NSW GOVERNMENT | Chief Scientist & Engineer

Response to questions about advice provided in the Koala Independent Expert Panel Report 'Advice on the protection of the Campbelltown Koala population'

February 2021

Introduction

On 9 December 2019, the Minister for Energy and Environment and the Minister for Planning and Public Spaces requested that the Deputy Chief Scientist & Engineer chair an Independent Expert Panel (the Panel) to provide advice regarding the protection of the Campbelltown koala population.

This advice was to include:

- The adequacy of the proposed measures, by the property group Lendlease, for koala conservation on the land referred to as Mount Gilead Stage 2 (MGS2) and the consistency of these measures with the NSW Koala Strategy (the Strategy)
- What, if any, additional conservation measures are considered necessary? What, if any, site specific measures for koala species should be incorporated into the Cumberland Plain Conservation Plan (CPCP) for the Greater Macarthur Growth Area (GMGA) to support the long-term viability of the koala population.
- Whether east-west corridors linking the Nepean and Georges Rivers can contribute to the conservation of the Campbelltown Koala population; and if so, which east-west corridors and what measures should be taken to ensure their effectiveness

The Independent Expert Panel included Dr Chris Armstrong PSM (Deputy Chief Scientist & Engineer; chair), Professor Kathy Belov AO (The University of Sydney), Dr Carolyn Hogg (The University of Sydney) and Professor Jonathan Rhodes (The University of Queensland).

The Koala Independent Expert Panel report "*Advice on the protection of the Campbelltown Koala population*" (the 'Report) was provided to government on the 30 April 2020 and made four recommendations.

Subsequent to the release of the Report, Campbelltown City Council placed the Mt Gilead Stage 2 Biodiversity Certification Application on exhibition (until 17 February 2021) and the Department of Planning, Industry and Environment (DPIE) has commenced pre-lodgement discussions with Lendlease regarding future rezoning of the site as part of their Technical Assurance Panel (TAP) process.

DPIE has requested clarifications on questions regarding the corridors and buffer zones. This document provides the Panel's advice on those questions, with excerpts from the Report italicised within.

The advice considers the following documents that were provided by DPIE:

- Attachment A: Technical assurance panel plan (proposal cross section)
- Attachment B1: ecological corridor width (map)
- Attachment B2: Gilead Stage 2: A commentary on koala carrying capacity and corridor, review reports prepared by Eco Logical Australia on behalf of Lendlease Communities (Fig Tree Hill) Pt. Ltd. (Advice to Council)
- Email correspondence: Gilead – CS&E recommended questions (independent review)
    - Letter to DPIE requesting independent review
    - Attachment B2: BioLink revised advice (full report)
- Email correspondence to DPIE (dated 22 January 2021)

Overall comments on additional questions

The guiding principles for the Panel in providing its advice were to

> *"…maximise koala population persistence and abundance, koala habitat amount and connectivity, and minimise contact between koalas and the urban environment to reduce hazards and threats."*[1]

The Panel also notes that subsequent to the report being submitted, in June 2020, the Legislative council inquiry into koala populations and habitat in New South Wales found that *"given the scale of loss to koala populations across New South Wales as a result of the 2019-2020 bushfires and without urgent government intervention to protect habitat and address all other threats, the koala will become extinct in New South Wales before 2050".*[2]

Then in July 2020, the Minister for Energy and Environment announced the goal of doubling the number of koalas in NSW by 2050.[3] The Panel's advice was based on the goal of the NSW Koala Strategy released in 2018 to *"stabilise and then increase koala numbers over the longer-term, ensuring genetically diverse and viable populations across New South Wales"* and not on this new goal to double koala populations.

Other relevant points from the April 2020 Panel report include that[4]:

- *The habitat in this region contains high quality feed trees due to the sandstone shale transition forest. The Campbelltown koala population is expanding and therefore, it is essential that this habitat supports the movement of koalas such that dispersing koalas can move through the landscape, can breed to ensure genetic diversity, and can access refugia in times of stress, drought or other threats.*
- *Overall, the Panel finds that efforts to increase the availability of habitat while reducing the interface with threats, and maintain genetic and physical health status, are important pillars upon which to plan mitigation measures.*
- *The opportunity presents itself, through forward planning and commitments by parties to protect habitat, mitigate threats and reduce stressors. If this approach is successful, and if it can be monitored, managed and measured, it could show the way for future developments on the rural fringe to minimise the impacts that will arise.*
- *Key to the success of this will be ensuring that koalas are separated from the risks that threatened them, in particular road traffic, and predation by dogs. The proposed high densities for residential and urban development that are proposed makes it unlikely that koalas could persist in the long-term in the urban matrix. Exclusion fencing will be key to keeping them separated from this, as will ongoing observation of the koala population to monitor for disease, indirect stressors such as light and noise, and also to monitor genetic health, population size and distribution.*
- *Habitat and corridor protection in landscapes is not only beneficial to koalas but also other flora and fauna.*
- *Exclusion fencing to prevent koalas accessing Appin Road from the eastern or western side is critical, as is the use of exclusion fencing more broadly to keep koalas separated from dogs and road traffic in the developments. Efforts to sympathetically landscape buffer zones further*

[1] Report, pg. iv
[2] NSW Legislative Council, Portfolio Committee No. 7 – Planning and Environment (2020) Koala populations and habitat in New South Wales, Report 3 https://www.parliament.nsw.gov.au/lcdocs/inquiries/2536/Koala%20populations%20and%20habitat%20in%20New%20South%20Wales%20-%20Report%203.pdf
[3] Hannam, P (2020, July 26) Matt Kean aims to double koala population by 2050, *Sydney Morning Herald*
[4] Report, pg. v - viii

assists in separating koalas from urban impacts and related stressors, while the approach proposed by the proponents to landscape street scapes and backyards of dwellings so to exclude koala feed trees is welcome, as it removes an attractant for koalas into the urban matrix.

- *Wildlife corridors that end with no connection to other habitat can be a considerable risk, in particular where the habitat exposes wildlife to threats, and in doing so can create population sinks, where wildlife kills occur, causing vacancies in the location which subsequently attract more animals.*

In providing this advice, the Panel reinforces that the aim of the recommendations is not to set an upper bound on effort and outcomes to be achieved in protecting koalas and habitat: rather, they should be exceeded wherever possible to ensure the persistence of the koala population and to further protect the current koala habitat (for both koalas and for other flora and fauna).

The Panel also notes that it is important that the corridors provide functional connectivity, in that the corridors are actually utilised by koalas for east-west and north-south movement. Monitoring will need to be conducted post-installation of any management and/or corridor solution to understand if there are koala movements along corridors and whether koalas continue to persist in the landscape, and if no movement is shown for populations or there is a decline in movement, active management solutions are to be implemented.

This is grounded in the principles of adaptive management that the Panel endorsed within the Mt Gilead and CPCP region to assist in managing uncertainties associated with the timeframes and interdependencies within the koala population across this large area (described in the Report, pg. xii-xiii).

Adaptive management would also assist in proactive understanding of the implications of changes in land management, both in the proponent's and adjacent tenures. For example, the gazettal of Mount Gilead Homestead as Heritage Listed has positive outcomes for the Campbelltown koala population, via the removal of urban development threats in its footprint[5].

Adaptive and active management strategies would guide and inform risk management and mitigation actions and, in monitoring these actions, improve best practice over time via the response to emerging acute threats or realignment of management actions.

[5] NSW Heritage (14 October 2020) Mount Gilead Estate listing, https://apps.environment.nsw.gov.au/dpcheritageapp/ViewHeritageItemDetails.aspx?ID=5052615

Question 1: Corridor A viability for connectivity?

The Department is currently seeking to determine the viability of a culvert under Appin Road at Noorumba with TfNSW. If an appropriate Appin Road crossing can be achieved, what is the OCSE's view of the ability of the corridor west of Noorumba to allow for koala movement if it cannot be expanded and parts remain no greater than 100m with development on either side? Further, is there any evidence to suggest the likelihood of a Koala using an underpass, that goes under a 6 or 4 lane road?

For context, Campbelltown Council and the proponent both want Corridor A for connectivity for koalas (rather than habitat), and there are discussions about the future of Appin Road (currently anticipated to become 6 lanes).

Viability of a culvert

- There is good evidence that koalas use culvert structures (e.g. Woolgoolga to Ballina Pacific Highway upgrade), with a documented case of successful crossing of a 100 m long culvert[6], noting that important aspects for koala crossings are in their fit-out, including that they are dry and well ventilated structures.
- In the context of the culvert at Noorumba Reserve, the Panel noted in the Report that the proponent was considering a tree-top bridge across Appin Road.[7]
    - Initial advice from the Panel was that it held "…*reservations that the proponent's preferred approach for a koala crossing (a tree-top bridge structure) will be used by koalas*".[8]
    - An alternative posed by the Panel to the tree-top bridge structure was "…*the development of an underpass or culvert under Appin Road, or a gantry bridge above Appin Road (see Mona Vale example) should be explored*". [9]

Corridor and habitat

- The Panel is of the view that if an appropriate crossing can be achieved across Appin Road at the Noorumba Reserve, then Corridor A would be a viable koala corridor/habitat if the recommendations within the Report and this document are followed.
- The Panel questions the meaning of the phrase in the question text "…both want Corridor A for connectivity for koalas (rather than habitat) …". Habitat is essential in corridors, and the Panel notes in the Report that *"a wildlife corridor is a stretch of habitat that joins two or more areas of similar habitat."* Therefore, planning must include the protection and restoration of habitat in this corridor for it to function as a corridor.
- The Panel notes that there are recent sightings and evidence of koalas in the Noorumba Reserve and across Appin Road in the Bionet database (2019).
- *If the Noorumba site can be secured with an Appin Road crossing effective for koalas, then exclusion fencing between habitat and threats would still be required. Efforts to widen the corridors should also be made, while it is acknowledged that there are constraints with corridor widening west of Noorumba due to land use and tenure issues. Narrow corridors with open vegetation, without exclusion fencing place koalas at risk of exposure to threats such as roaming dogs and foxes, so fencing should be pursued. If fencing is not feasible, then buffer*

[6] Australian Museum Business Services (2012) Investigation of the Impact of Roads on Koalas, prepared by Australian Museum Business Services for the NSW Roads and Maritime Services
[7] Report, pg. 40
[8] Report, pg. viii
[9] Report, pg. 41

zones (~60 m wide) containing non-feed trees, and with monitoring to track predators, and population dynamics to understand these outcomes will be needed. Management decisions regarding the koala population in this area will be informed by those data, and responses could include further active management or even relocation to more suitable habitat. [10]

- Noting the connection between Noorumba Reserve and the rest of Corridor A to the west, there is an important strip of vegetation at Point 2 (Figure 1) that extends for approximately 400 m (east-west). If this cannot provide functional connectivity for koalas, Noorumba Reserve effectively becomes a 'dead end'; therefore, efforts should be made to ensure that this habitat functions as connectivity.
- The Upper Canal (between Point 2 and 3, Figure 1) could also prevent the east-west movement under the proposed development. The Panel did not see the topography at this point; therefore field inspections should be undertaken to understand the impact on the corridor and associated habitat, and the impact on koala movement.
- As per Recommendation 2(c), koala proof fencing along the strip of vegetation (Corridor A) from the Noorumba Reserve to Corridor B would allow the movement of koalas and other native species through the landscape, whilst mitigating direct threats such as predation.
- The Panel notes that tree species (for feed and shelter for koalas) and vegetation density are the key characteristics that would lead to functional connectivity, in conjunction with the removal and mitigation of threats (including indirect threats such as light and noise pollution). Buffer zones (of at least 30 m in fenced and 60 m in unfenced) and other mitigations here would aim to reduce these threats.
- The Panel recommends that all efforts should be made to expand and protect the current habitat, and that without appropriate fencing of Corridor A, the mitigation of threats will not be successful.
- The Panel notes that the Mount Gilead Homestead was gazetted as Heritage Listed by the NSW Government (14 October 2020). This will protect the 150 ha homestead from any further development that is not sympathetic to the heritage listing, which will also indirectly benefit adjacent koala habitat including Corridor A at Points 4 and 5 on Figure 1.
    - In noting this gazettal, the Panel recommends discussion with the Mount Gilead Homestead estate and the proponent as to how the protected farmland could provide additional protections for koalas. This includes the proposed increased habitat at Point 3 (Figure 1, Figure 2) and potential protections (such as fencing) at Point 4 and Point 5 (Figure 1). This can also be seen in Figure , which shows this as 'land to be conserved' (Points 3 and 5) and 'land to be conserved (homestead)' (Points 4 and 5) respectively. Discussions with the Homestead managers should include farm dog management.

[10] Report, pg. viii

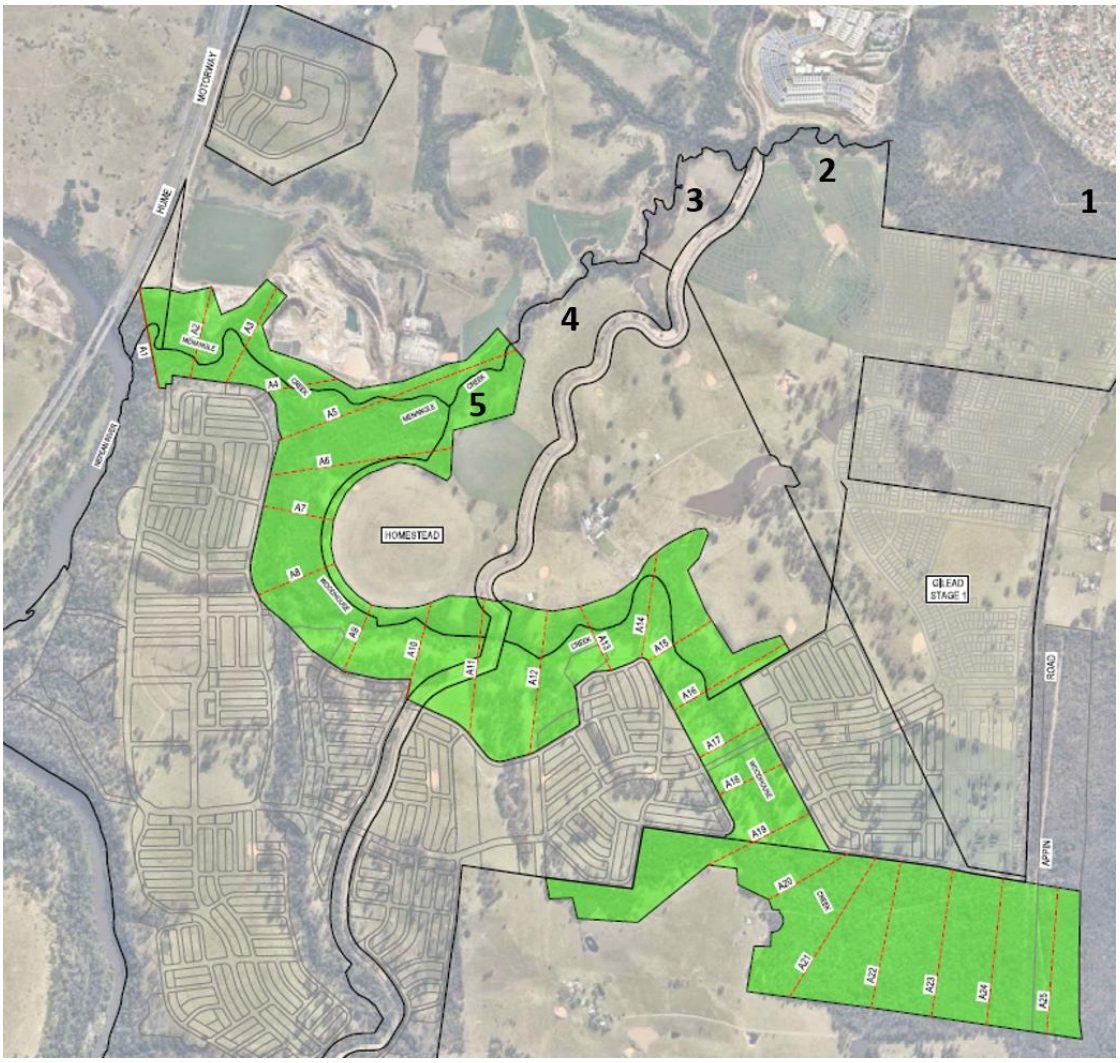

Figure 1: Mt Gilead Biobank Koala Corridor with points on Noorumba Reserve (Source: Lendlease)

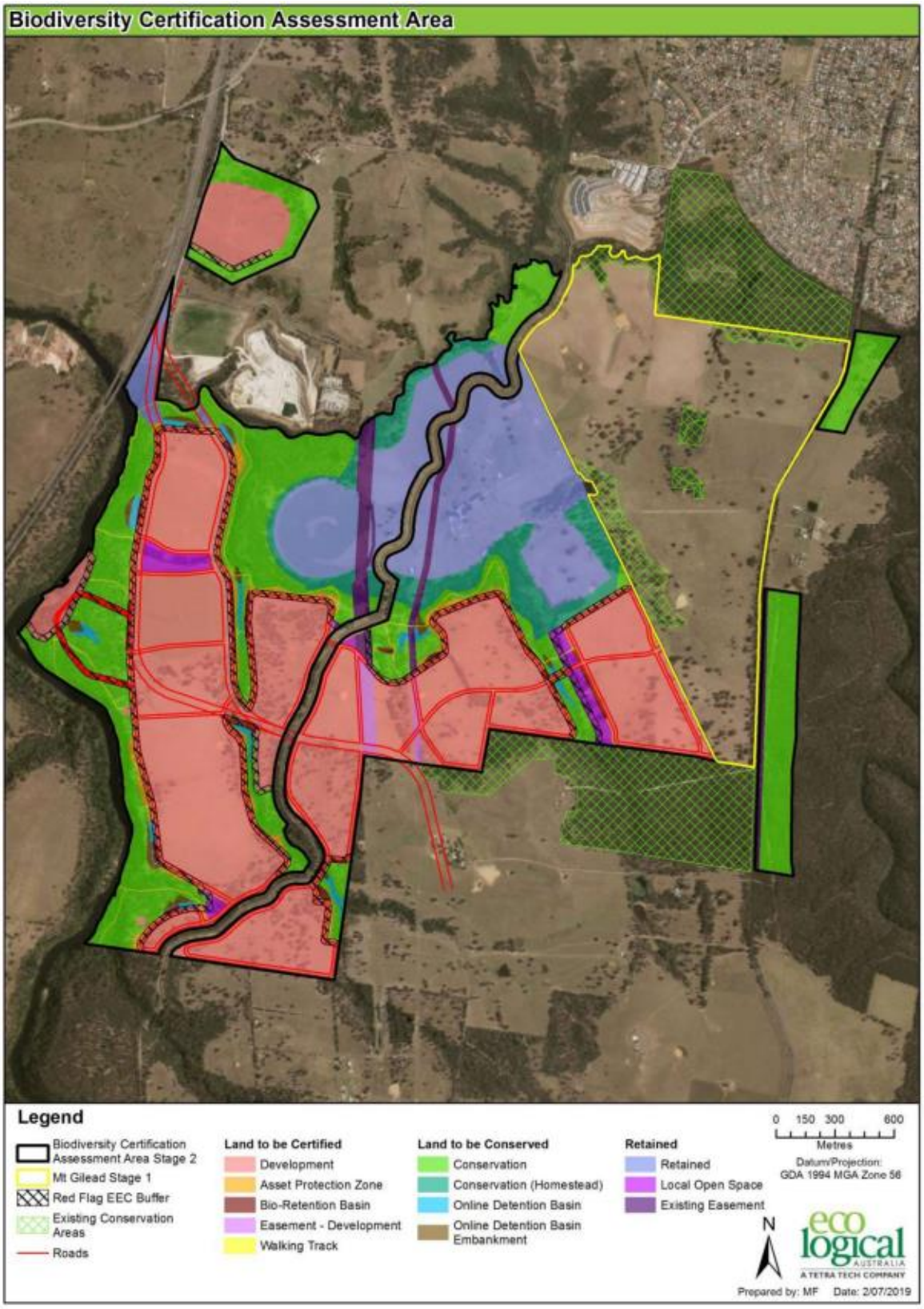

Figure 2: Mt Gilead Biobank Koala Corridor with points on Noorumba Reserve (Source: Lendlease)

Question 2: Can the calculation of average corridor width include adjacent landholdings?

For corridor B (Woodhouse Creek), the proponent is including adjacent landholdings north of Menangle Creek, the existing Beulah Biobank site to the south and land east of Appin Road, in the calculation of average corridor widths.

For context, refer to "Attachment Map" – Lendlease purports to have measured the width of Corridor B in accordance with the methodology outlined by Dr Steve Phillips in "Advice to Campbelltown City Council June 2020" (see "Attachment Advice to Council")

Can OSCE please provide advice on whether adjoining sites should be included for the purposes of calculating the average corridor width within the Mt Gilead Stage 2 lands? (i.e. should we consider "the corridor" only as it applies to proponent's landholdings?).

Adjacent landholdings

- In the report the Panel highlighted the importance of a holistic planning approach. Further that by "*…their very nature, the habitat corridors within the two study areas cross multiple tenures and landscapes, connect internally and with each other. Koalas, in using these corridors, do not recognise lines on maps.".*[11]
- The tenure of the land should not preclude it from being included in the corridor or buffer calculations. However, the features, management and future of the tenure need to be considered, including:
    - Within a corridor, barriers between the tenures such as fences or water bodies have the potential to stop koalas accessing the land. This limit its function as a corridor and should be considered – see further related discussion on Nepean River (Question 3).
    - Any habitat included in the corridor needs to be protected in perpetuity. There may be the need to investigate methods and/or levers to ensure the corridor and its fencing is protected on other tenures or in a change of tenure, including any future developments. For example, the proposed structure plan for the Greater Macarthur Growth Area has an indicative transport corridor that goes through Corridor B[12].
- In some cases, there will be different landholders that own adjacent tenure that is part of the corridor. For example, the proponent has included the existing Beulah Biobank within the corridor measures.
    - There is a need to protect the Biobank and other landholdings in the same manner as the rest of the corridor (including fencing, as per Report Recommendation 2). This will prevent the incursion of threats or the dispersion of koalas into the urban environment. This will require the proponent working with adjacent landholders.
    - Any structures (such as roads) that cross, or might have an impact on, the corridor have to be designed to be sympathetic to the protections of the corridor. For example, the proponent has proposed a road crossing Corridor B: in constructing this, consideration must be given to the aim of the corridor (i.e. allowing for koalas to move east-west whilst also persisting in the environment, via mitigating direct and indirect threats) and take appropriate mitigation actions to ensure that this structure does not negatively impact on this aim. Considerations would include how this would interact with the corridor fencing and what mitigation measures will be used to stop koalas getting into the development via the road.

[11] Report, pg. vi
[12] Report, pg. 20

- The management of a corridor on various tenures is a policy question and outside of the Panel's remit. The Panel did not consider whether there were legal or policy restrictions on the inclusion of other entities' offset land or private land, but viewed it from the perspective of koala habitat.
- *Beulah Biobank*
    - West of Appin Road can form part of Corridor B and can be included in the calculation. As per previous points, the Belulah Biobank should be fenced to form part of the corridor.
- *East of Appin Road*
    - East of Appin Road is part of the primary Georges River Corridor and should not be included in the calculation for Corridor B.
- *Land holdings north and east of Menangle Creek*
    - At Point 5 in Figure 1 is the confluence of Menangle and Woodhouse Creeks. The area north and east of this point (i.e. prior the confluence of the creeks) would be considered part of Corridor A – contributing to its length. Therefore, this should not be included in the calculation of Corridor B as a width component.
- *Mt Gilead Homestead*
    - The proponent notes that their corridor is "approximately 400 m wide (average) without Beulah Reserve. If we to include some of the rural land on the (heritage) Homestead Lot which is proposed to be zoned E3 (consistent with the draft Cumberland Plain Conservation Plan) the average width of the corridor would be approximately 600 m"[13]
    - The Panel notes that the gazettal of the Mount Gilead Homestead provides a protection of koala habitat from urban development and the associated direct/indirect impacts, effectively having the same desired attributes of a buffer zone for indirect threats (i.e. light and noise, although noting the comment in the response to Question 1 on farm dog management). Question 4 also provides further clarity around how the homestead and associated farmland should be treated.

Measurement of average corridor width

- The methodology from Dr Steve Phillips in his advice to council states that[14]:
    - *an optimum width of 409 m – 425 m be maintained as desirable*
    - *The means of which these measures are to be validated must also be transparent and statistically robust, to which end we propose a series of width measurements at 200 m intervals along the entire length of the SLA, each of which must evidence the minimum width requirement of 250 m*[15]
- Based on the Figure provided by Lendlease, the Panel does not understand how this methodology of Dr Phillips was applied by the proponent which is purported to be in accordance. For example, there is no consistency in the application of the 200 m intervals between the transects along the length. For example, the distance between A8 to A9 is much greater than the distance between A17 to A18.
- Further, there are irregularities in the orientation of the transects: for example, A4 is at an unusual angle to the other measures, and to the corridor (i.e. oblique, rather than perpendicular), and this is noted for a number of the other transects.
- Dr Phillips' calculation methodology requires a "…*series of width measurements…each of which must evidence the minimum width requirement of 250 m…"*. It appears to the Panel that

[13] Lendlease (17 December 2020), per comms
[14] Lendlease, Attachment Advice to Council, provided by DPIE to OCSE
[15] Strategic Linkage Area

rather than drawing 90 degree cross sections that demonstrate a minimum corridor width of 250 m, as is understood as the intent in Dr Phillips approach, instead lines appear to have been drawn at random angles to meet the minimum width requirement of 250 m (this may explain the orientation of the A4 transect). The Panel would expect the transects to measure corridor width to be perpendicular to the length of the corridor.

- The Panel views that the transects as drawn do not provide a realistic reflection of the actual corridor width, as there is no consistency in the distance between and angles of the transects, and the potential interaction between Corridors A and B (transects A5 and A6).
- Therefore, the Panel recommends that the Proponent should provide a clearly articulated, transparent and defendable method for calculating the corridor widths and the orientation of the transects.
- The Panel also notes the clarification sought in Question 4 regarding average corridor width and buffer to the corridor, this should be considered in the calculations.

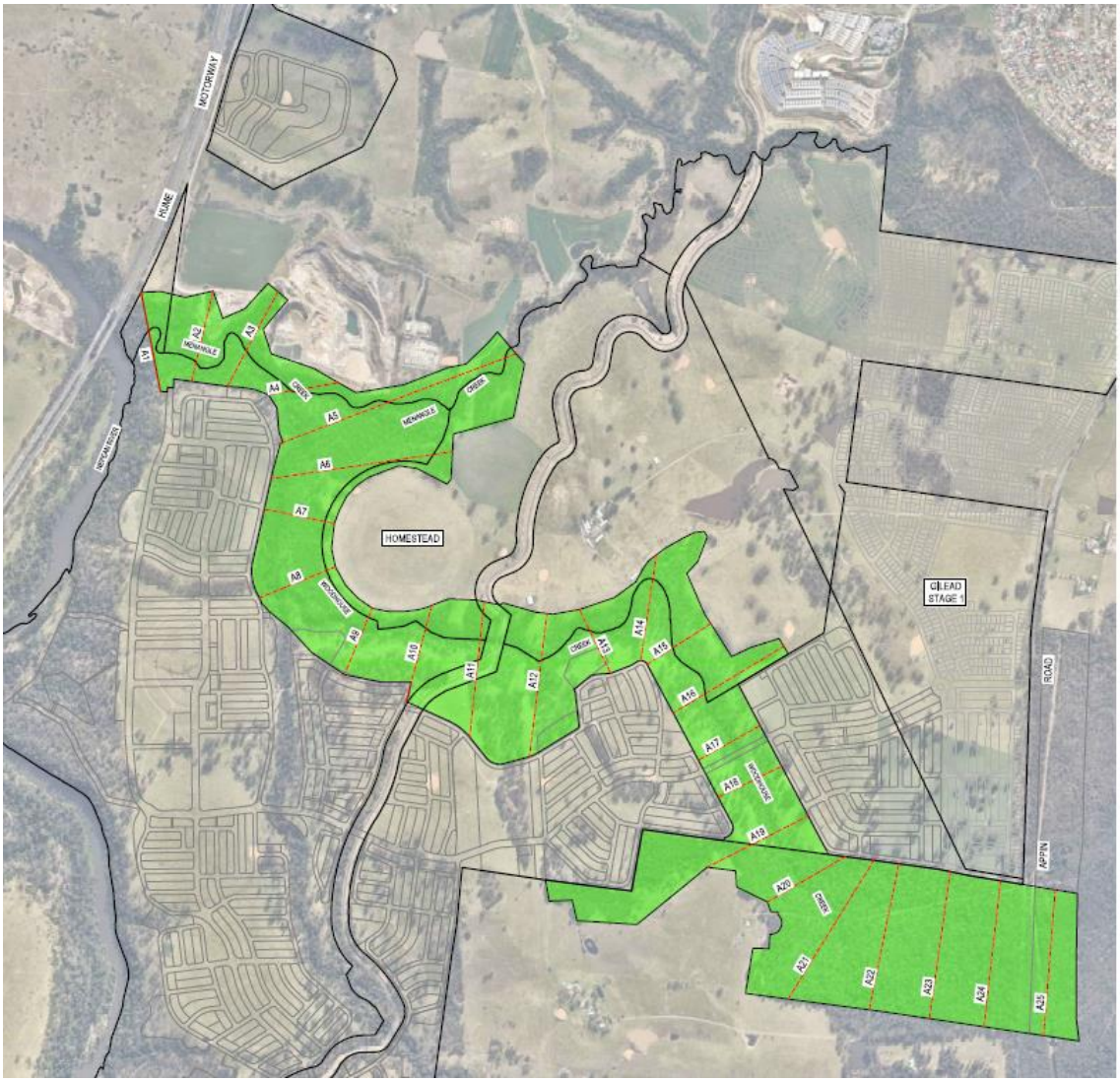

Figure 3: Mt Gilead Biobank Koala Corridor showing measurement lines (source Lendlease)

Question 3: Nepean River koala corridor

The OCSE advice focused on the east-west corridor. Can the OCSE please provide its view on the Nepean River Corridor? Should the vegetation on either side of the river be considered as two separate corridors or one corridor that spans the river and addresses the corridor requirements in Recommendation 2 c) of the OSCE report?

- The majority of the corridors examined were riverine, which provide important refugia and resilience to warming and drying climates[16]. This included the Nepean River and associated habitat, which was identified by the Department as a primary north-south corridor and as a strategic conservation area in the draft CPCP material, with possible protections including Biodiversity Stewardship Agreements (BSA).
- The Panel noted that a primary concern for the Nepean River habitat is to prevent a functional 'dead-end' at the northern point, which appears to be in the vicinity of MGS2. If functional connectivity is provided by Corridor A (Noorumba Reserve and Menangle Creek) and/or Corridor B (Woodhouse Creek), this would allow for east-west movement at the end of the Nepean River corridor.
- "*Close attention should be paid to test the feasibility of the design of the koala connectivity at the confluence of Menangle Creek and Nepean River, near the Hume Highway and possibly under three bridges*"[17].
- Although koalas have been known to swim, the Nepean River would effectively act as a barrier and therefore encourage koala movement separately along each side. Therefore, for the purposes of functional connectivity, koalas would move north-south along either side of the Nepean river, so in that sense habitat on each side of the river functions as separate corridors.
- Given that the two sides/corridors are parallel and adjacent to each other, some functions of one side will assist in the minimisation of stressors and/or threats to the adjacent bank. In particular, increasing separation from direct and indirect threats on the river side of the corridor (i.e. from the opposite side): for example, sound and noise attenuation from the adjacent side. Other functions, however, would not be provided by the adjacent corridor: for example the amount and quality (both food and shelter) of vegetation available to use and move through.
- Therefore, they should be treated as separate corridors that provide a symbiotic-like protection to the adjacent riverbank.
- The area highlighted in Figure 4 should be examined on the ground (field trip inspection) to ensure that the amount (width and density) and structure of the habitat and terrain will facilitate a functional corridor given distance to roads and suburban footprint that is evident on the map in Figure 4.
- The Panel also notes the potential for steep topography in the riparian zone and associated koala habitat (Figure). There is a need to understand this topography, and how the current koala population moves through the landscape, including if the koalas have a preference for moving long the steep river bank or whether they use the plateau (where the suburban footprint is planned), which will inform any additional protections. This is also important when considering the risk of fire. These issues should be addressed in the planning phase but prior to approval.
- Monitoring of the population and visual inspections of the site will assist in understanding these parameters once the developments are underway.

[16] Report, pg. vii
[17] Report, Recommendation 2(a)

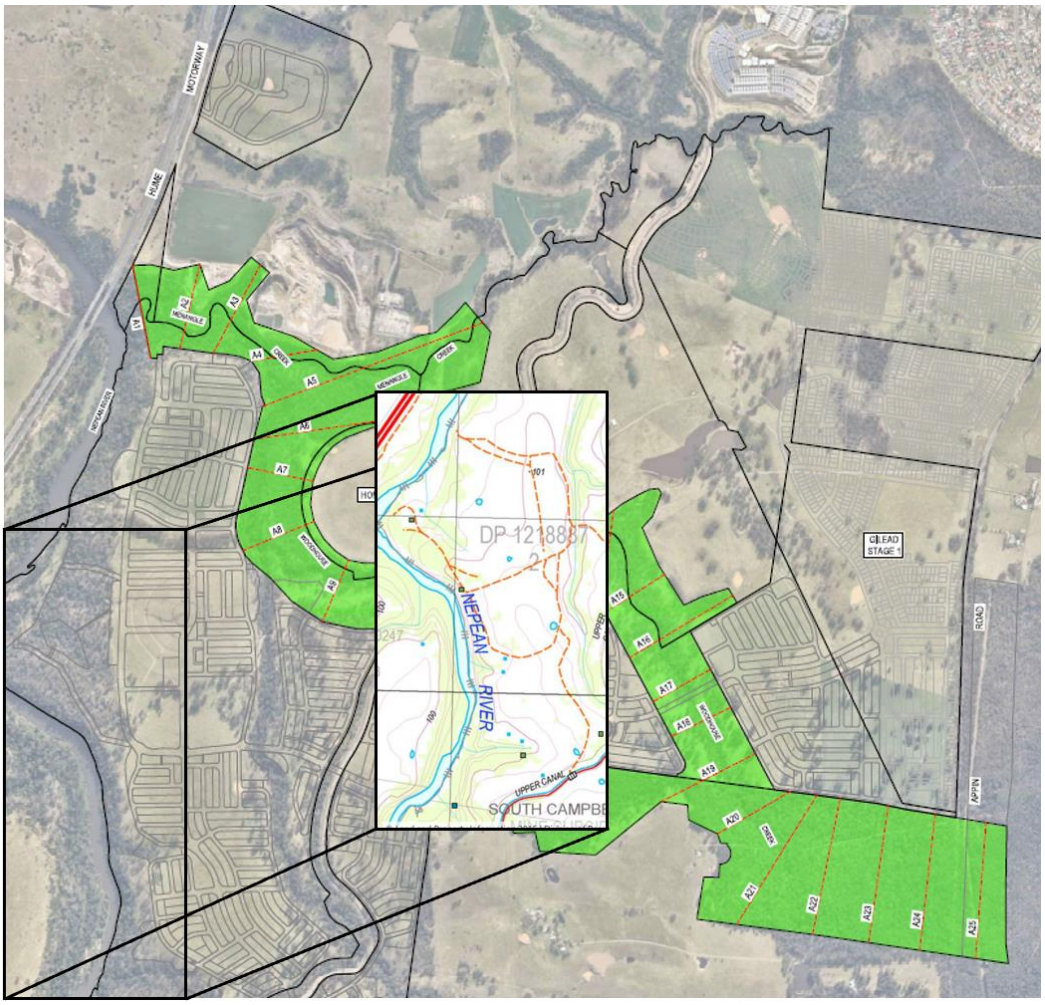

Figure 4: Steep topography associated with the Nepean River Corridor (Sources: Lendlease and overlay from SEED Portal[18])

[18] NSW SEED (Sharing and Enabling Environmental Data) Portal, https://www.seed.nsw.gov.au/

Question 4: Interpretation of Recommendation 2 (C) "Connectivity and Habitat"

EES has interpreted the OCSE requirement for corridors, buffers and exclusion fencing as detailed in the EES prepared diagrams below.

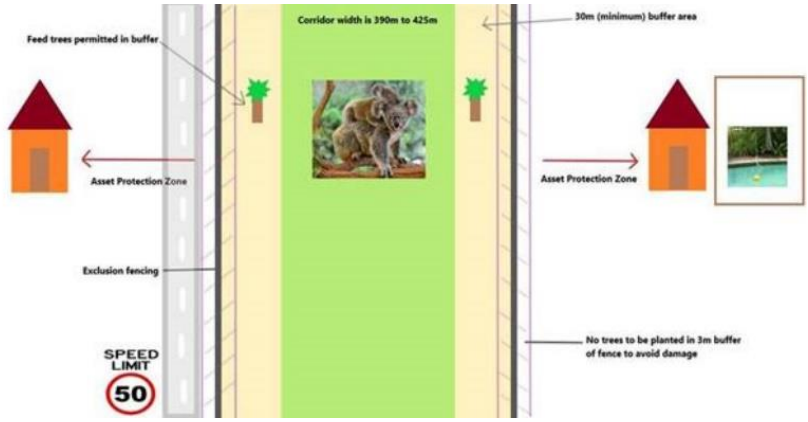

Figure 2: With exclusion fencing

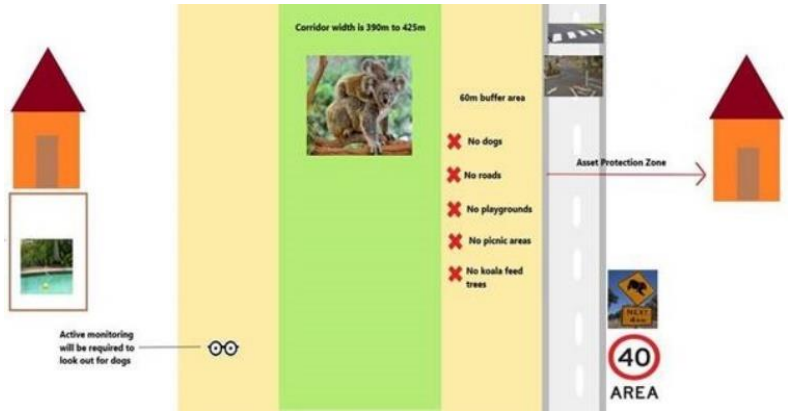

Figure 3: Without exclusion fencing

For context, the proponent has queried whether APZ (outer protection areas) should be permitted within the corridors and buffers to allow for areas of reduced fuel load/ flame intensity as refuse for fauna. (refer to "Attachment – proponent cross section")

Could we please confirm the OCSE's intention in regard to Recommendation 2 c) and whether EES's interpretation, as illustrated in the diagrams above, is accurate?

Why were buffer zones recommended?

- As discussed in the Report:
  - *Urban development in proximity to fauna has increased the potential 'edge effects' that species such as koalas experience*
  - *Edge effects can include both direct (i.e. vehicle strike and dog attacks) and indirect (i.e. light and noise pollution, urban storm runoff) impacts on fauna and flora, and can result in altered behaviour (for example, changes in home ranges or in how species disperse throughout a landscape) that can have longer term repercussions.*

- *There are a number of strategies and methods that can mitigate the impact on koalas, particularly at the interface of urban and native environments. This includes, but it is not limited to, vegetated buffer zones and managed habitat areas, koala exclusion fencing (includes fencing at the interface to roads, but also around pools and yards), predator and pest management (including weeding programs), vehicle-strike mitigation measures (under and overpasses, road grids, traffic calming devices and road design, signage, speed limits, etc.), and community awareness programs.*[19]

- The Mt Gilead Biocertification initially proposed a 30 m buffer (15 m inner buffer and 15 m outer buffer, and included the APZ), however the buffer was only on one side of the corridor, served a dual purpose and contained infrastructure and possible threats to koalas (including roads). See Figure 4 and Figure 5.

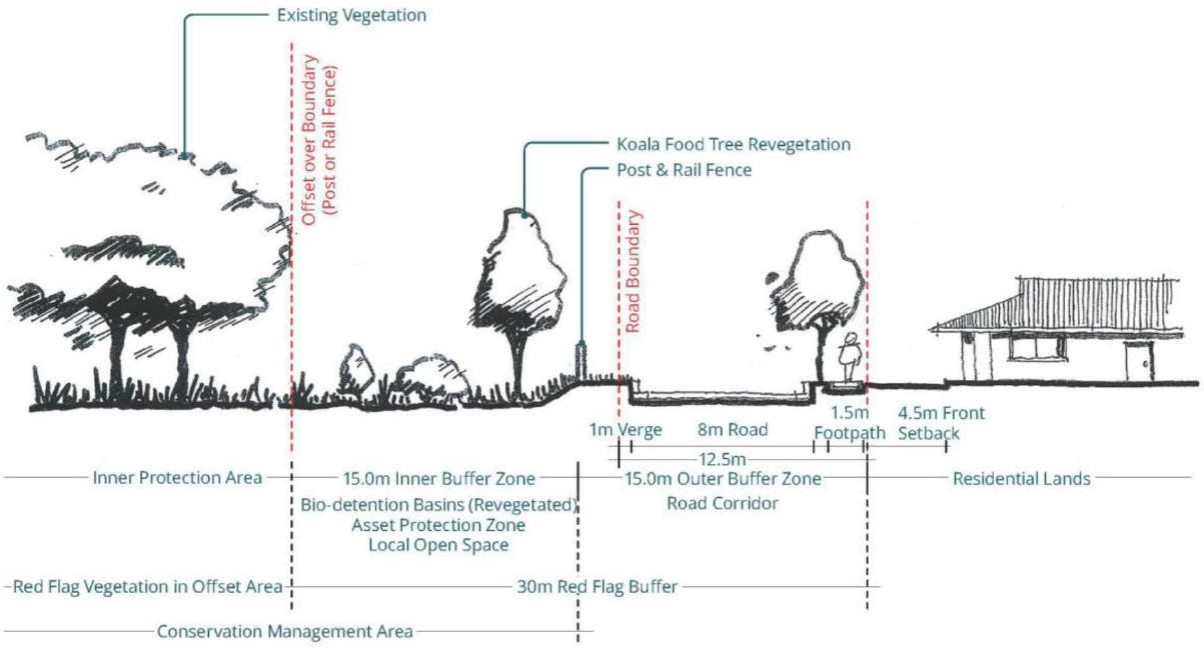

Figure 4: Example of buffer zone at proposed Mount Gilead Stage 2 development (Source: Eco Logical Australia, 2020)

[19] Report, pg. 49

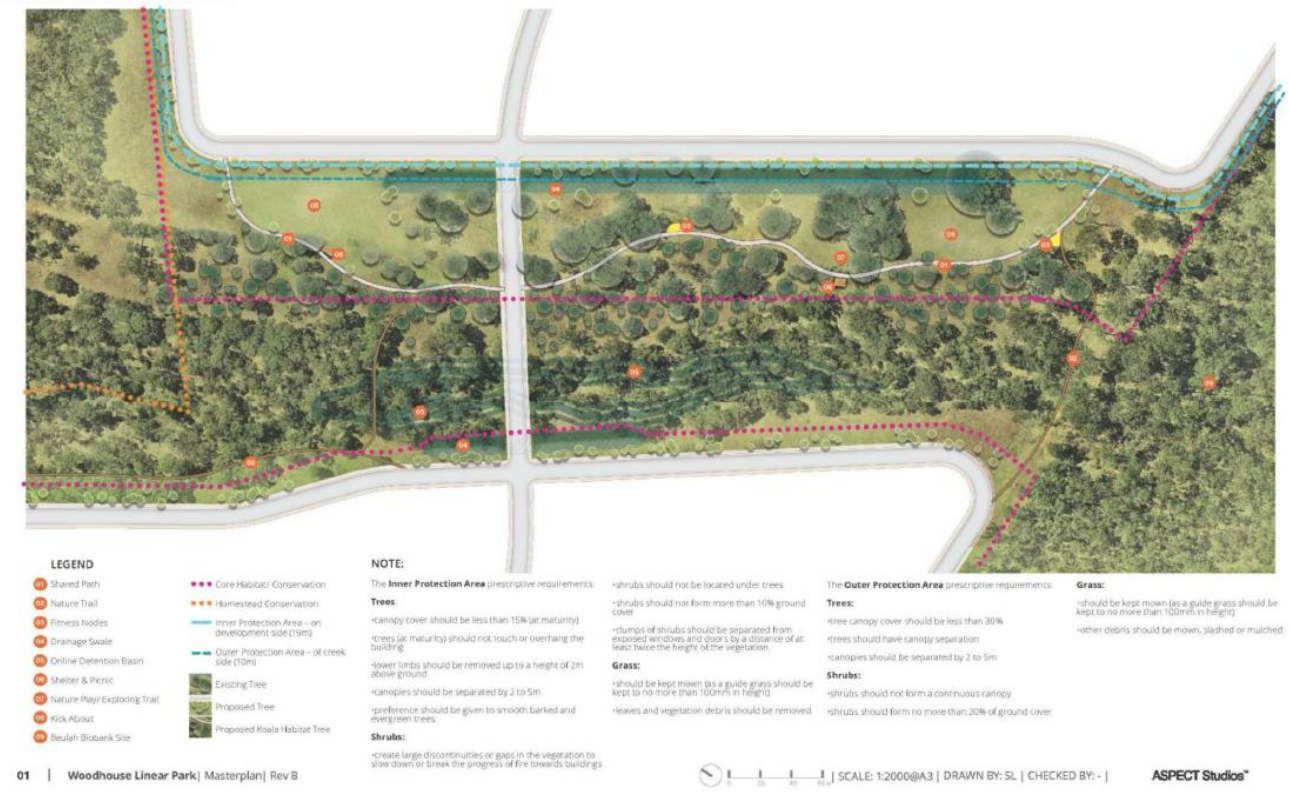

Figure 5: Mount Gilead Stage 2 Woodhouse Creek Koala corridor (Source: Eco Logical Australia, 2020)

- The Panel saw the design as ineffective as it permitted threatening activities in close proximity to koalas and koala habitat with no barrier to interaction between koalas and hazards.
- Further, the Panel's site visit allowed them to see the current habitat and assisted in their advice (Figure 6). In particular, this site visit showed the Panel the topography of the creek lines and the sparseness of the remaining vegetation (as you can see through the remaining habitat). As the habitat stands, it would not provide adequate protection to koalas and their habitat from the development, including in regard to light and sound penetration. Therefore, the recommendations that were made in the Panel's Report reflect the on-ground assessment and the need to improve and protect the koala corridor habitat.

Figure 6: Woodhouse creek – Panel site visit on 14 February 2020

- The recommendation of the Panel is to exclude the APZ from the buffer as the functional purpose of an APZ is different to a habitat buffer. The APZ is to protect the homes and infrastructure. A habitat buffer protects the habitat and the species within it.
    - "…*the functional roles of Asset Protection Zones (APZ) and of buffer zones to protect koalas are different, and as such need to be differentiated in the design of the interface. APZs serve a role of protecting people and property from bushfire hazard, while buffers associated with koala protection reduce the impact of threats, light and noise on koalas*…"[20]

[20] Report, pg. ix

- "…*The APZ should be in the development footprint, not the koala corridor/buffer, and the APZ should be on the development side of the exclusion fence. The APZ, unlike the buffer, could accommodate roadways and parks. People would be permitted into the koala buffer, but dogs would be prohibited from entering through the exclusion fence area*."[21]

- The NSW Rural Fire Service (RFS) defines an APZ as "… *a fuel reduced area surrounding a built asset or structure. This can include any residential building or major building such as farm and machinery sheds, or industrial, commercial or heritage buildings. An APZ provides:*
  - *a buffer zone between a bush fire hazard and an asset;*
  - *an area of reduced bush fire fuel that allows suppression of fire;*
  - *an area from which backburning may be conducted; and*
  - *an area which allows emergency services access and provides a relatively safe area for firefighters and home owners to defend their property.*

  Potential bush fire fuels should be minimised within an APZ. This is so that the vegetation within the planned zone does not provide a path for the transfer of fire to the asset either from the ground level or through the tree canopy".[22]

- The purpose of having a buffer separate to the APZ is to ensure that there is protection of the habitat and the species within that buffer and not subject them to the management activities required to maintain the APZ as well as the activities permitted within it.
- The Panel views the buffer as a vegetated protection for koalas and their habitat from direct and indirect threats (i.e. 'edge effects'), whilst the APZ is for the protection of the built urban environment: therefore, two distinct functions that necessitate their separation (Figure 7). However, this is not to say that there could not be some level of bushfire fuel reduction activities conducted within the buffer zone.
  - The buffer is designed to reduce the impact of direct and indirect impacts from humans, such as light and noise. Koalas could still persist in these areas and use them as part of the functional corridor but would also be able to retreat to existing habitat areas where the edge effects are less apparent.
  - In undertaking revegetation in the buffer, the layout and tree species chosen should achieve the function of protecting koalas from noise, light, etc. and provide possible refuge from fires (Figure 6 images provide an indication of the current habitat). These images illustrate that looking through and across the corridor, any koalas within the corridor would be relatively exposed, therefore designing vegetation in the buffers on either side of the corridor could be done in a way that reduces exposure and increases protection.
  - The Panel acknowledges that koalas will move along and utilise the buffer zone, so food and other habitat trees (shelter, etc.) could be incorporated into the design, whilst also recognising other metrics that would protect the current habitat (such as canopy height, canopy density, fuel load contribution, etc.)
  - Removing habitat from buffer areas should be avoided unless absolutely necessary.
  - The exclusion fencing also reduces the risk of predation or injury from domestic dogs, amongst other threats, and would also discourage koala movement into the urban environment (with associated threats such as vehicle strike).
  - In regards to refugia for koalas and other wildlife from bushfires, this risk could be potentially managed by sections of the koala proof fencing being able to be temporarily removed/lowered (allowing either koalas/other species to disperse and/or the ability for

[21] Report, pg. ix
[22] NSW RFS Standards for Asset Protection Zones, https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0010/13321/Standards-for-Asset-Protection-Zones.pdf

fire fighters to gain access) and by appropriate revegetating and active management of fuel loads within the habitat buffer. In considering options for fencing, the proponents should (if not already) engage with RFS and the CPCP team within DPIE who are examining this issue within the broader region.

- Figure 9 provides a view of the Panel's thinking in response to Figure 6 – the Asset Protection Zone should be outside of the exclusion fencing, and the 'Inner Buffer Zone' should be doubled from 15m in Figure 6 to 30 m in Figure 9.

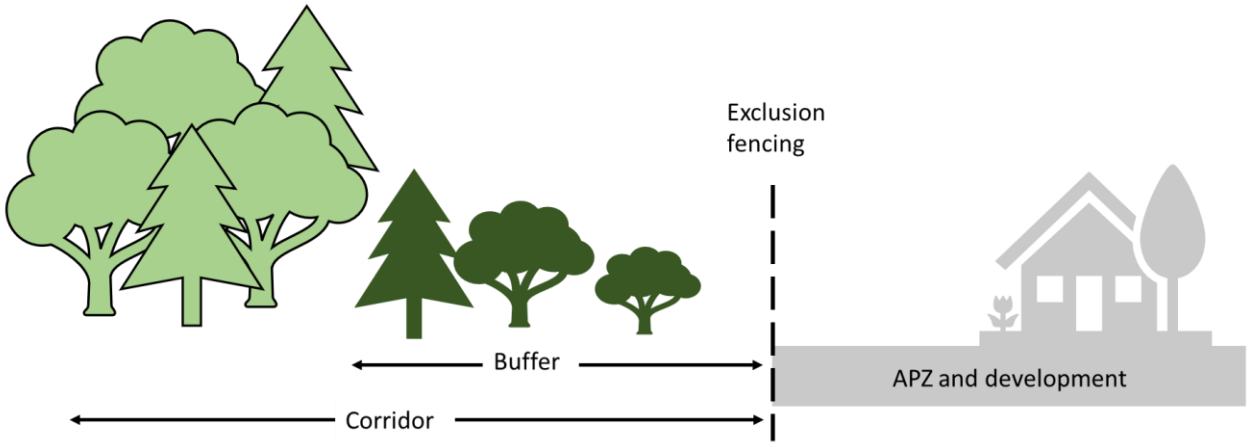

Figure 7: The separation of the vegetated buffer (which can include koala feed and shelter trees, with a bias towards the area adjacent to the corridor) and APZ

Requirements for corridors, buffers and fencing

- From the Report, Recommendation 2(c) states
  - "*Habitat within identified corridors should be:*
    - *protected (especially from development creep)*
    - *widened through revegetation (average size 390 to 425 m)*
    - *include a buffer on either side of the corridor habitat that is at least 30 m wide from the corridor to the exclusion fence with feed trees permitted in this buffer area*
    - *include, between the buffer area and the urban areas, koala proof fencing to prevent the movement of koalas out of the corridor into urban areas (with trees more than 3 m from the fencing to avoid damage) and the movement of domestic dogs (amongst other potential threats) into the corridor*
    - *for sites where exclusion fencing is infeasible due to steep terrain, then additional buffer width should be utilised (buffer ~60 m), with a traffic speed limit of 40 km/h and predator / dog monitoring*
    - *asset protection zone is outside the exclusion fencing, within the development footprint*

    Further, connectivity structures within corridors should also be assessed including local roads and other infrastructure (e.g. the Upper Canal)."[23]
- In arriving at this recommendation, the Panel noted that:
  - as a general rule for the overall review, and in the context of the planned urban growth in this area (~110,000 human inhabitants), "… *buffers should be at least 30 m wide from the edge of existing corridor habitat, occur on both sides of the corridor, and have exclusion fencing at their edge, with koala feed trees allowed to grow to the fence, with*

[23] Report, page xiv

a suitable distance between trees and fencing to prevent fallen boughs creating damage to the fence"[24].

- "*Every opportunity to maintain or increase the width of corridors should be taken and work to understand whether there is a minimum width to make a viable corridor, as well as how this minimum is affected by vegetation density of the corridor and urban density of the surrounding developments*"[25]
- "*east-west corridors within the Greater Macarthur Growth Area can provide connectivity and biodiversity values for flora and fauna species. Not all the identified corridors are suitable to provide connectivity for koalas, but the habitat should be protected for koala habitat, biodiversity values and amenity in the region*."[26]

- The Panel and the proponent have both identified "… *the Corridor B route to be important for koalas and other wildlife through the proposed development*" and, more broadly, the importance in the CPCP region.[27]
- The key tenet is that the primary aim should be to maximise koala habitat and to protect that habitat. Whilst average corridor widths (390 m to 425 m) have been used, this should be the minimum average to aim for, with *"…every opportunity to maintain or increase the width of corridors should be taken…"* .[28] We have reflected this concept in the figures below (Figure 8). This should not lead to perverse outcomes or be to the detriment of current habitat (i.e. habitat should not be removed from the corridor/buffer unless absolutely necessary), but with a revegetated corridor and buffer designed to protect and increase this habitat.
- As mentioned previously, the gazettal of the Mount Gilead Homestead also provides buffering between the koala habitat and urban development (Figure 8(B)). As in Figure 2, the Homestead includes both land to be conserved ('Conservation (Homestead)') and 'Retained' land. The 'Conservation (Homestead)' land, which the Panel understands is accessible koala habitat, could be counted in the corridor calculations if the habitat is protected in perpetuity. The Panel is not familiar with the allowed activities on the heritage listing and whether in the future the koala habitat ('Conservation (Homestead)') could be removed for activities 'sympathetic to the listing' e.g. farming. This matter should be clarified by the Department when reviewing material and making decisions.
- The Homestead's 'Retained' land, while acting as a buffer, should not be included in corridor calculations.
- Figure 8(A-C) provides a visual guide from the Panel in response to DPIE's interpretation (Figure 2 and Figure 3), with Table 1 providing a summary of activities allowed in the buffer zones.

[24] Report, pg. ix
[25] Report, pg. ix
[26] Report, pg. xiii
[27] Report, pg. viii
[28] Report, pg. ix

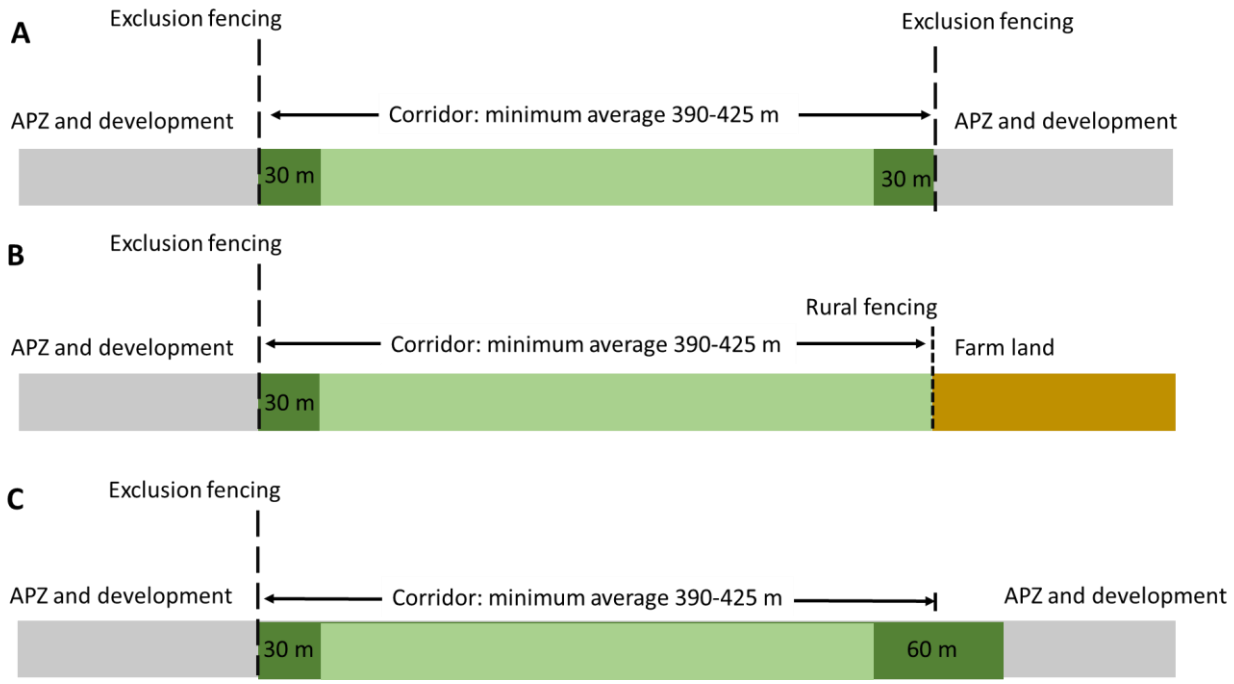

Figure 8: Recommendations for corridors. A) Development either side of the corridor, B) Development on one side and farmland on the other, C) Development on both sides, but with one side unable to be fenced.

Table 1: A non-exhaustive list of activities allowed within the various buffer zones

	Exclusion fencing (30 m buffer)	**No exclusion fencing (60 m buffer)**	**Rural fencing on homestead**
Members of the public	Acceptable; access via appropriate gates in koala exclusion fencing	Acceptable	N/A
Dogs	No dogs allowed within buffer	No dogs allowed within buffer	Proponent discuss with Homestead management about approach to managing farm dogs to prevent access to corridor.
Roads	No roads within buffer, unless required to cross corridor. Requires appropriate mitigation devices (raised, fenced, cattle grid etc)	No roads within buffer, unless required to cross corridor. Requires appropriate mitigation devices (raised, fenced, cattle grid etc) Reduced speed limits (40km/h) on adjacent roads to buffer with traffic calming devices	In discussion with the Homestead manager, roadways that cross corridors would require appropriate mitigation devices within the corridor (raised, fenced, cattle grid etc)
Playgrounds	No playgrounds within buffer	No playgrounds within buffer	N/A
Picnic Areas	No picnic areas within buffer	No picnic areas within buffer	N/A
Koala feed trees	Koala feed trees should form part of the buffer, ensuring that no large tree is within 3 m of the buffer	Koala feed trees could form part of the vegetation within the 30 m closest to the corridor; noting that there should be minimal koala feed/shelter trees in the outer 30 m (i.e. adjacent to the APZ and development) to discourage koala movement into these areas	N/A