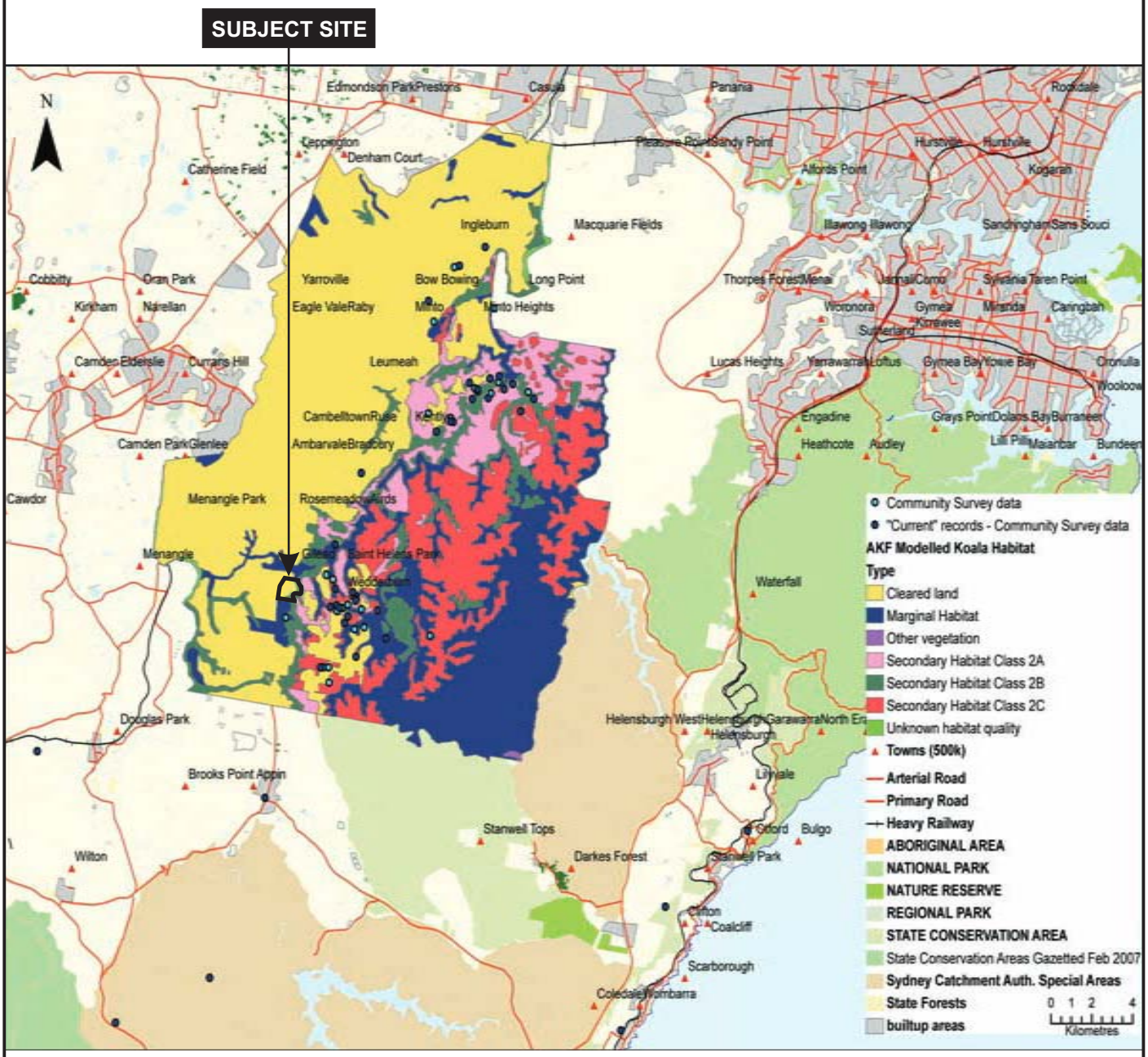
Threatened Species Scientific Committee (TSSC) (2012a) Commonwealth Conservation Advice on *Phascolarctos cinereus* (combined population in Queensland, New South Wales and the Australian Capital Territory). Accessed online:

http://www.environment.gov.au/biodiversity/threatened/species/pubs/197-conservation-advice.pdf. In effect under the EPBC Act from 02-May-2012.

Threatened Species Scientific Committee (TSSC) (2012b) Listing advice for *Phascolarctos cinereus* (Koala). Accessed online: http://www.environment.gov.au/biodiversity/threatened/species/pubs/197-listing-advice.pdf. In effect under the EPBC Act from 02-May-2012.

Tristan, L., Zenger, K., Close, R., Jones, M. and Phalen, D. (2010) Defining spatial genetic structure and management units for vulnerable koala (*Phascolarctos cinereus*) populations in the Sydney region, Australia. *Wildlife Research* **37**:156–165.

APPENDIX 1 – PLANS FROM LUNNEY *ET AL*. (2010)



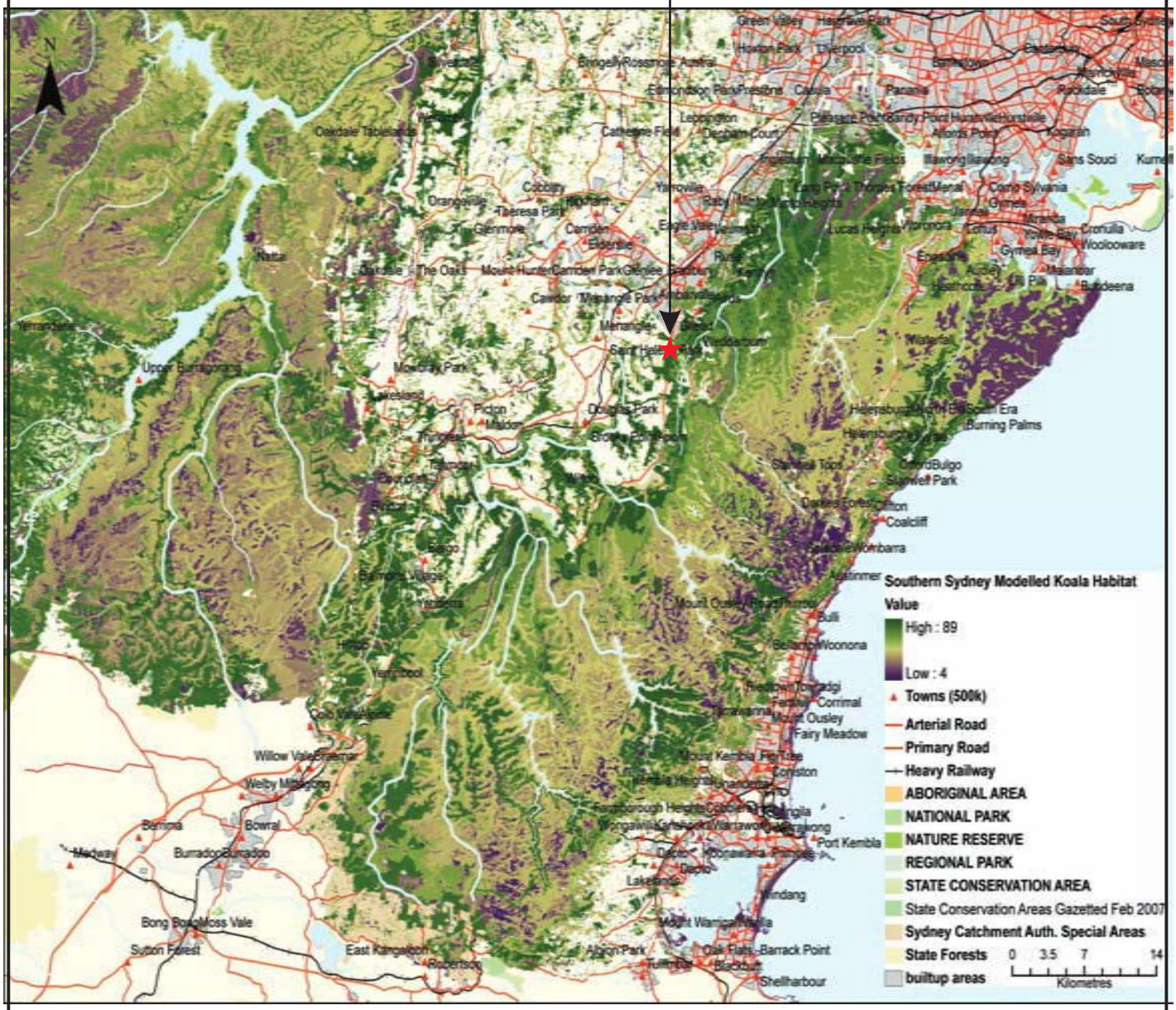
LEGEND
Subject Site

N

0 5km

SOURCE: Lunney et al. 2010 Figure 8 SCALE: Approx. 1 : 250,000 @ A4 *James Warren & Associates PTY LTD Ecological Consultants*	CLIENT The Brticevic Family PROJECT Assessment of Koala Issues Gilead, Appin Road Planning Proposal Appin Road, Gilead NSW Campbelltown City Council LGA	**FIGURE 8** PREPARED: BW DATE: 03 October 2018 FILE: Job no_Lunney Fig8.cdr	TITLE **2006 COMMUNITY RECORDS & AKF MODELLED KOALA HABITAT**

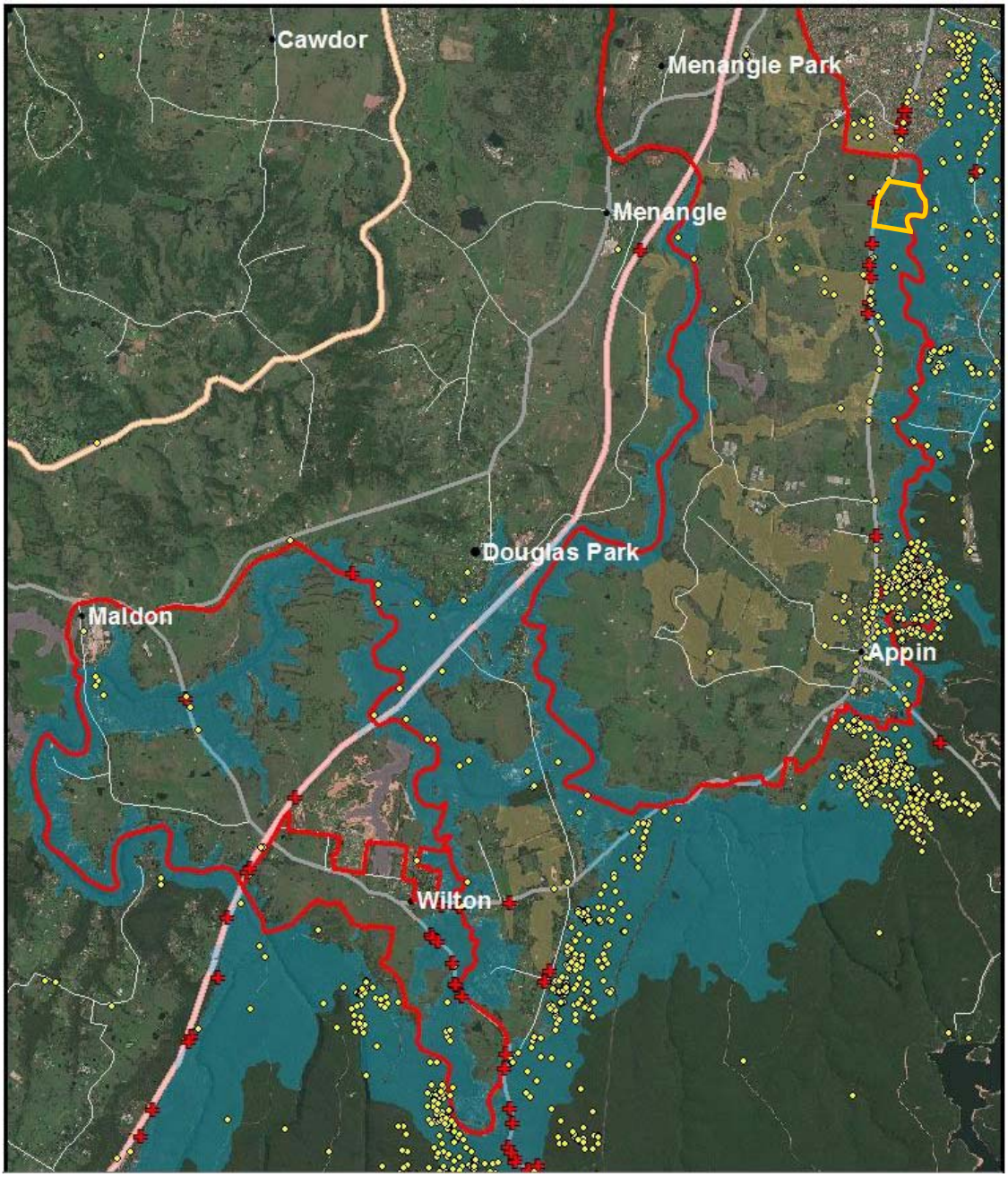
SUBJECT SITE



0 10km

SOURCE: Lunney et al. 2010 Figure 10a SCALE: Approx. 1 : 500,000 @ A4 *James Warren & Associates PTY LTD Ecological Consultants*	CLIENT The Brticevic Family PROJECT Assessment of Koala Issues Gilead, Appin Road Planning Proposal Appin Road, Gilead NSW Campbelltown City Council LGA	**FIGURE 10A** PREPARED: BW DATE: 03 October 2018 FILE: Lunney Fig10a.cdr	TITLE **KOALA HABITAT MODELLED USING VALIDATED SUBSET OF THE WILDLIFE ATLAS DATA**

APPENDIX 2 - PLANS FROM NSW OFFICE OF ENVIRONMENT & HERITAGE (2018)



LEGEND

- Subject Site
- Koala Records
- Road Kill Koala
- Priority Growth Area
- Primary
- Secondary
- Tertiary

N

0 3 km

SOURCE: OEH - Conserving Koalas in the Wollondilly and Campbelltown LGA's Figure 4

SCALE: Approx. 1 : 125,000 @ A4

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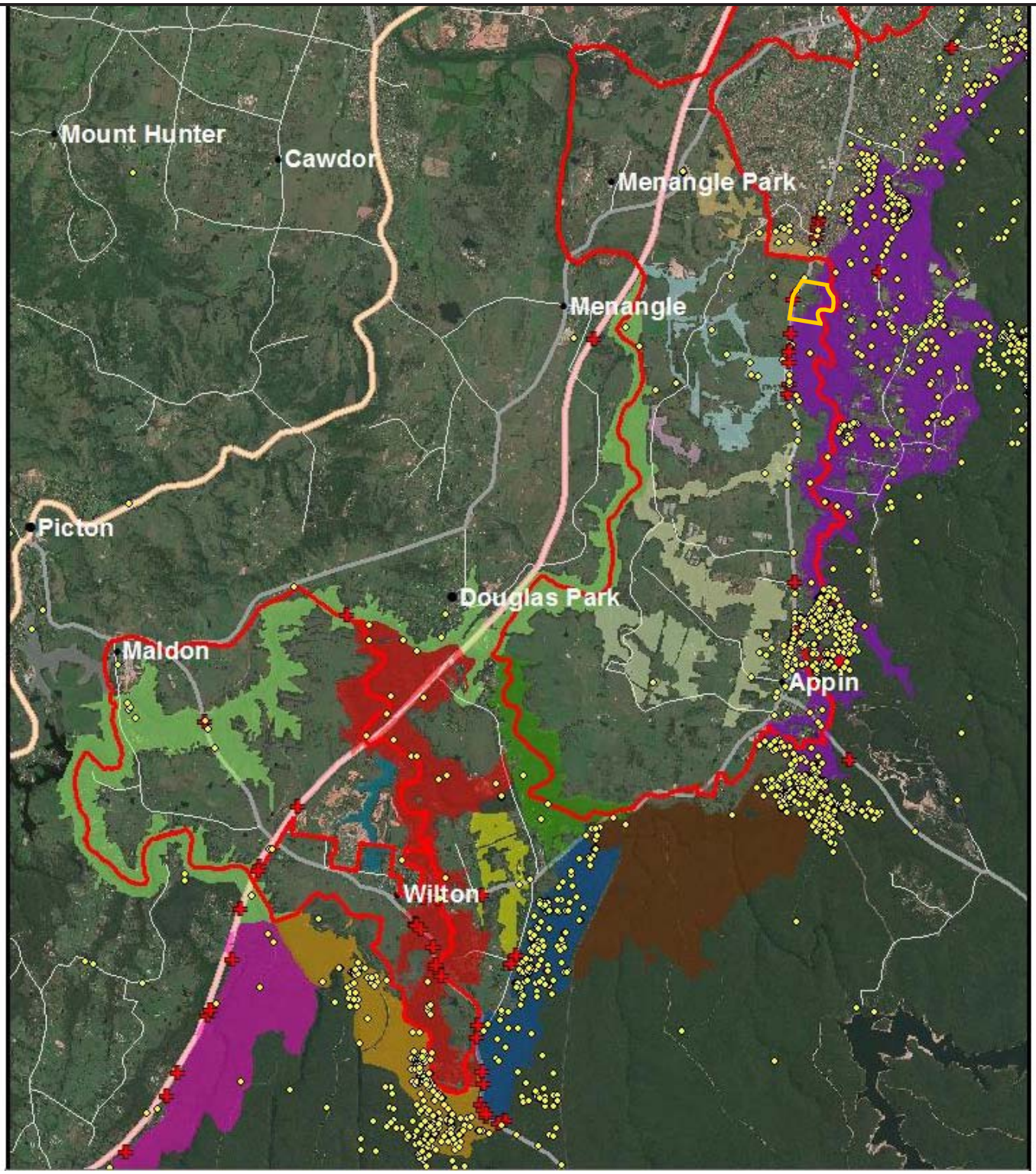
FIGURE 4

PREPARED: BW
DATE: 03 October 2018
FILE: OEH Fig4.cdr

TITLE
KOALA CORRIDORS ACROSS THE WILTON & GREATER MACARTHUR PRIORITY GROWTH AREAS



LEGEND

- Subject Site
- Koala Records
- Road Kill Koala
- Priority Growth Area
- Allens
- Avon-Nepean
- Cascade
- Cataract
- Clements
- Cordeaux
- Georges
- Leafs Gully
- Myrtle
- Nepean
- Noorumba
- Ousedale-Mallaty
- Simpsons-Elladale
- Stonequarry
- Stringybark
- Wallandoola-Cataract
- Woodhouse-Menangle

0 3 km

N

SOURCE: OEH - Conserving Koalas in the Wollondilly and Campbelltown LGA's Figure 5

SCALE: Approx. 1 : 125,000 @ A4

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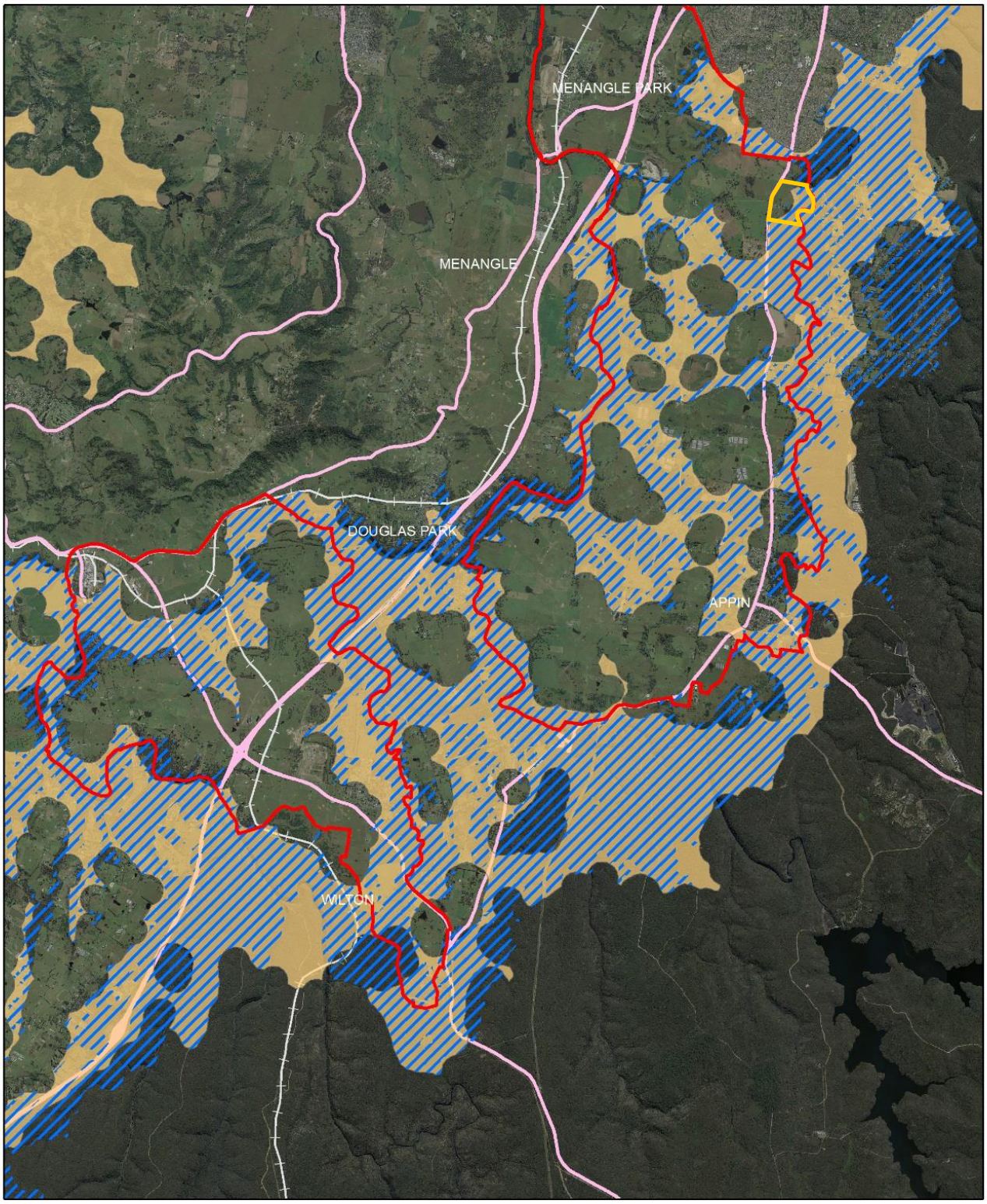
FIGURE 5

PREPARED: BW
DATE: 03 October 2018
FILE: OEH Fig5.cdr

TITLE

KOALA CORRIDORS



LEGEND

- Subject Site
- Priority Growth Area
- GLM of Koala Habitat/Linkage
- New Corridor Mapping

N

0 3 km

SOURCE: OEH - Conserving Koalas in the Wollondilly and Campbelltown LGA's Figure 6

SCALE: Approx. 1 : 125,000 @ A4

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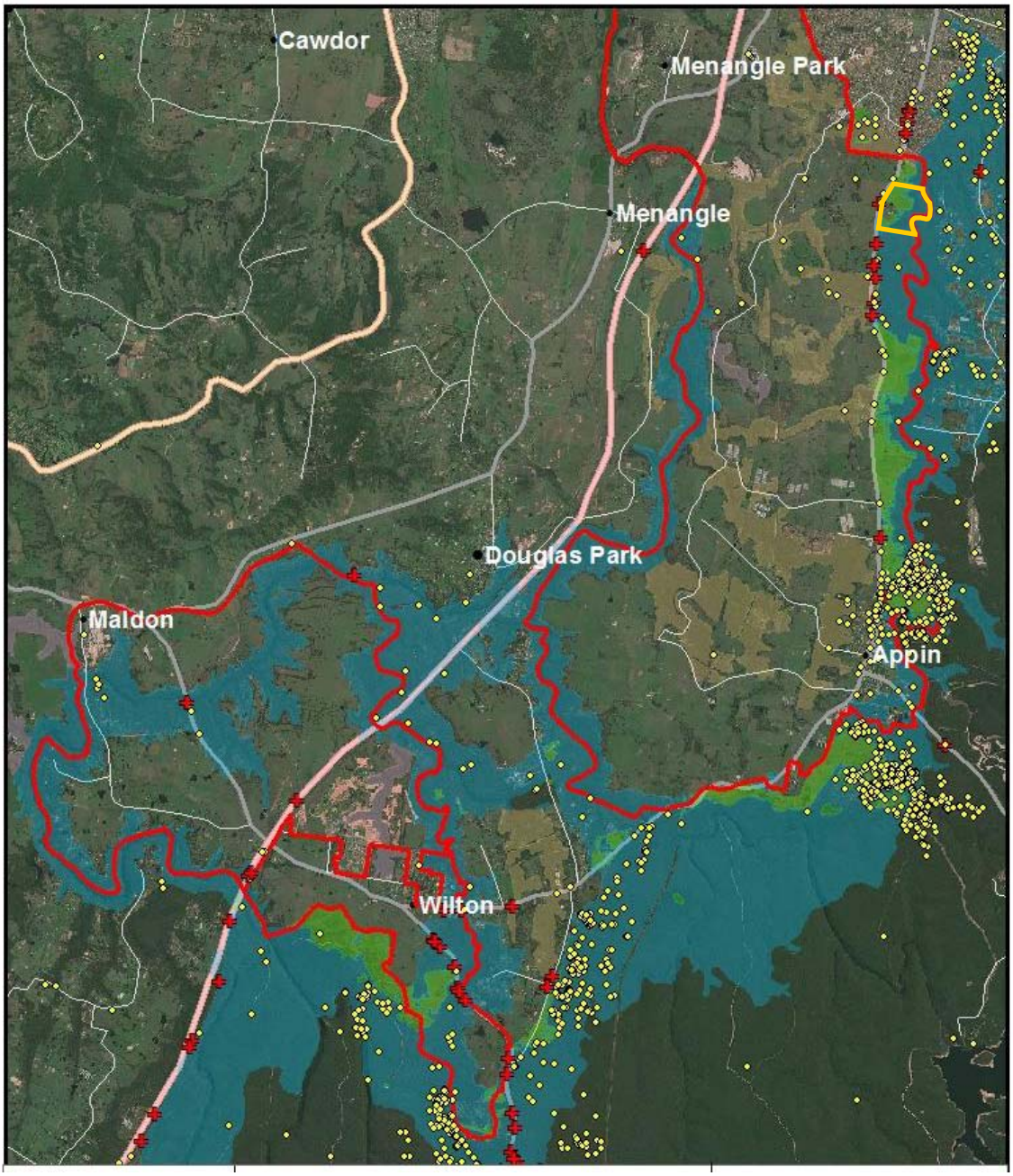
FIGURE 6

PREPARED: BW
DATE: 03 October 2018
FILE: OEH Fig6.cdr

TITLE
COMPARISON OF THE GENERALISED LINER MODEL OF KOALA HABITAT/LINKAGE & THE NEW CORRIDOR MAP



LEGEND

- Subject Site
- Koala Records
- Road Kill Koala
- Priority Growth Area
- Primary
- Secondary
- Tertiary
- Priority Revegetation

N

0 3 km

SOURCE: OEH - Conserving Koalas in the Wollondilly and Campbelltown LGA's Figure 9

SCALE: Approx. 1 : 125,000 @ A4

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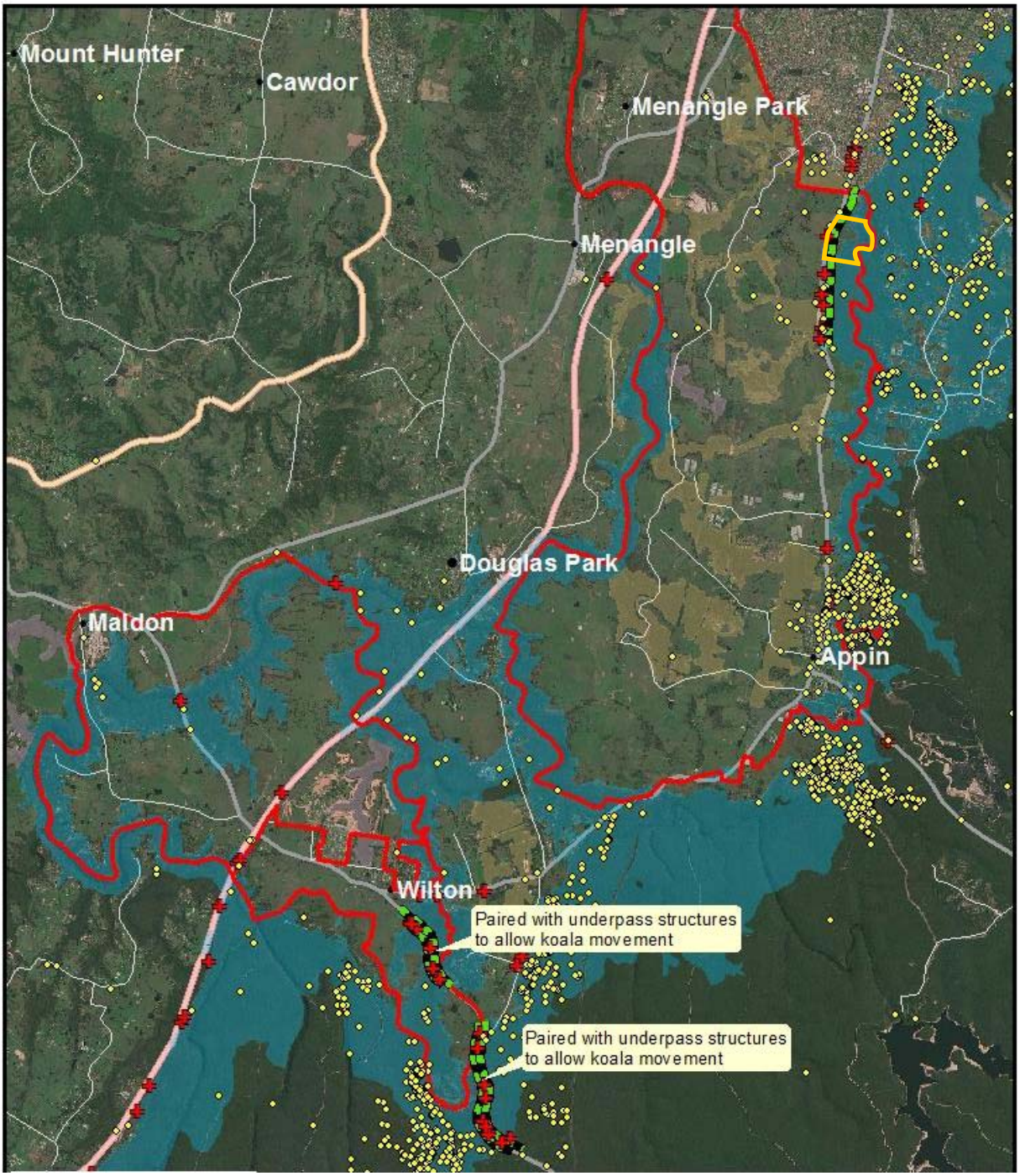
FIGURE 9

PREPARED: BW
DATE: 03 October 2018
FILE: OEH Fig9.cdr

TITLE
PRIORITY AREAS FOR RESTORATION IN THE WILTON & GREATER MACARTHUR PRIORITY GROWTH AREAS



LEGEND

- Subject Site
- Koala Records
- Road Kill Koala
- Road Kill Mitigation Fence
- Priority Growth Area
- Primary
- Secondary
- Tertiary

N

0 3 km

SOURCE: OEH - Conserving Koalas in the Wollondilly and Campbelltown LGA's Figure 10

SCALE: Approx. 1 : 125,000 @ A4

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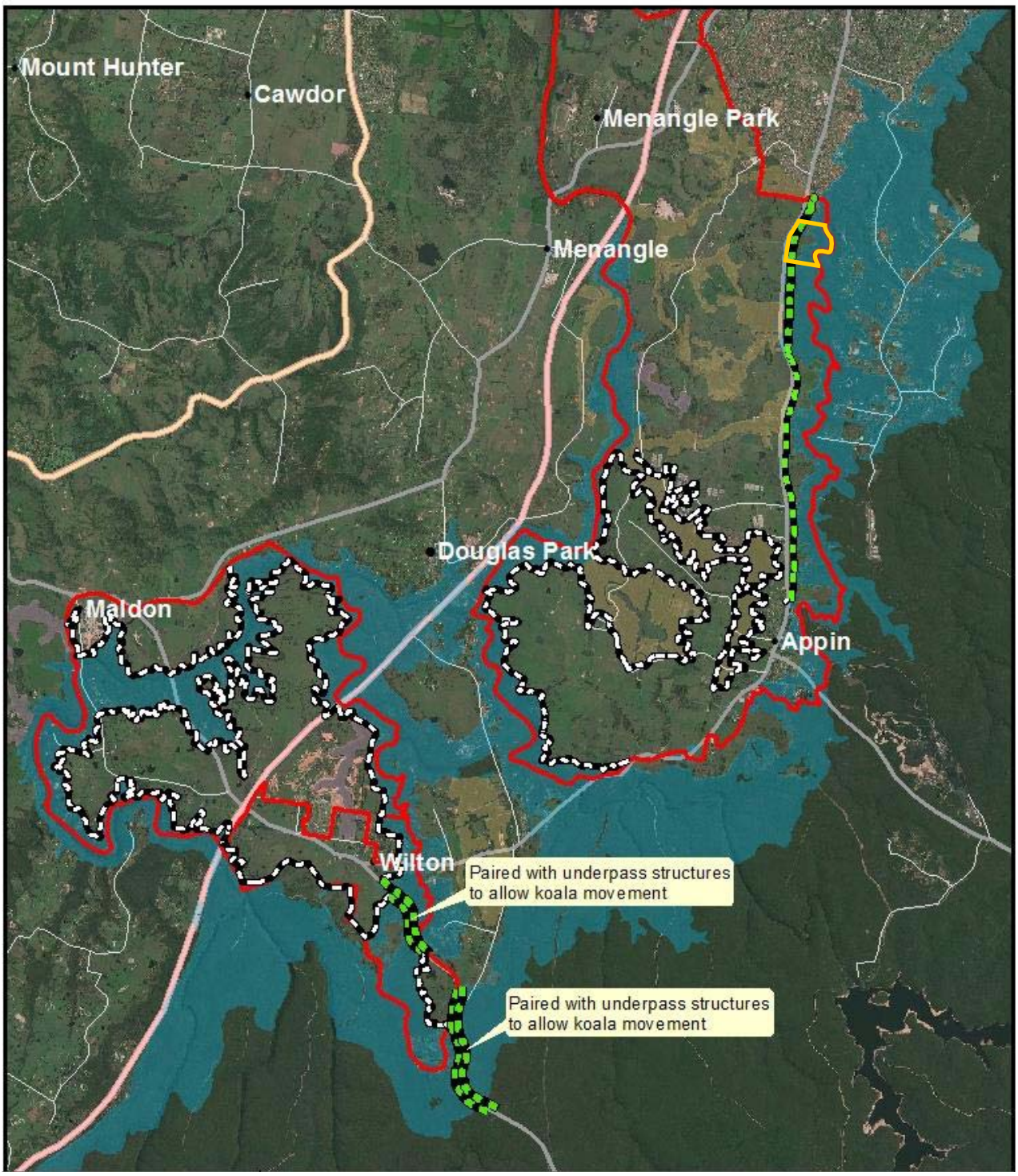
FIGURE 10

PREPARED: BW
DATE: 03 October 2018
FILE: OEH Fig10.cdr

TITLE
RECOMMENDED KOALA ROADKILL MITIGATION INFRASTRUCTURE THAT SHOULD BE IMPLEMENTED



LEGEND

- Subject Site
- Residential Enclave Fence
- Road Kill Mitigation Fence
- Priority Growth Area
- Primary
- Secondary
- Tertiary

N

0 3 km

SOURCE: OEH - Conserving Koalas in the Wollondilly and Campbelltown LGA's Figure 11

SCALE: Approx. 1 : 125,000 @ A4

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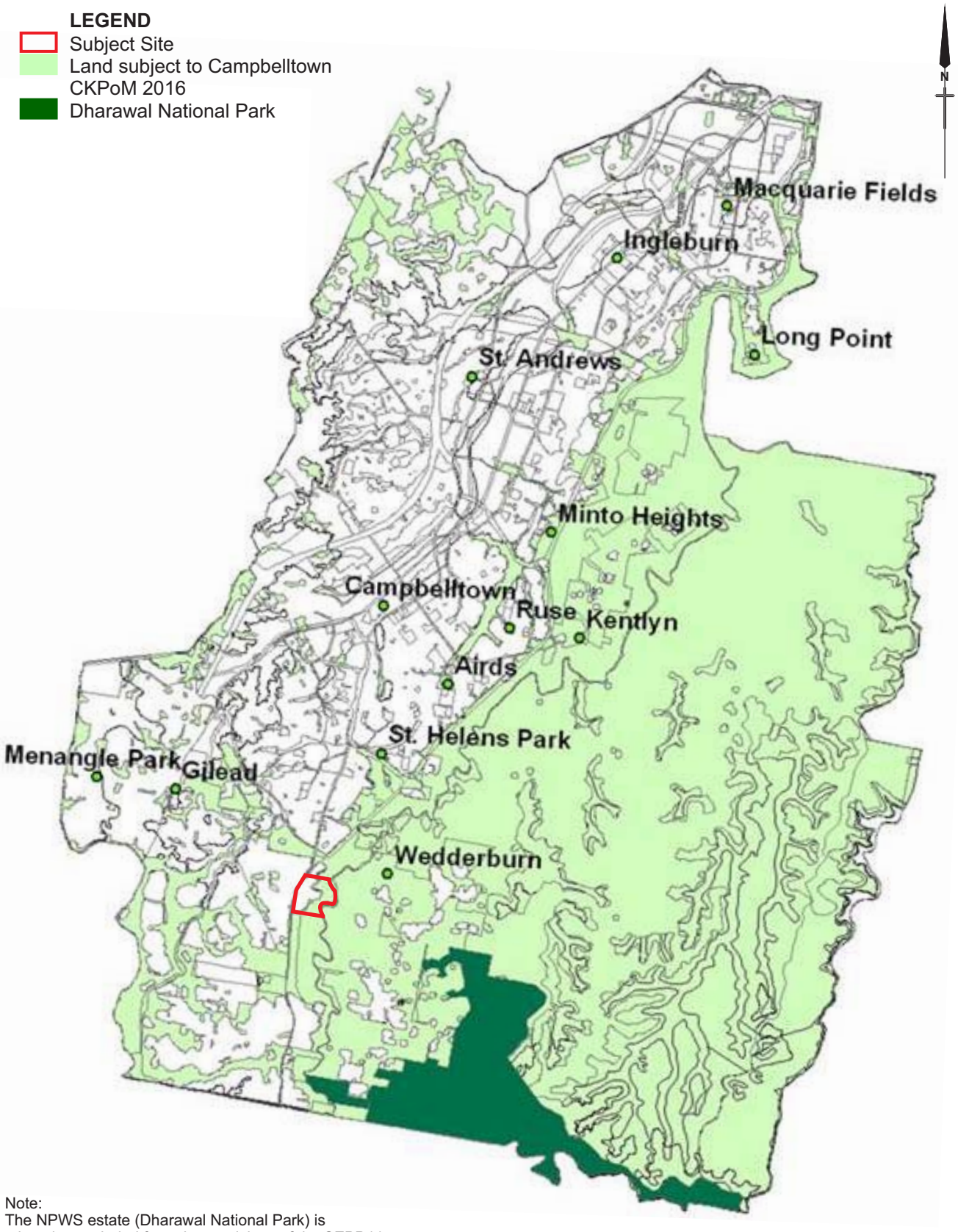
FIGURE 11

PREPARED: BW
DATE: 03 October 2018
FILE: OEH Fig11.cdr

TITLE
KOALA CORRIDORS POST-REVEGETATION & ALL RECOMMENDED MITIGATION MEASURES

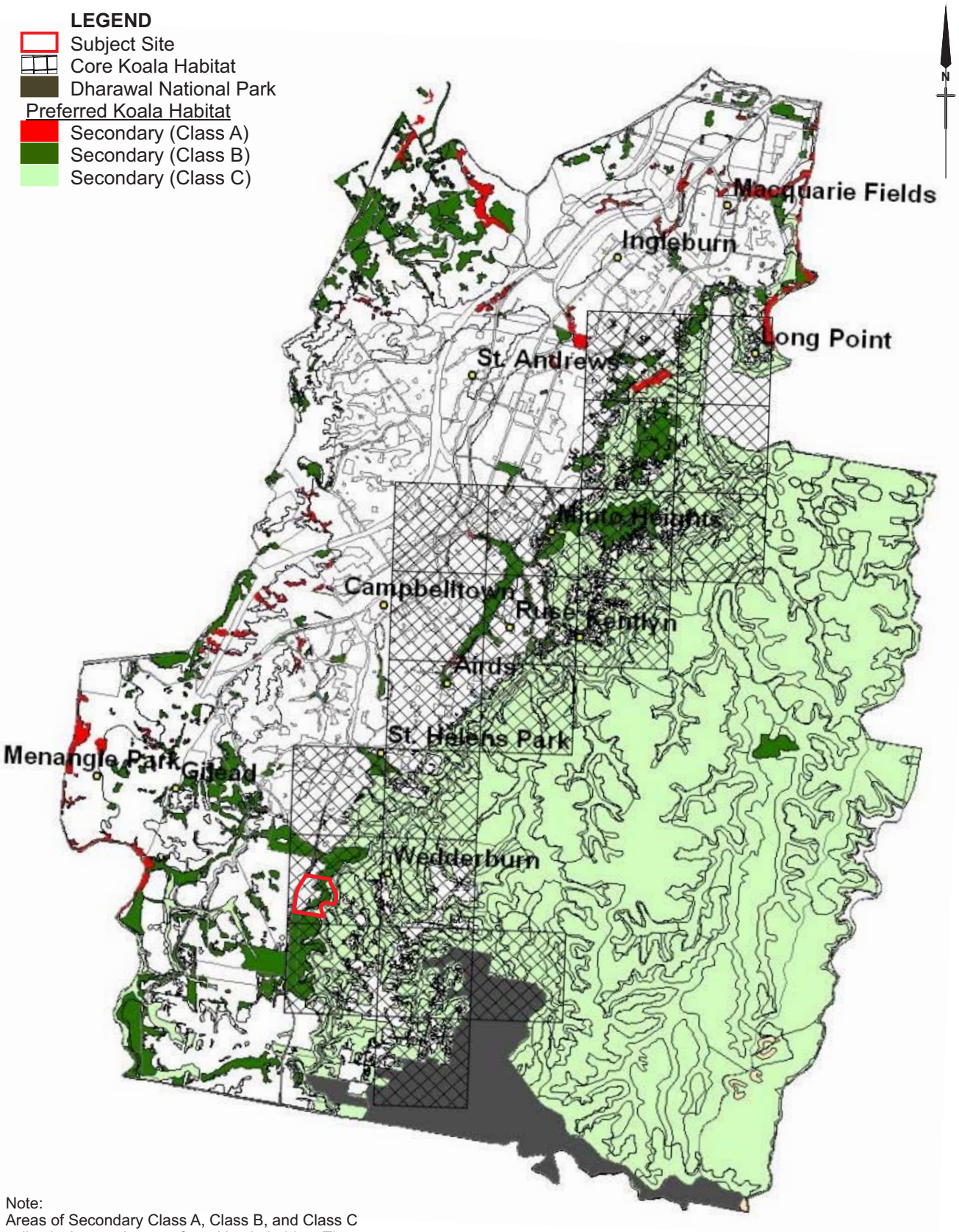
APPENDIX 3 - PLANS FROM PHILLIPS (2016)



Note:
The NPWS estate (Dharawal National Park) is otherwise excluded from the provisions of the SEPP44.

0 3 km

SOURCE: Phillips 2016 Campbelltown CKPoM Figure 2.1 SCALE: Approx. 1 : 125,000 @ A4 *James Warren & Associates PTY LTD Ecological Consultants*	CLIENT The Brticevic Family PROJECT Assessment of Koala Issues Gilead, Appin Road Planning Proposal Appin Road, Gilead NSW Campbelltown City Council LGA	**FIGURE 2.1** PREPARED: BW DATE: 03 October 2018 FILE: Phillips 2.1.cdr	TITLE **LAND SUBJECT TO THE CAMPBELLTOWN COMPREHENSIVE KPOM 2016**



SOURCE: Phillips 2016 Campbelltown CKPoM Figure 5.1

SCALE: Approx. 1 : 125,000 @ A4

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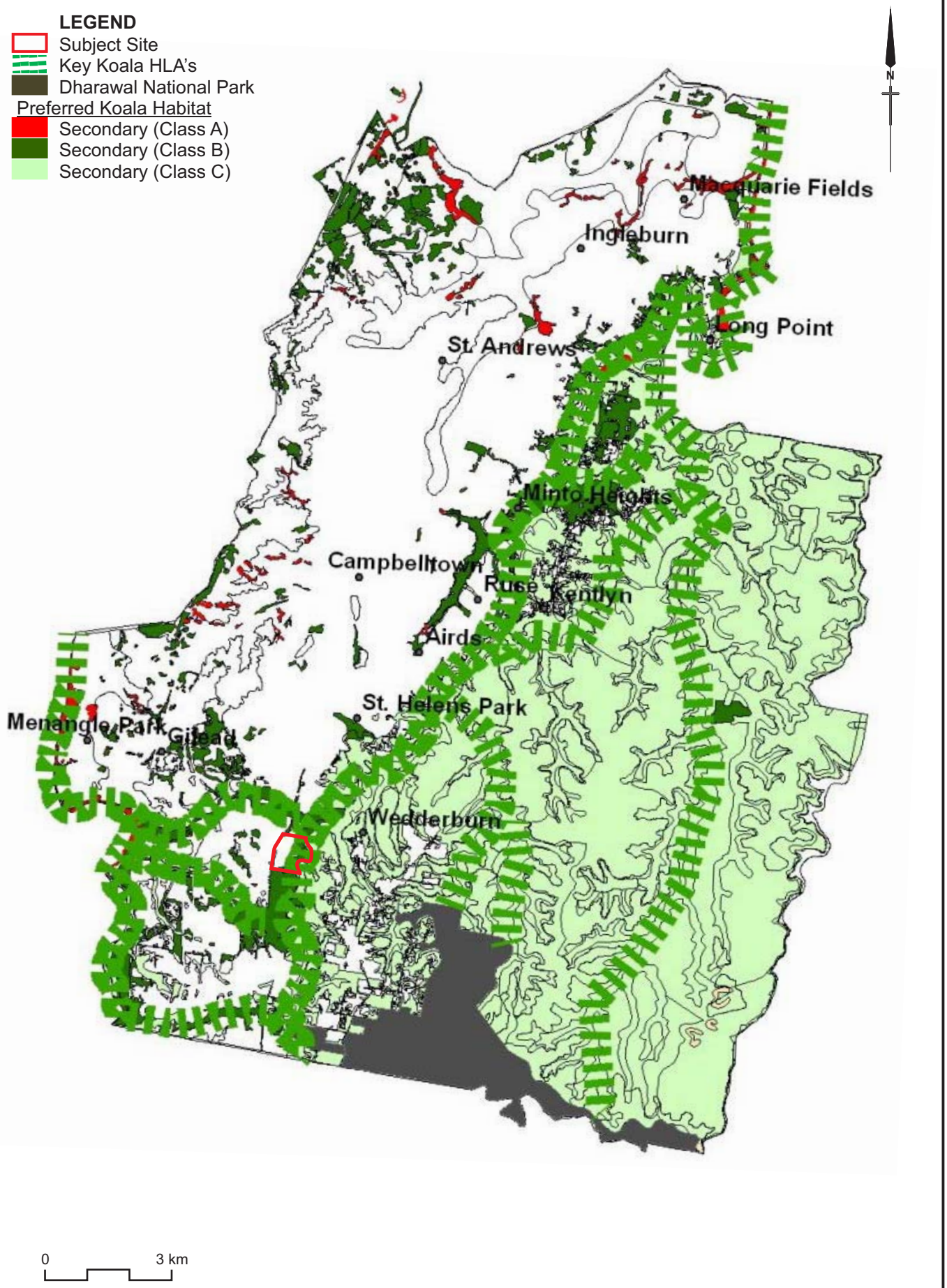
Appin Road, Gilead NSW
Campbelltown City Council LGA

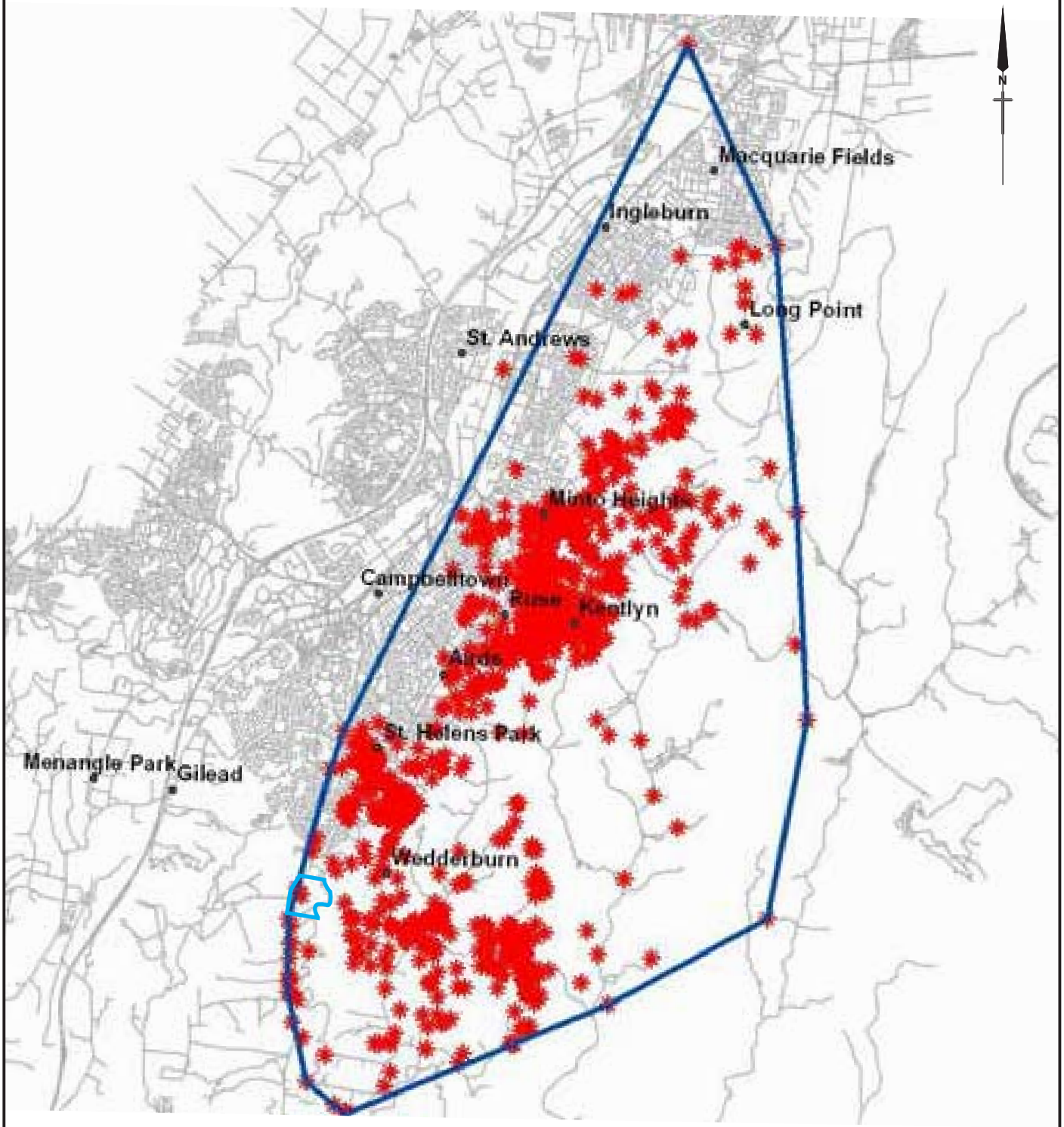
FIGURE 5.1

PREPARED: BW
DATE: 03 October 2018
FILE: Phillips 5.1.cdr

TITLE
EXTENT OF PREFERRED & CORE HABITAT ACROSS THE CAMPBELLTOWN LGA



SOURCE: Phillips 2016 Campbelltown CKPoM Figure 5.3 SCALE: Approx. 1 : 125,000 @ A4 *James Warren & Associates PTY LTD Ecological Consultants*	CLIENT The Brticevic Family PROJECT Assessment of Koala Issues Gilead, Appin Road Planning Proposal Appin Road, Gilead NSW Campbelltown City Council LGA	**FIGURE 5.3** PREPARED: BW DATE: 03 October 2018 FILE: Phillips 5.3.cdr	TITLE **KEY KOALA HLAs**



LEGEND

Subject Site

Historical Extent of Occurrence 1995-2012

Minimum Convex Polygon

Note: Single pre 1995 record in St Andrews

0 3 km

SOURCE: Phillips 2016 Campbelltown CKPoM Appendix C Figure 4

SCALE: Approx. 1 : 125,000 @ A4

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APPENDIX C FIGURE 4

PREPARED: BW
DATE: 03 October 2018
FILE: Phillips AppCFig4.cdr

TITLE
HISTORICAL EXTENT OF OCCURRENCE OF KOALAS IN CAMPBELLTOWN 1995-2012

APPENDIX 4 – ECO LOGICAL AUSTRALIA (2018)

Brticevic Family
c/o Martin Abell
MacroPlan Dimasi
Level 52, MLC Centre
19 Martin Place
Sydney NSW 2000

ECO LOGICAL AUSTRALIA PTY LTD
ABN 87 096 512 088
www.ecoaus.com.au

Ref number: 18SUT-9567

18 April 2018

RE: 880, 894, 900, 880A, 894A and 900A Appin Road Gilead – Terrestrial Ecology Constraints Assessment

Dear Martin,

This letter outlines the methods, results and recommendations of the preliminary desktop review and field survey of potential terrestrial biodiversity constraints within the land at Appin Road, Gilead. The study area comprises six lots, three with frontage to Appin Road (Lots 10, 11 and 12 of DP613878), three rear lots (Lots 1, 2 and 3 of DP255351).

The purpose of this letter is to highlight the key terrestrial biodiversity constraints which may affect future planning and development within the study area.

Methods

Desktop review

Relevant data was reviewed to inform the field survey. Data reviewed included:

- BioNet (OEH 2018a)
- BioNet vegetation classification dataset (OEH 2018b)
- vegetation mapping for the Sydney Metropolitan Catchment Management Authority v3.0 (OEH 2016)
- vegetation mapping for the Sydney Metropolitan Catchment Management Authority v2.0 (OEH 2013)
- threatened species profile database (OEH 2018c)
- recent high-resolution aerial imagery.

Data was prepared into field maps to validate the vegetation mapped by OEH (2016). Records of threatened species were overlain on the field maps to focus attention to the likely habitat features for those species.

Field survey for vegetation types

Two ecologists traversed the site on foot and by car to establish the likely vegetation types present, and their condition. The car was used to traverse relatively open areas without canopy to determine if these areas were likely to correspond with any native vegetation types (e.g. a derived native grassland). Areas with canopy or with difficult access were traversed on foot. Where areas mapped by OEH were not considered to reflect the

vegetation type on site, changes were made to a hard copy field map. The condition of each vegetation type was noted and assigned to broad categories:

- intact
- underscrubbed
- derived native shrubland.

Where vegetation types were not clear or could not be readily assigned to a specific type, full floristics plots were conducted. These were 20 m x 20 m plots placed in an area of homogeneous vegetation type and condition. All aboveground vascular plant species were recorded during the systematic traversing across the plot area. Once all species were recorded, their percent foliage cover and abundance were noted.

To determine what vegetation types were present, data collected from the full floristics plots were compared with vegetation descriptions published (e.g. OEH 2013, Tozer et al 2010, Tozer 2003), the threatened species profile database, and final determinations for threatened ecological communities. Data was also analysed using a plant community type (PCT) identification tool. The PCT tool uses presence data of the plant species and compares against known PCTs in an iterative process. Where the plot data meets certain assumptions (e.g. minimum number of native plants detected), the database compares the highest number of characteristic species present to those in each different PCT. The database does not rely on other factors such as soil type, landscape position and disturbance.

Fauna habitat

Canopy tree species were checked for the presence of hollows and signs of fauna use. It should be noted that the study area contains a large and continuous canopy and therefore not all trees were checked. Where trees observed contained hollows or signs of use (e.g. scratch marks) they were spatially marked. Other habitat features such as caves and rock overhangs were also noted. Incidental fauna observations were made.

Constraints classes

Constraints for terrestrial biodiversity values across the site were based on the legislated level of protection as follows;

- *Very High*
    - Vegetation was listed as or contained known habitat for threatened species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or
    - Was listed as subject to Serious and Irreversible Impacts under the *Biodiversity Conservation Act 2016* (BC Act),
- *High*
    - Vegetation was only listed under the BC Act or contained threatened species habitat listed under either the BC Act or EPBC Act
- *Low*
    - Vegetation was not protected under either the BC Act or EPBC Act and did not contain threatened species habitat

Results

Vegetation communities

The desktop review showed that three vegetation communities were mapped by OEH (2016):

- Sydney Hinterland Apple-Blackbutt Gully Forest
- Sydney Hinterland Grey Gum Ridgetop Forest
- Cumberland Shale-Sandstone Ironbark Forest.

Of these three vegetation communities, Cumberland Shale-Sandstone Ironbark Forest corresponds with the threatened ecological community (TEC) Shale Sandstone Transition Forest in the Sydney Basin Bioregion. This ecological community is listed as Critically Endangered under the *Biodiversity Conservation Act 2016* (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The field survey confirmed the presence of the three native communities listed above plus two additional exotic vegetation types:

- Exotic grassland
- Pine / managed vegetation.

Neither of these two types correspond with any listed ecological community.

While the field survey confirmed the three native vegetation communities, the locations of those communities differed between OEH (2016) and ELA. ELA also noted and updated the condition of the communities. The TEC Shale Sandstone Transition Forest was present on site in three different condition classes:

- intact
- under-scrubbed
- derived native shrubland.

Both the validated vegetation communities and the condition are shown in **Figure 1.**

The TEC Shale Sandstone Transition Forest is likely to meet the EPBC Act definition because it had:

- a patch size of greater than 2 ha
- more than 70% of the perennial understorey vegetation cover made up of native species.

Fauna and fauna habitat

Several trees contained large hollows, which would be important for hollow dependent fauna. Several *Eucalyptus punctata* (Grey Gum) trees contained scratches which resembled marks made by *Phascolarctos cinereus* (Koala). During the riparian field survey, the team observed a Koala in one of the trees close to the aforementioned scratch trees. The likely habitat for Koala in the study area, covers most of the treed areas in the rear three lots. The exception to this would be the area dominated by the *Pinus radiata* copse.

Small caves, overhangs and rock ledges were abundant in the areas close to the Georges River and the small tributaries. These rocky areas may be habitat for reptiles and the vulnerable *Dasyurus maculatus* (Spotted-tailed Quoll).

Much of the forested area contained complex and dense midstorey vegetation. This structural complexity would be important habitat for threatened woodland and forest birds.

Targeted survey for the birds, mammals and reptiles would need to be undertaken to confirm their presence. The Koala present is considered a sign that the habitat on site is in use and the vegetation should be classed as core Koala habitat.

Figure 1 Validated vegetation communities and condition

Ecological constraints

The results were combined to create a map of the differing areas of constraint across the site, which can be used to inform the planning and layout for the site. **Figure 2** shows the constraint outcomes and **Table 1** further details the legislative requirements for each constraint class.

Table 1 Site constraints and recomendations

Constraint class	Value	Recommendation
Very high	Shale Sandstone Transition Forest – underscrubbed and intact Koala habitat	Impact on these areas should be avoided The Shale Sandstone Transition Forest is a matter subject to Serious and Irreversible Impacts and would require a consent authority to refuse a development application that affected (cleared) this vegetation type If clearing of these values was proposed, biodiversity offsets would be required Koala compensatory habitat may also be required to satisfy the Campbelltown City Council Draft Comprehensive Koala Plan of Management Clearing in these areas may be possible with alternate approvals pathways (e.g. Biodiversity Certification) but offsets would be required.
High	Shale Sandstone Transition Forest – derived native shrubland	Impact on these areas should be avoided where possible These areas could be subject to Serious and Irreversible Impacts, which may result in consent refusal Impacts on these values may require biodiversity offsets
Low	Exotic grassland *Pinus radiata* copse	These areas are more likely to be suitable for development Biodiversity offsets are unlikely to be required unless the vegetation is associated with threatened species foraging habitat. This risk of this is relatively low.

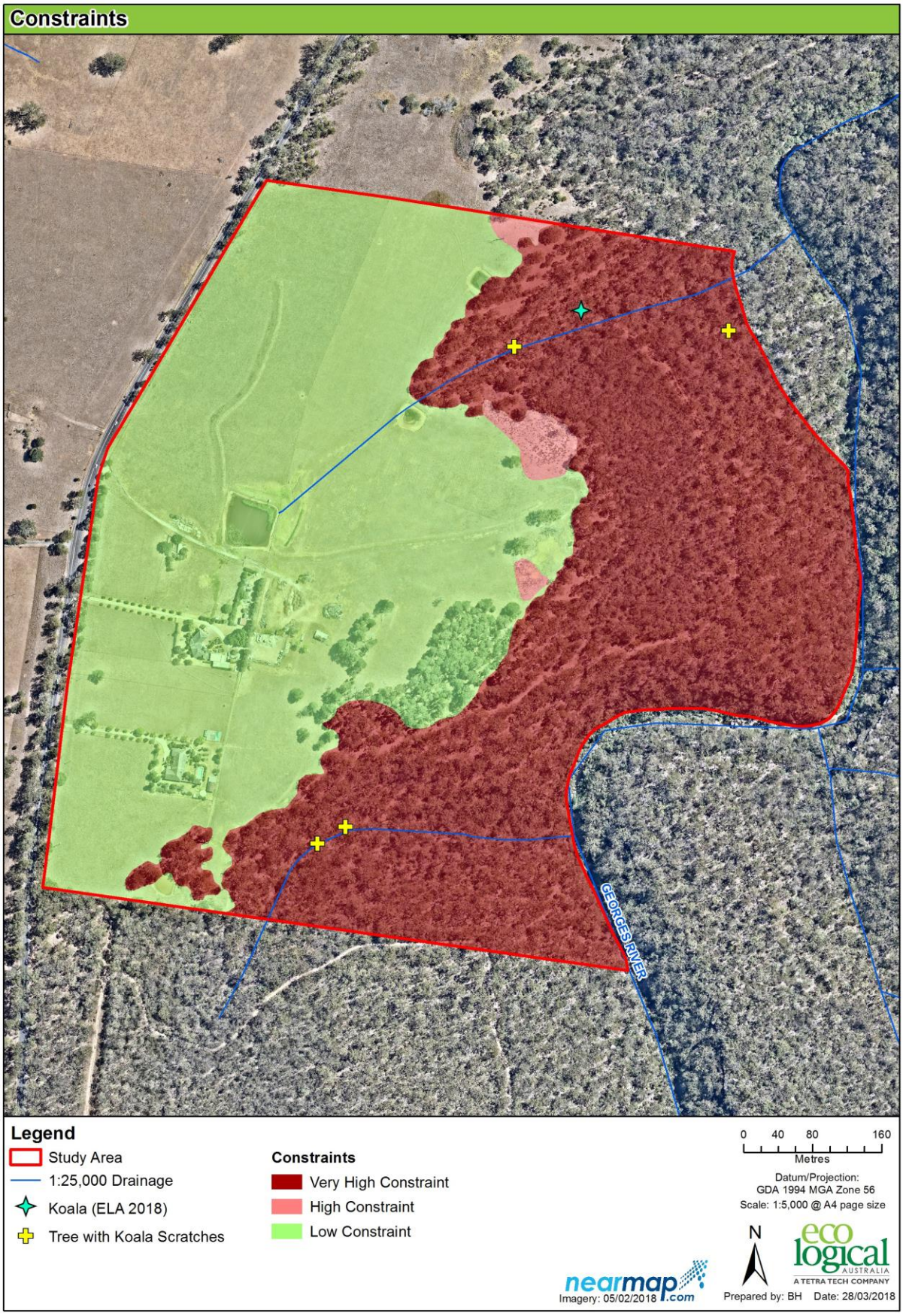

Figure 2 Site Constraints

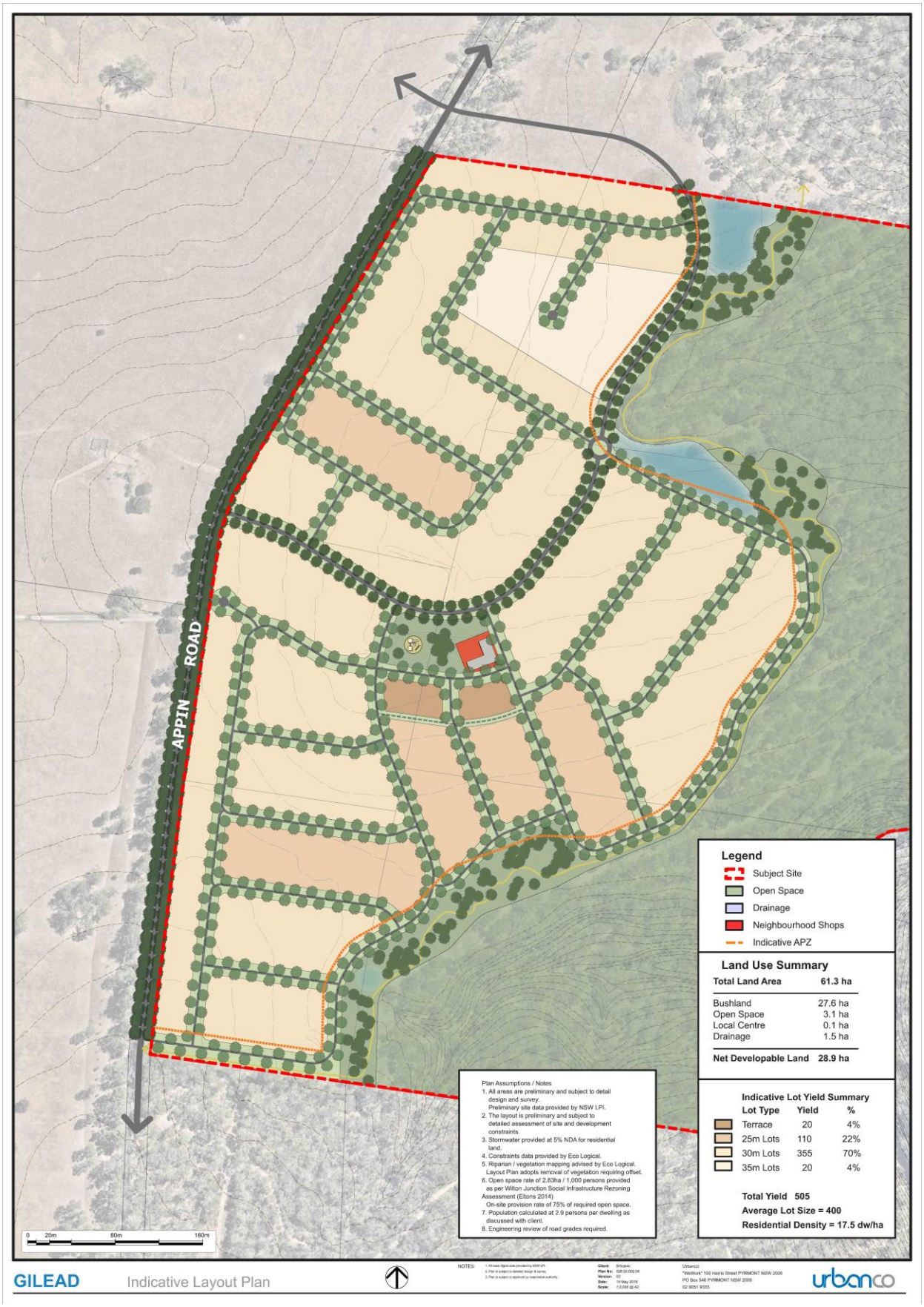

Figure 3 Indicative Layout Plan Option 1 (UrbanCo May 2018)

Figure 4 Indicative Layout Plan Option 1 Environmental Overlay (UrbanCo May 2018)

Further detailed advise and assessment will be available as the potential layout and design of the site is developed. If you have any further questions in the meantime please don't hesitate to call me on 4201 2209.

Yours sincerely,

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