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ELA Reference Number: 22SUT – 1581

11 October 2023

Dear Mark

RE: Biodiversity Impact Assessment for Addendum Appin Road Upgrade Review of Environmental Factors – Gilead to Ambarvale NSW including refinements made since exhibition.

I refer to your request to prepare the statutory "Assessments of Significance" (AoS) in accordance with the NSW *Biodiversity Conservation Act* 2016 (BC Act) and the Commonwealth *Environmental Protection and Biodiversity Conservation* Act 1999 (EPBC Act) to accompany the Appin Road Upgrade (Mount Gilead to Ambarvale) REF prepared by WSP for Roads and Maritime Services in October November 2018 (RMS 2018) and an addendum to the Appin Road Upgrade (Mount Gilead to Ambarvale) REF prepared by EMM 2022 along with changes made to the project since the exhibition of the AREF in December 2022 and after consideration of submissions received.

In order to address this, I have provided a brief summary of the koala mitigation proposed at each stage of the project to date.

The 2018 REF

The 2018 REF proposed to erect Koala exclusion fencing along the eastern side of Appin Road to prevent the east-west movement of Koalas across Appin Road and mitigate a significant risk to the local Koala population (vehicle strike) as recommended by the then Department of Planning, Industry and Environment (DPIE) (DPIE 2019). Following feedback and recommendations from the then DPIE, independent expert reports and consideration of submissions received by the community and key stakeholders, additional Koala fencing was added to the western side of Appin Road at Noorumba Reserve (RMS 2019).

The 2018 assessment concluded that the impact to Koala would not be significant under Part 7.3 of the BC Act or the Commonwealth EPBC Act.

The 2022 AREF

The 2018 REF, while addressing koala vehicle strike through a fencing strategy, did not support the ongoing management of the koala habitat corridors through Beulah and Noorumba Reserves by providing koala underpasses under Appin Road. The importance of these corridors for the ongoing viability of the local koala population, had since exhibition of the 2018 REF, been confirmed by the Office of the NSW Chief Scientist and the DPE have announced their intention to protect them through future precinct planning processes (OCSE 2020; DPIE 2021 Greater Macarthur 2040 Urban update, December 2021). The scope of the Appin Road Upgrade works were subsequently adjusted to accommodate these additional ameliorative measures and included two Koala underpasses (a northern underpass at Glen Lorne / Noorumba Reserve and an interim southern underpass at Browns Bush / Beulah Biobank site), koala exclusion fencing on the western side of Appin Rd to compliment

the fencing that was already provided on the eastern side of Appin Road and has been further extended to the southern boundary of the Beulah Biobank site and the addition of Koala grids at all property access points (EMM 2022). These measures, combined with the original REF, sought to address the concerns raised by OCSE 2020, 2021), ameliorate the impacts associated with vehicle strike and will maintain an important connectivity for the local koala population between the Georges and Nepean Rivers (Attachment B, Appendix A, **Figure 1**).

The proposed underpasses at Glen Lorne and Browns Bush coincided with the priority east-west koala movement corridors (Menangle Creek Corridor A and Woodhouse Creek Corridor B) connecting the Georges and Nepean Rivers identified by the Office of the NSW Chief Scientist and Engineer (OCSE February 2021). Further, the residential development proposed by Lendlease Communities at Mt Gilead (GLN Planning and ELA 2022) includes a 250 ha Koala Conservation area (236 ha of which will be registered as Biodiversity Stewardship Sites) with over 48 ha of restored habitat providing in perpetuity protection and fully funded, active conservation management) that will also be fully fenced with Koala exclusion fencing providing a fully contained Koala movement corridor connecting the Georges and Nepean River corridors (ELA 2022).

Changes following exhibition of the 2022 AREF

The AREF detailing these changes was exhibited in late 2022 and submissions received led to further changes to the design of the proposed koala mitigation, most notably:

- Changes to underpass dimensions from a 2.4m diameter pipe at Glen Lorne to a 2.4M(H)*3M(W) Reinforced Concrete Box Culvert (RCBC) and from two 1.2m diameter pipes at Browns Bush to a single 1.5M(H)*2.4M(W) RCBC, both at the same location as presented in the AREF
- Changes to the alignment of the Glen Lorne underpass making it perpendicular to Appin Road, rather than angled.
- Addition of ‘fauna furniture’ within the underpass structures and on batters to support koala movement
- Realignment of fencing to ensure tie-ins to underpass entrances and neighbouring fences and to avoid sharp angles that might impede koala movement
- Addition of refuge poles to connect culvert exits with nearby koala habitats to reduce predation risk while revegetation establishes and additional of escape poles to provide an additional koala escape route should they become inadvertently trapped in the road corridor
- Additional design detail about koala grid design and location at access points.
- Additional undertakings to extend the koala exclusion fencing at the southern boundary of the works should the koala exclusion fencing proposed by another TfNSW project, the Appin Road Safety Improvements Project not be installed within a reasonable period (e.g., 12 months).
- Additional monitoring and adaptive management requirements.

These changes are likely to improve the likelihood that koalas will use the underpasses and reduce the likelihood that koalas will be invertedly trapped behind the koala exclusion fencing and exposed to vehicle strike. Transport has published information about koala use of culverts on Transport projects since 2011. The underpasses as now proposed following exhibition of the AREF, clearly fit into the range of known use of underpasses by koalas and have good prospects for success.

Additional monitoring and adaptive management requirements will also address the risk that the mitigation measures not perform as expected (fence breaches, failure to use the underpass), or fence end effects occurring due to unexpected delays in the construction of the Appin Road Safety Improvements Project or dispersal of koalas from habitat corridors into Rosemeadow (due to fence installation) and potential entrapment on the wrong side of the fence on Appin Road.

Together with some design refinements since exhibition of the AREF, these changes required project boundary adjustments:

- at the eastern exit of the Glen Lorne underpass to accommodate its new perpendicular alignment.
- at the western exit of the Glen Lorne underpass to accommodate required drainage pipeline
- along the eastern side of Appin Road to accommodate high voltage connection point
- at the existing Lendlease property access point to accommodate a new material storage and compound location.

These changes are shown at Attachment B, Appendix A Figure 6: Changes in design since exhibition of the AREF.

Expected impacts on threatened species and ecological communities

The 2018 REF (Tables 3.3, 4.1 and 4.3 in WSP 2018) identified 7.28 ha of direct impacts to Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest (SSTF), both of which are listed as Critically Endangered Ecological Communities under the BC and EPBC Acts, and 6.22 ha of habitat for various threatened fauna species (including 6.22 ha of Koala habitat and 2.38 ha of Cumberland Plains Land Snail habitat (CPLS)). Part of these impacts (2.38 ha) had already been "certified" in the Mt Gilead Stage 1 residential development (Attachment A **Table 1**).

The Project as now proposed following the changes made since exhibition of the AREF will impact 10.96 ha CPW and SSTF (3.85 ha of which has already been certified) and 10.05 ha of direct impacts to Koala habitat (2.91 ha of which is already certified) and 7.83 ha of direct impacts to CPLS (2.75 ha of which is already certified) (Attachment A and **Attachment B, Appendix A, Figure 1)**. It is noted that slight changes to the areas of native and exotic vegetation have arisen when merging WSP 2018 and ELA 2022 data sets for the expanded study area and refining areas mapped as 'Planted Native Trees' and 'Exotic Grassland'.

Likelihood of significant impacts

This report provides an assessment of the 'likely' threatened species that may be 'directly' or 'indirectly' impacted by the proposed amended activity together with an "Assessment of Significance" under Part 7.3 of the BC Act (to determine whether a 'Species Impact Statement' (SIS) or Biodiversity Development Assessment Report (BDAR) is required) and an assessment of Matters of National Environmental Significance (MNES) under the EPBC Act (to determine whether a referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) is required).

The 2018 REF for the Appin Road Upgrade assessed the likely significance of impacts of the project on threatened species and ecological communities under both NSW and Commonwealth legislation and found no significant impacts were likely. The AREF, by providing koala connectivity under Appin Rd, provided an important update to the 2018 REF. The 2018 REF, while addressing koala vehicle strike through a fencing strategy, did not support the ongoing management of the koala habitat corridors through Beulah and Noorumba Reserves by providing koala underpasses under Appin Road. The importance of these corridors for the ongoing viability of the local koala population has since been confirmed by the Office of the NSW Chief Scientist and the now DPE have announced their intention to protect them through future precinct planning processes (DPE 2022 Greater Macarthur Urban Release Area update, November 2022). By addressing connectivity, the conclusion of this assessment report is that neither the impacts anticipated by the original REF (as now amended) or the minor additional impacts arising from the addendum REF or the changes made to the design since the exhibition of the AREF to improve the functionality of the underpasses and other koala mitigation measures are likely to have a significant impact on the koala or any other NSW or Commonwealth listed species or ecological communities.

All residual impacts will be offset in accordance with the RMS Offset Guidelines (RMS 2016) and a Biodiversity Offset Strategy will be prepared prior to the commencement of the action.

Attachment A: Expected impacts to vegetation tables.

Attachment B: Assessment of significance for final project including changes made since exhibition including

Appendix A: Maps including

Figure 1: Location of proposed koala underpasses in relation to the certified Figtree Hill Biocertification assessment area and proposed Mt Gilead Stage 2

Figure 2: Threatened flora species recorded within 5km of the study area (source Bionet 2023)

Figure 3: Threatened fauna species recorded within 5km of the study area (source Bionet 2023)

Figure 4: Threatened flora and fauna survey effort – Glen Lorne/Noorumba Underpass (ELA 2014, 2018, 2020, 2022, WSP 2018)

Figure 5: Threatened flora and fauna survey effort – Browns Bush – Beulah Underpass (ELA 2014, 2018, 2020, 2022, WSP 2018)

Figure 6: Changes in design since exhibition of the AREF (ELA 2023)

Figure 7(a – m): Amended REF Boundary (ELA 2023)

Figure 8(a – m): Plan Community Types (ELA 2023)

Figure 9(a – m): Potential Koala and Cumberland Plain Land Snail Habitat (ELA 2023)

Appendix B: Likelihood table

Appendix C: General site photos showing structure and condition of vegetation at proposed koala underpass locations

Appendix D: BC Act assessments of significance

Appendix E: EPBC Act MNES assessments of significance

Appendix F: References

Attachment A: Expected impact tables

Table 1: Impacts to native vegetation and threatened species habitat as described in the original REF (WSP 2018)

Plant Community Types & Condition	WSP 2018 Impact Area (Certified & Non-certified – Table 3.3)	Certified Land (June 2019)	Net Impacts requiring assessment
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (High)	0.74		0.74
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Medium)	1.34	1.11	0.23
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Low – remnant trees)	2.03	0.05	1.98
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Low – Derived Native Grasslands)	0.00		0.00
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (High)	0.29	0.00	0.29
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Moderate))	0.00		0.00
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Low – remnant trees)	1.81	0.36	1.45
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Low – Derived Native Grasslands)	1.07	0.85	0.22
Planted Natives	0.28		0.28
Urban Exotic/Native	0.89		0.89
Exotic grassland	5.73	1.66	4.07
Total	**14.18**	**4.04**	**10.14**
Total Native Vegetation Impacts	7.28	2.38	4.90
Vegetation Requiring offsets (RMS 2016)	2.08	0.00	1.26
Threatened Species habitat (Species Credit Species)			
Koala	6.22	1.52	4.70***
Cumberland Land Snail	2.38	1.11	1.27

*** Refer to Table 3 for Koala habitat calculations that includes planted native trees as Koala habitat

Table 2: Impacts to vegetation including native vegetation and threatened species habitat.

Table 2 includes impacts to all vegetation including native vegetation and threatened species as described in the Addendum REF (EMM 2022) and as a consequence of changes made since exhibition of the AREF.

Also identified are impacts already assessed due to the biodiversity certification of the Mt Gilead Estate Stage 1 and the offsetting required under RMS offsetting guidelines.

Plant Community Types & Condition	Vegetation Condition	Total Impacts (Original & Addendum REF as amended following exhibition of the AREF)	Certified Land (June 2019)	Net impacts requiring assessment
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (High)	High (EPBC Category D)	1.40	0.00	**1.40**
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Medium)	Moderate (EPBC Category C)	3.51	2.31	**1.19**
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Low – remnant trees)	Low	2.19	0.16	**2.03**
PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Low – Derived Native Grasslands)	Low	0.21	0.00	**0.21**
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (High)	High (EPBC Category A)	0.33	0.04	**0.30**
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Low – remnant trees)	Low	2.38	0.41	**1.98**
PCT 849: Grey box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Low – Derived Native Grasslands)	Low	0.94	0.94	**0.00**
Planted Natives		0.24	0.00	**0.24**
Urban Exotic/Native		0.97	0.00	**0.97**
Exotic grassland		8.15	3.40	**4.75**
Total		**20.32**	**7.25**	**13.08**

Total native vegetation impacts (less planted natives, urban exotic/native and exotic grassland)		10.96	3.85	7.11
Vegetation requiring offsets under RMS biodiversity offsetting guidelines (2016)		N/A	N/A	2.89

Table 3: Impacts to Koala and other threatened fauna species habitat as described in the Addendum REF (EMM 2022) and as a result of changes made since exhibition of the AREF

PCT and Condition	Total Impacts (Original & Addendum REF as amended since exhibition of the AREF)	Certified Land (June 2019)	Net Impacts Requiring Assessment
PCT 1395 Narrow-leaved Ironbark- Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (High)	1.40	0.00	**1.40**
PCT 1395 Narrow-leaved Ironbark Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Medium)	3.51	2.31	**1.19**
PCT 1395 Narrow-leaved Ironbark-Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Low – remnant trees)	2.19	0.16	**2.03**
PCT 849: Grey box-Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (High)	0.33	0.04	**0.30**
PCT 849: Grey box-Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Low – remnant trees)	2.38	0.41	**1.98**
Planted natives	0.24	0.00	**0.24**
TOTAL	**10.05**	**2.91**	**7.14**

Table 4: Impacts to Cumberland Plain Land Snail habitat as described in the Addendum REF (EMM 2022) and as a result of changes made since exhibition of the AREF

PCT and Condition	Total Impacts (Original & Addendum REF as amended since exhibition of the AREF)	Certified Land (June 2019)	Net Impacts Requiring Assessment
PCT 1395 Narrow-leaved Ironbark-Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (High)	1.40	0.00	**1.40**
PCT 1395 Narrow-leaved Ironbark-Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Medium)	3.51	2.31	**1.19**
PCT 1395 Narrow-leaved Ironbark-Broad-leaved Ironbark-Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Low – Derived Native Grasslands)	0.21	0.00	**0.21**
PCT 849: Grey box-Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (High)	0.33	0.04	**0.30**
PCT 849: Grey box-Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (Low – remnant trees)	2.38	0.41	**1.98**
TOTAL	**7.83**	**2.75**	**5.08**

Attachment B: Assessment of Significance – Gilead to Ambarvale Appin Rd Upgrade

Study Area and Impact Assessment Methodology

Lend Lease have provided the construction boundary and design details for the final proposed project as amended as a consequence of the exhibition of the AREF and the consideration of submissions. These changes include:

- Changes to underpass dimensions from a 2.4m diameter pipe at Glen Lorne to a 2.4M(H)*3M(W) Reinforced Concrete Box Culvert (RCBC) and from two 1.2m diameter pipes at Browns Bush to a single 1.5M(H)*2.4M(W) RCBC, both at the same location as presented in the AREF
- Changes to the alignment of the Glen Lorne underpass making it perpendicular to Appin Road, rather than angled.
- Addition of 'fauna furniture' within the underpass structures and on batters to support koala movement
- Realignment of fencing to ensure tie-ins to underpass entrances and neighbouring fences and to avoid sharp angles that might impede koala movement
- Addition of refuge poles to connect culvert exits with nearby koala habitats to reduce predation risk while revegetation establishes and additional of escape poles to provide an additional koala escape route should they become invertedly trapped in the road corridor
- Additional detail about koala grid design and location at access points.
- Additional undertakings to extend the koala exclusion fencing at the southern boundary of the works should the koala exclusion fencing proposed by another TfNSW project, the Appin Road Safety Improvements Project not be installed within a reasonable period (e.g. 12 months).
- Additional monitoring and adaptive management requirements.

Appendix A provides a series of maps showing the 2018 AREF disturbance area and amended impact area (following exhibition of the AREF) and the final location of proposed Koala underpasses and temporary construction and permanent Koala exclusion fencing. The general location of the two proposed underpasses (Glen Lorne in the north and Browns Bush in the south), is shown in Appendix A Figure 1.

ELA have undertaken extensive ecological studies of the Mt Gilead area since 2013 (ELA 2014, 2018a, b and c, 2019, 2020 and 2022) and the Noorumba Reserve (ELA 2018d), in addition to the surveys undertaken by WSP for the Appin Road REF (WSP 2018), and have used this information and an updated review of BioNet threatened species records within 5km of the study area (**Figures 2** and **3**), to undertake this assessment of the likely impacts to biodiversity values. **Appendix B** is a summary of all the listed threatened species known or likely to occur in the vicinity of the project.

Appendix A Figure 1 and Figure 7 (a – m) shows the amended 'limit of disturbance' of the project, the position of temporary and permanent Koala exclusion fencing and the location of the earth works required to construct the two fauna underpasses.

The extent of targeted threatened flora and fauna survey effort along the entire route of the Project is described in WSP (2018) and ELA (2013 and 2022). Additional surveys in the vicinity of the two underpass locations as a result of changes since exhibition of the AREF are shown in Appendix A **Figures 4** and **5**.

Appendix A Figure 8 (a – m) and Figure 9 (a – m) shows the vegetation mapping along the entire route of the Project and the areas mapped as Koala and/or CPLS habitat.

The amended impact footprint will directly impact 10.96 ha of native vegetation in various condition states (as shown in **Table 2 of Attachment A**):-

- 1.40 ha of 'good' condition SSTF,
- 3.51 ha of moderate condition SSTF,

- 2.19 ha of low condition SSTF (scattered remnant tress over exotic grassland)
- 0.21 ha of derived native grassland SSTF (DNG)
- 0.33 ha of 'good' condition CPW,
- 2.38 ha of low condition CPW (scattered remnant tress over exotic grassland); and
- 0.94 ha of derived native grassland CPW (DNG); and
- 0.24 ha of planted native vegetation (providing potential foraging habitat for the Koala).

3.85 ha of these impacts have already been approved as part of the biodiversity certification of the Mt Gilead Residential development (ELA 2018, **Appendix A Figure 1**), leaving residual net impacts of 7.11 ha to be assessed as part of the Project.

The amended impact footprint will directly impact 10.05 ha of Koala habitat and 7.83 ha of Cumberland Plain Land Snail (CPLS) habitat in various condition states (as shown in Attachment A, **Table 3** and **4**). 2.91 ha of Koala habitat impacts and 2.75 ha of CPLS habitat impacts have already been approved as part of the biodiversity certification of the Mt Gilead Residential development (ELA 2018 and Attachment B, **Appendix A**), leaving residual net impacts of 7.14 ha of Koala habitat and 5.08 ha of CPLS to be assessed as part of the REF and AREF.

Results of database review and site assessment undertaken as part of the REF, AREF and following exhibition of the AREF and resultant design changes

The biodiversity assessment for the AREF (and the results of previous investigations undertaken by WSP 2018) have found the following biodiversity values in (or adjacent to) the impact area:-

- The presence of two ecological communities (Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest (SSTF) in various condition states, which are listed on both the NSW Biodiversity Conservation Act (BC Act 2016) and Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) as critically endangered ecological communities
    - The Project study area (limit of disturbance) includes 3.66 ha of CPW (0.33 ha in good condition and 3.32 ha in poor condition). Only 0.33 ha of the CPW to be impacted meets the EPBC Act CPW condition thresholds (Category A) of which 0.04ha is already approved as Part of Mt Gilead Stage 1 (**Table 2**). There are a number of trees with hollows to be impacted.
    - The study area includes 7.30 ha of SSTF (1.40 ha in good condition, 3.55 ha in moderate condition and 2.40 ha in poor condition). 4.90 ha of SSTF in the study area meets EPBC Act SSTF condition thresholds (1.40 ha Category D, 3.51 ha Category C), of which 2.31 of Category C SSTF has already been approved in Mt Gilead Stage 1 and includes a number of hollow bearing trees.
- 10.05 ha of habitat for Koala (the area is mapped as "Core Habitat" in Campbelltown Councils approved Comprehensive Koala Management Plan (CCC 2018), although the SEPP (Biodiversity and Conservation) 2021 does not apply to Part 5 Activities). 2.91 ha of this habitat has already been certified as part of Mt Gilead Stage 1 and also approved under EPBC 2015/7599 leaving 7.14 ha of residual impacts.
- 7.83 ha of habitat for the Cumberland Plain Land Snail (CPLS) in areas where there is native ground cover deep litter present. 2.75 ha of this habitat has already been certified as part of Mt Gilead Stage 1 and also approved under EPBC 2015/7599 leaving 5.08 ha of residual impacts
- Up to 10.05 ha of 'Known' and 'Potential' foraging habitat for the Squirrel Glider, threatened owl species including Powerful and Barking Owls, Glossy-Black and Gang-gang Cockatoos (Gang-gang Cockatoos

were recorded breeding at St Helens Park in 2020 and 2021) and potential foraging habitat for the Swift Parrot (although the area is not mapped by DPE as "important Habitat" for the Swift Parrot.

- There were no raptor nests observed in the impact area.
- A number of threatened plants may also occur (*Pomaderris brunnea* (recorded along Woodhouse Creek in Mt Gilead Stage 2 between 2015-2018 and the Georges River corridor), *Pimelea spicata* (recorded on the eastern side of Appin Rd opposite Noorumba Reserve, and north of the proposed koala underpass in 2020) and *Pterostylis saxicola* (recorded on the western side of the Nepean River at Menangle in 2019).
- No threatened plants species have been recorded in the impact areas despite several seasons of targeted survey during appropriate seasons (WSP 2018 and ELA 2020 and 2022).

The BC and EPBC Acts require consideration of whether an 'activity' or proposed 'action' respectively, is likely to 'significantly' affect threatened species, populations and ecological communities or their habitats (BC Act) or MNES (EPBC Act). Threatened species, populations and ecological communities that were recorded or considered likely to occur within the study area are listed in Appendix B**.**

Impact Assessment

An assessment of significance (five-part test) as set out in Section 7.3 of the BC Act is included for all species 'known' or considered 'likely' to occur in the study area (**Appendix B**) and is provided at **Appendix D**.

All AoS prepared by WSP (2018) have been reviewed and updated with new impact areas, with only impacts to listed threatened communities and the Koala and CPLS AoS's requiring significant changes due to the material changes to the likely impacts of the Project. It is noted that the revised assessments has only included those 'residual impacts' not already approved by the Biodiversity Certification of the Mt Gilead Residential Development (Order conferring Biodiversity Certification of Mt Gilead Stage 1 dated 28 June 2019, NSW Government Gazette No. 70 of 5 July 2019) or the EPBC approval of the Mt Gilead Residential Development (EPBC 2015-7599 dated 21 December 2018), which both provided for that part of the Appin Road upgrade within the biodiversity certification area.

The revised assessments have concluded that the Appin Road Upgrade Project, as amended by the addendum REF and further changes to design following exhibition of the AREF is unlikely to result in a 'significant effect' on the Koala or local Koala population (or any other threatened species or listed ecological community) by the impact to up to 2.28 ha of CPW (in various condition states and multiple fragmented patches and 4.83 ha of SSTF in various condition states and multiple fragmented patches, and associated threatened fauna habitat, and thus a species impact statement or BDAR is not required.

The loss of a further 7.14 ha of habitat for the Koala will be balanced by a significant reduction in existing and future road mortality that is likely to be impacting the viability of the local Koala population. New environmental safeguards involving monitoring and adaptive measures have been put in place to manage any unexpected residual impacts arising from installing a koala exclusion fence along Appin Road including the possibility of isolating koalas within Noorumba Reserve (should the proposed Appin Road underpass not function as anticipated and the Sydney Water canal continue present a barrier to koalas) or increased koala dispersal in to the suburb of Rosemeadow due to the barrier effects of the new fence.

Similarly, an assessment of whether any Matters of National Environmental Significance (MNES) under the Commonwealth EPBC Act (i.e. CPW, SSTF, Koala, foraging habitat for Large-eared Pied Bat, Swift Parrot and Grey-headed Flying-fox or any potential breeding sites for Gang-gang Cockatoo and Glossy Black Cockatoo) will be significantly affected is included at **Appendix E**. The assessment has also concluded that the Appin Road Upgrade project, as amended by the addendum REF (to include Koala underpasses and Koala exclusion fencing),

is unlikely to result in a 'significant effect' on the Koala or local Koala population or any other EPBC Act threatened species or listed ecological community by the direct impact to up to 0.30 ha of EPBC Act Condition A CPW and 2.59 ha of EPBC Act Condition D and C SSTF (and associated threatened fauna habitat), and thus a referral is not required. Any loss of potential foraging habitat for Koala will be balanced by a significant reduction in existing road mortality that is likely to be impacting the viability of the local population and, provided the underpasses function as expected, improved east-west connectivity between the Georges and Nepean River corridors.

Biodiversity Offsets

The RMS Guideline for Biodiversity Offsets Version 2.0 (RMS November 2016) includes thresholds for when offsets are required (Table 1 of RMS 2016). Any clearing of national or NSW listed critically endangered ecological communities (CEEC) in moderate to good condition require offsets. Any works involving clearing of NSW listed threated species habitat where the species is a species credit species (e.g. Koala, CPLS) requires an offset when the area to be cleared is > 1ha.

As there is CPW and SSTF in moderate and good condition to be cleared, and there is greater than one hectare of Koala and CPLS habitat to be cleared, offsets for these entities are required.

These impacts will be offset in accordance with the RMS Offset Guideline (RMS 2016) and a Biodiversity Offset Strategy will be prepared.

Conclusion

The 2018 REF for the Appin Road Upgrade assessed the likely significance of impact of the Project on threatened species and ecological communities under both NSW and Commonwealth legislation and found no significant impacts were likely. The addendum REF (EMM 2022) has materially changed the potential impact to the local Koala population by maintaining koala connectivity under Appin Rd by the provision of two Koala underpasses at strategic locations recommended by the Office of the NSW Chief Scientist, now includes Koala exclusion fencing on both sides of Appin Road to guide Koala's to areas where safe crossings can be made and includes specially designed and constructed Koala-grids across driveways and fence-ends. The 2018 REF, while addressing koala vehicle strike through a fencing strategy, did not support the ongoing efficacy of the koala habitat corridors through Beulah / Woodhouse Creek and Noorumba / Menangle Creek by providing koala underpasses under Appin Road. The importance of these corridors for the ongoing viability of the local koala population has since been confirmed by the Office of the NSW Chief Scientist and the DPE have announced their intention to protect them through future precinct planning processes (DPIE 2021 and DPE 2022). By addressing connectivity including the improvements made since the exhibition of the AREF, the conclusion is that neither the impacts anticipated by the original REF (as now amended) or the minor additional impacts arising from this addendum REF or the changes made since the exhibition of the AREF are likely to have a significant impact on the koala or any other NSW or Commonwealth listed species including the koala.

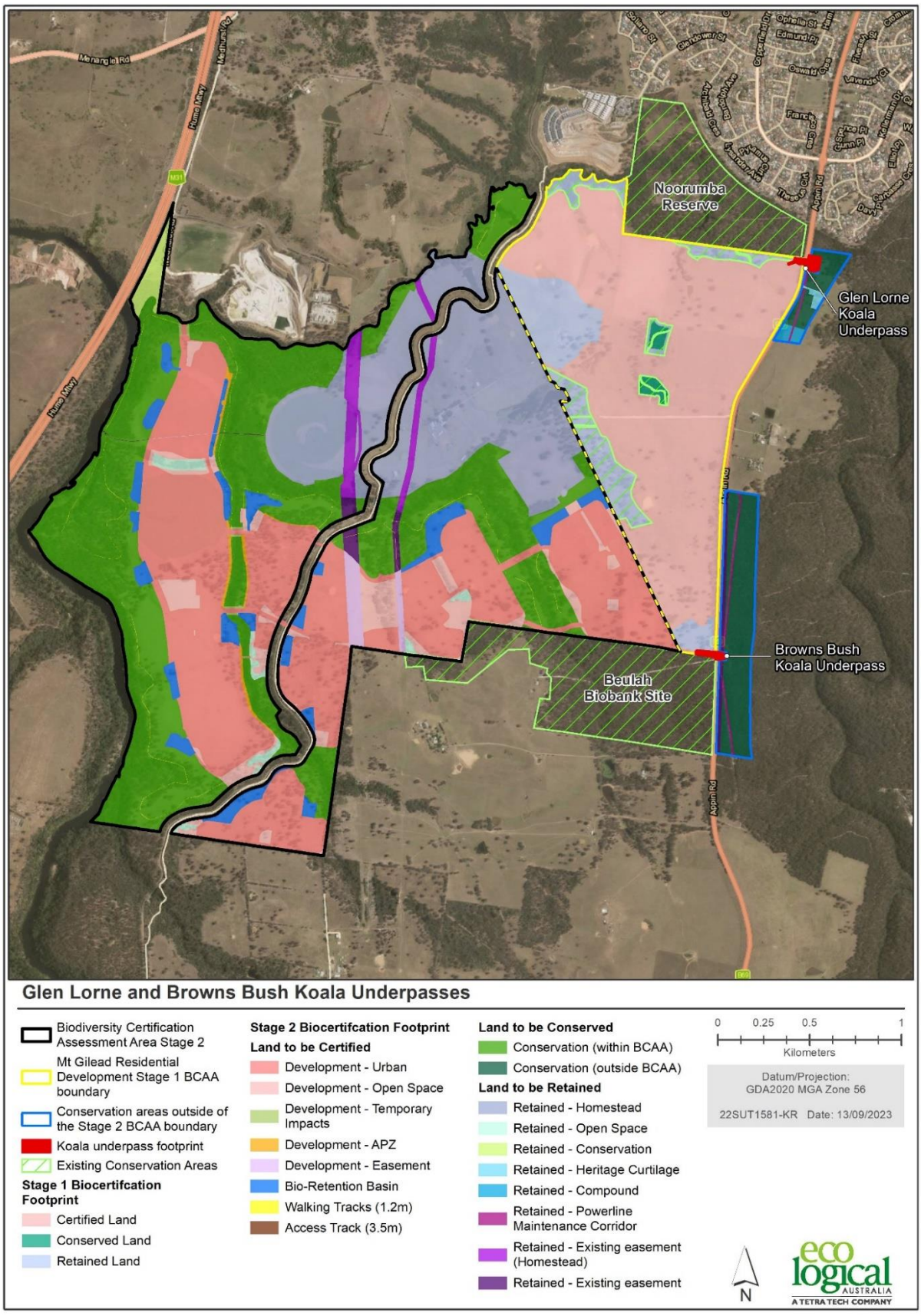

Figure 1: Location of proposed koala underpasses in relation to the certified Figtree Hill Biocertification Assessment Area and proposed Mt Gilead Stage 2

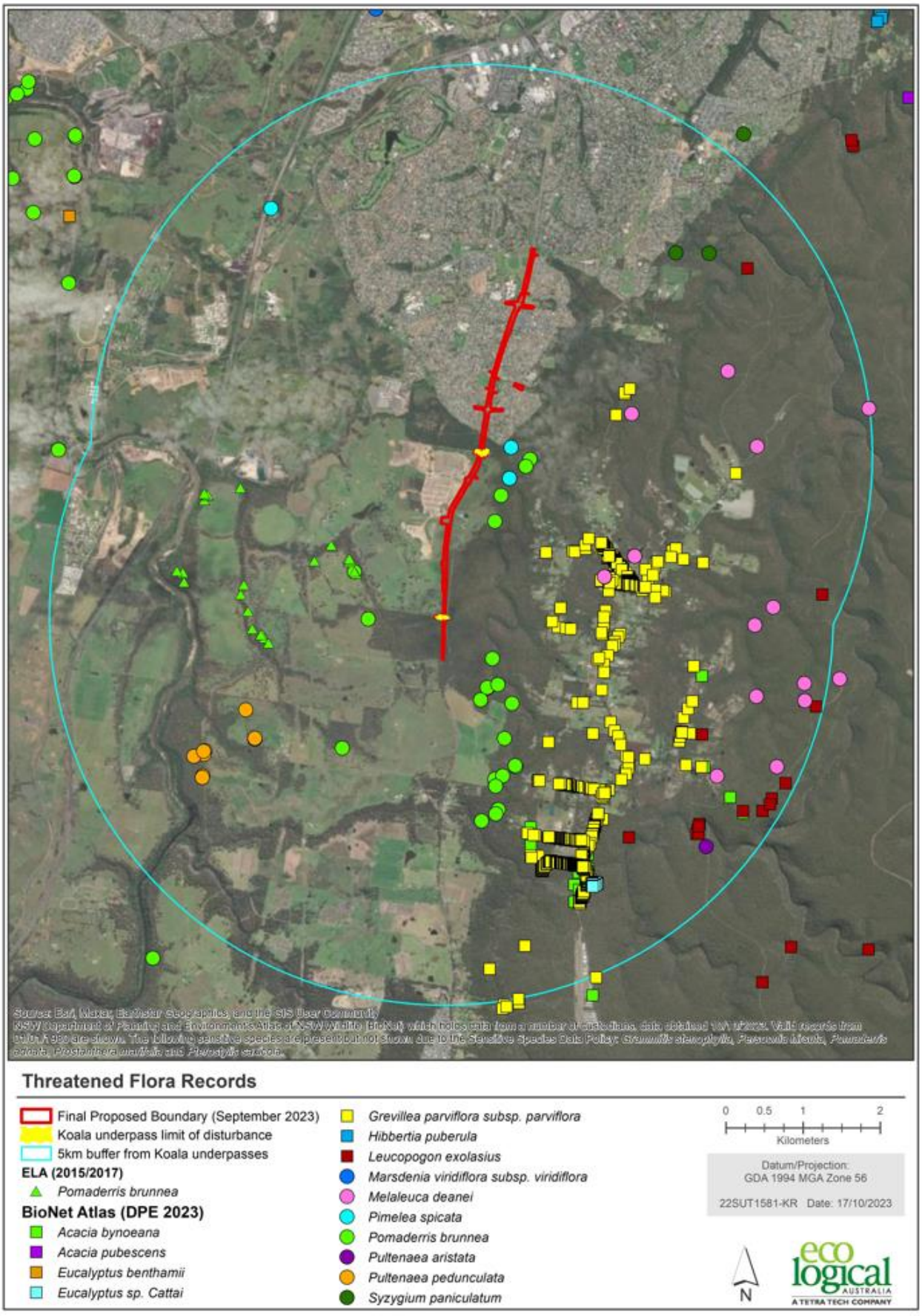

Figure 2: Threatened flora species recorded within 5 km of study area (Source BioNet 2023)

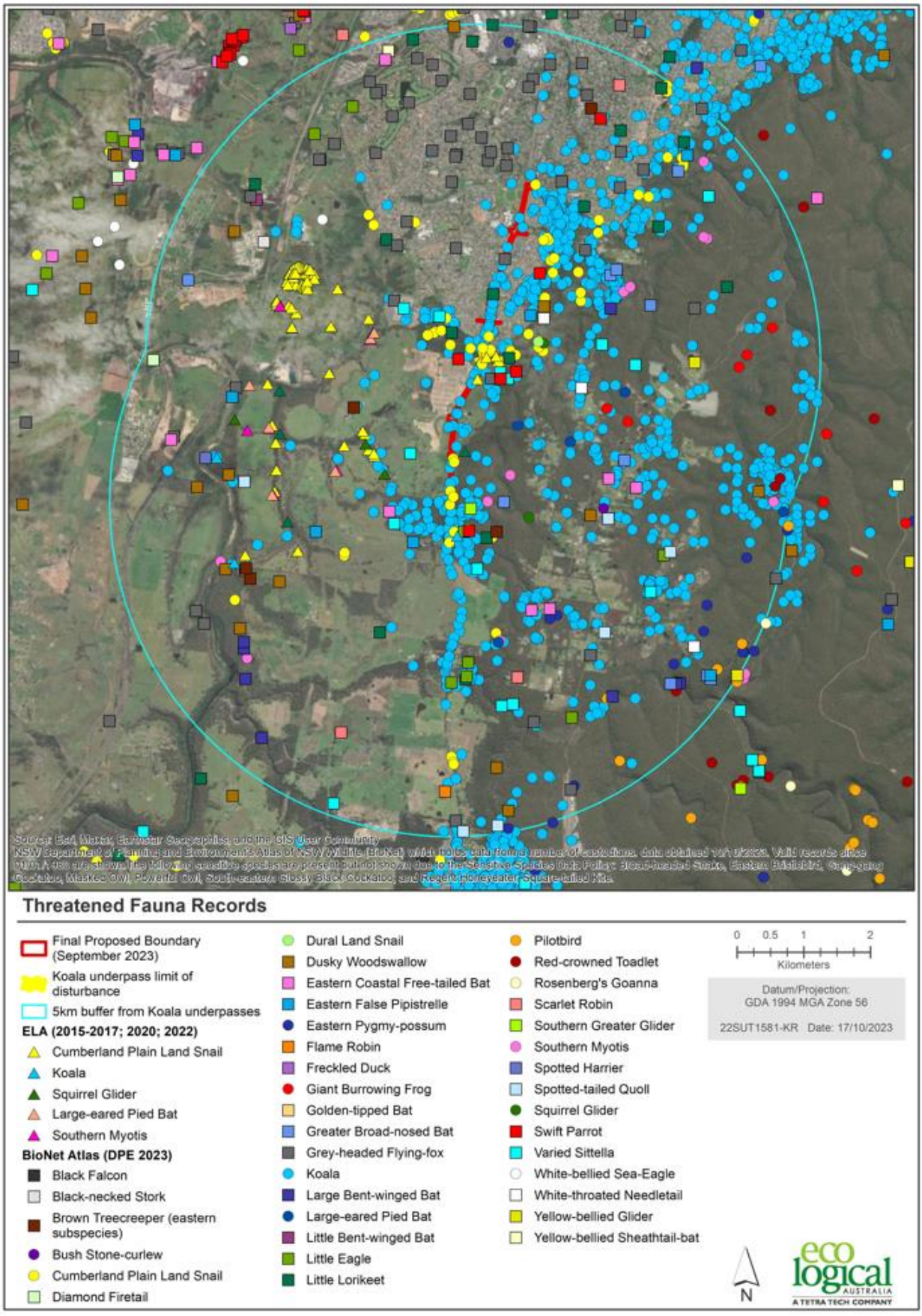

Figure 3: Threatened fauna species recorded within 5 km of study area (Source BioNet 2023)

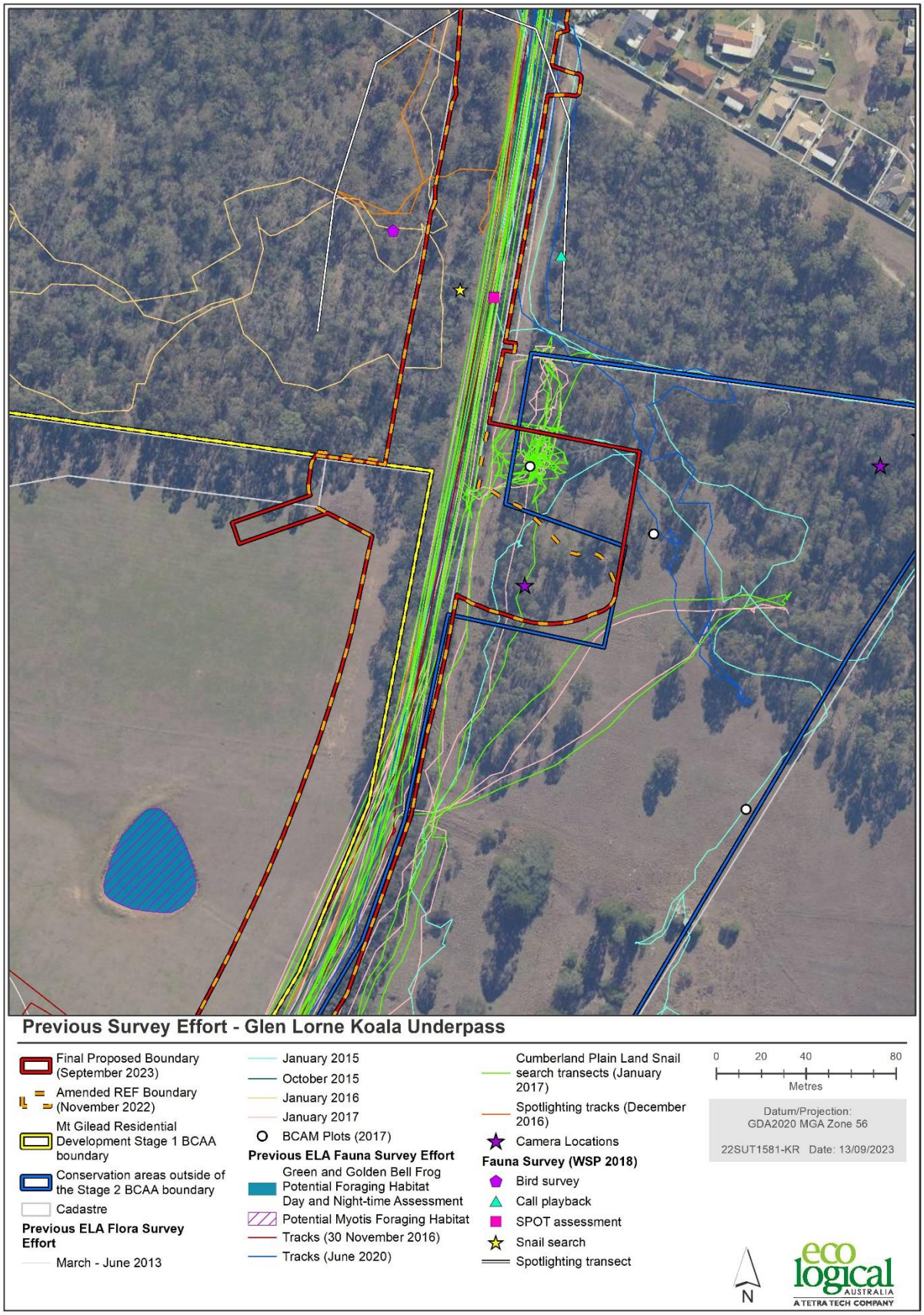

Figure 4: Threatened flora and fauna survey effort – Glen Lorne / Noorumba Underpass (ELA 2014, 2018, 2020, 2022, WSP 2018)

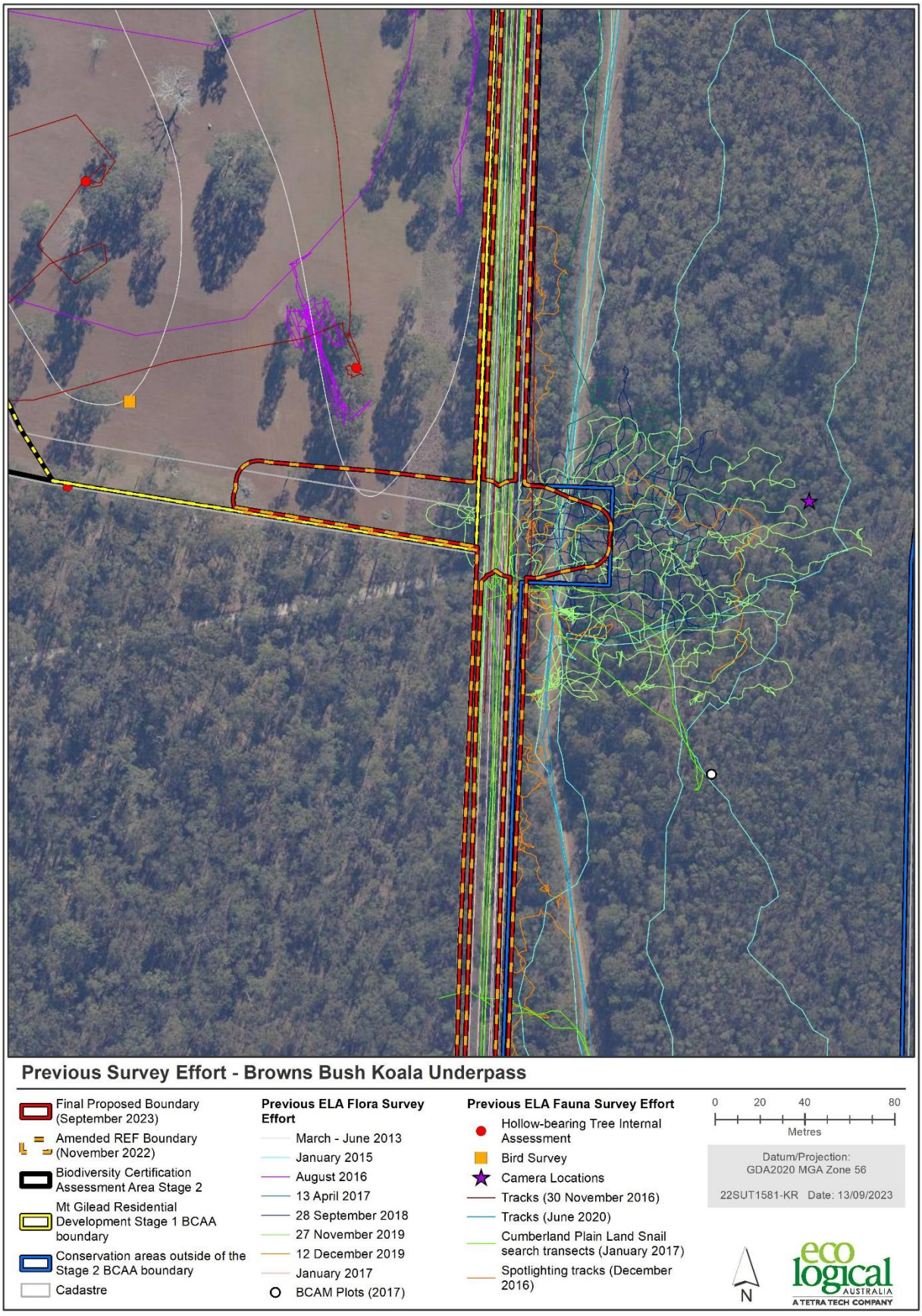

Figure 5: Threatened flora and fauna survey effort – Browns Bush - Beulah Underpass (ELA 2014, 2018, 2020, 2022, WSP 2018)

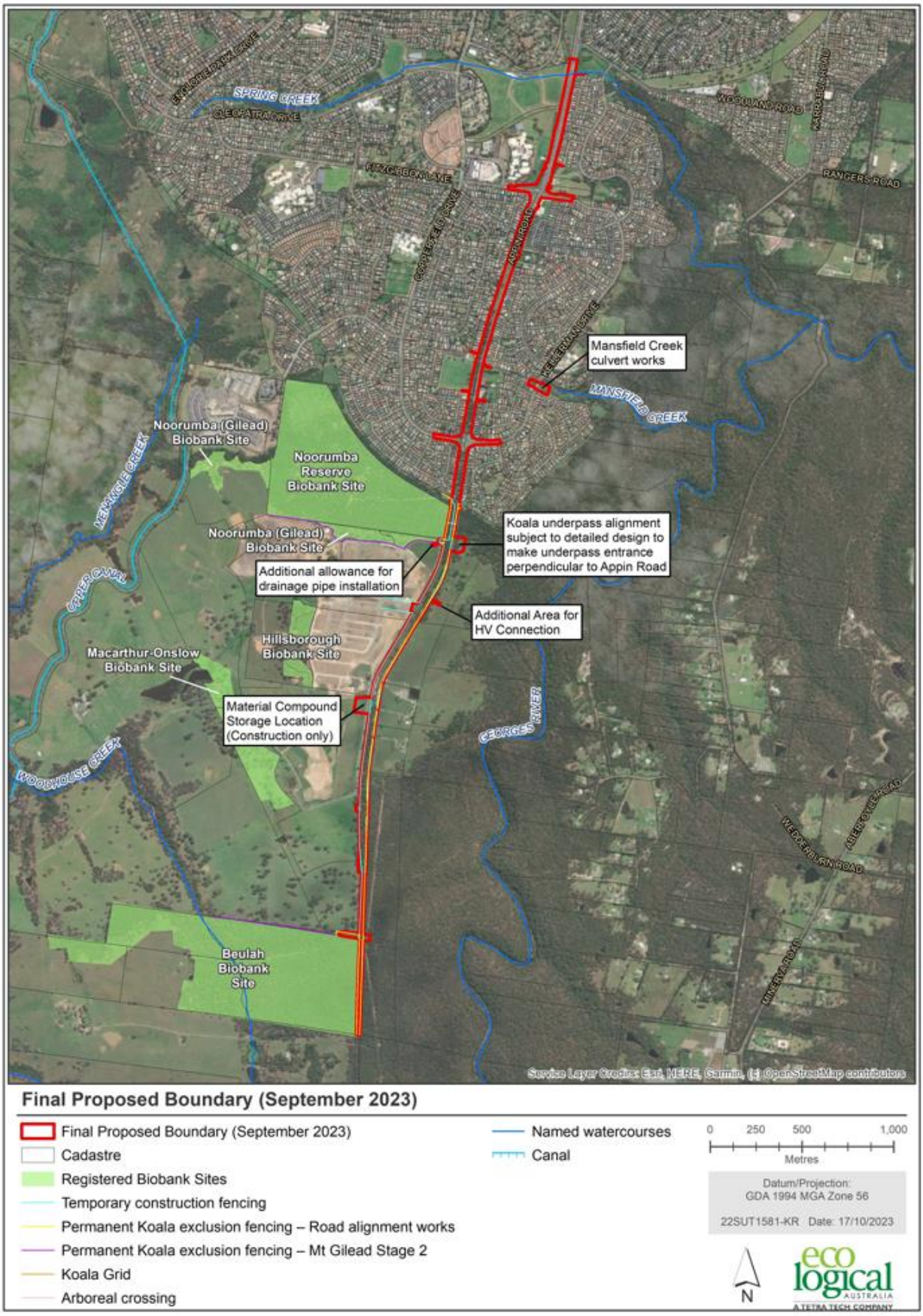

Figure 6: Changes in design since exhibition of the AREF – (ELA 2023)

Figure 7(a): Page 1 of 13 Amended REF Boundary – (ELA 2023)

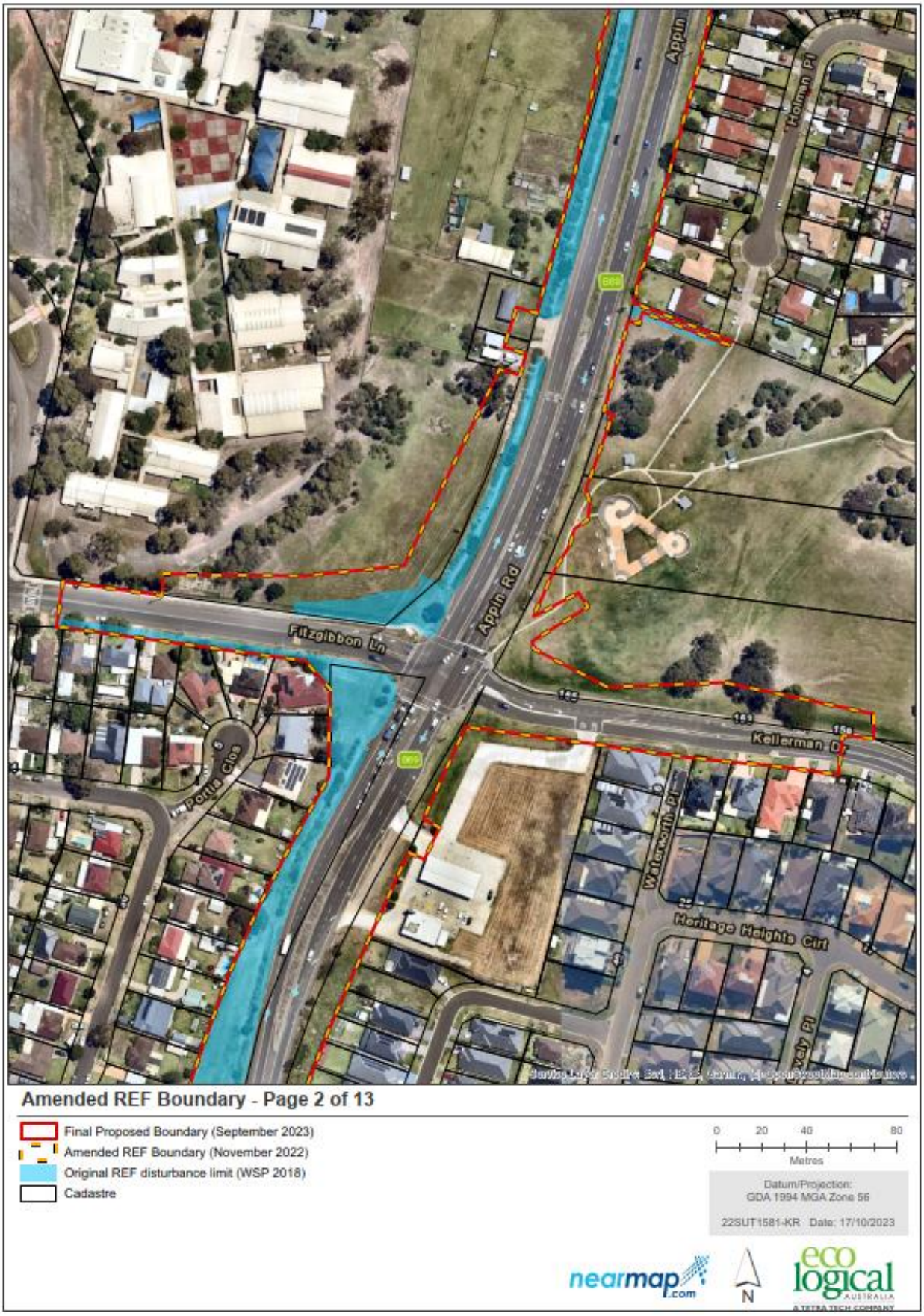

Figure 7(b): Page 2 of 13 Amended REF Boundary – (ELA 2023)

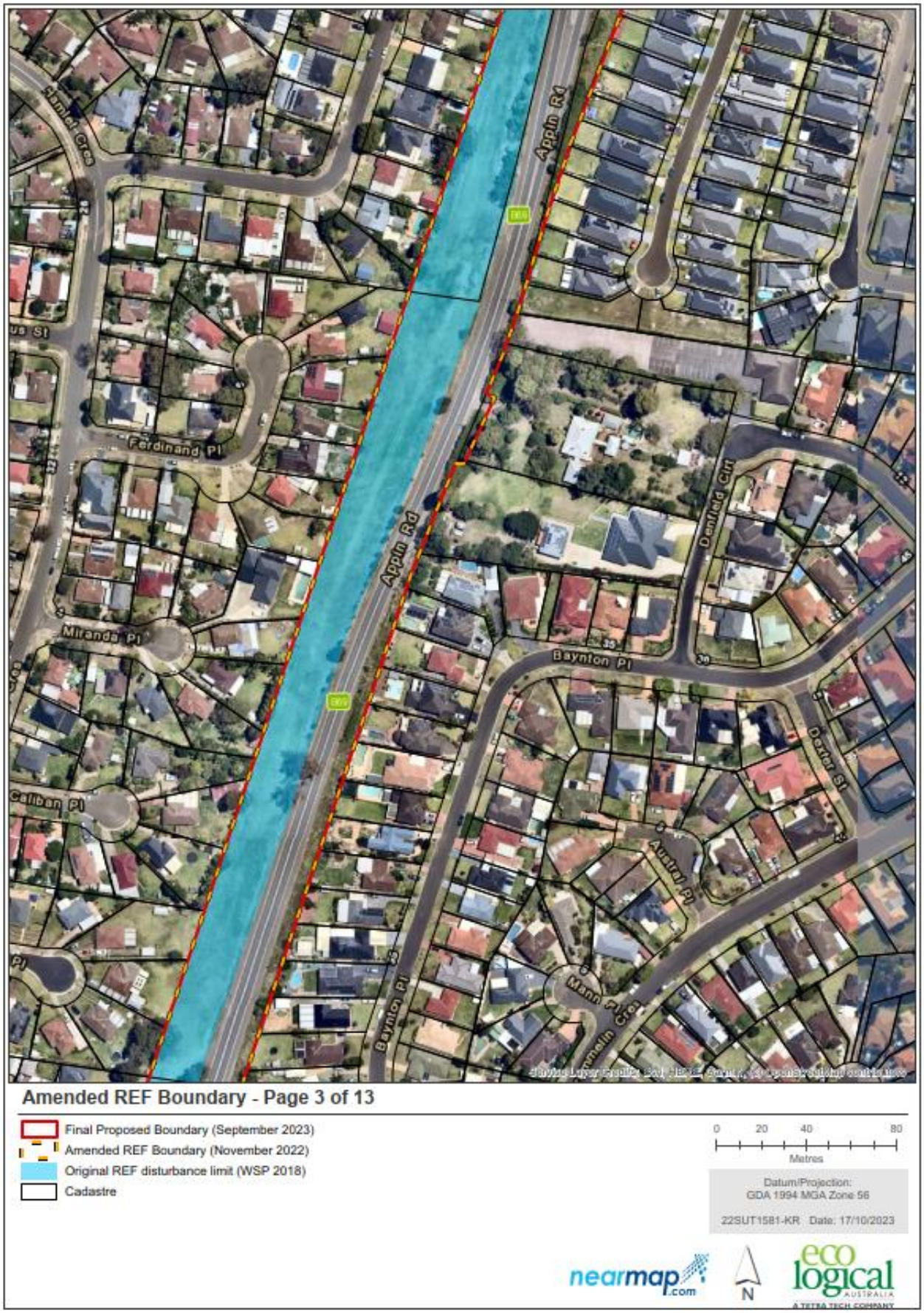

Figure 7(c): Page 3 of 13 Amended REF Boundary – (ELA 2023)

Figure 7(d): Page 4 of 13 Amended REF Boundary – (ELA 2023)

Figure 7(e): Page 5 of 13 Amended REF Boundary – (ELA 2023)

Figure 7(f): Page 6 of 13 Amended REF Boundary – (ELA 2023)

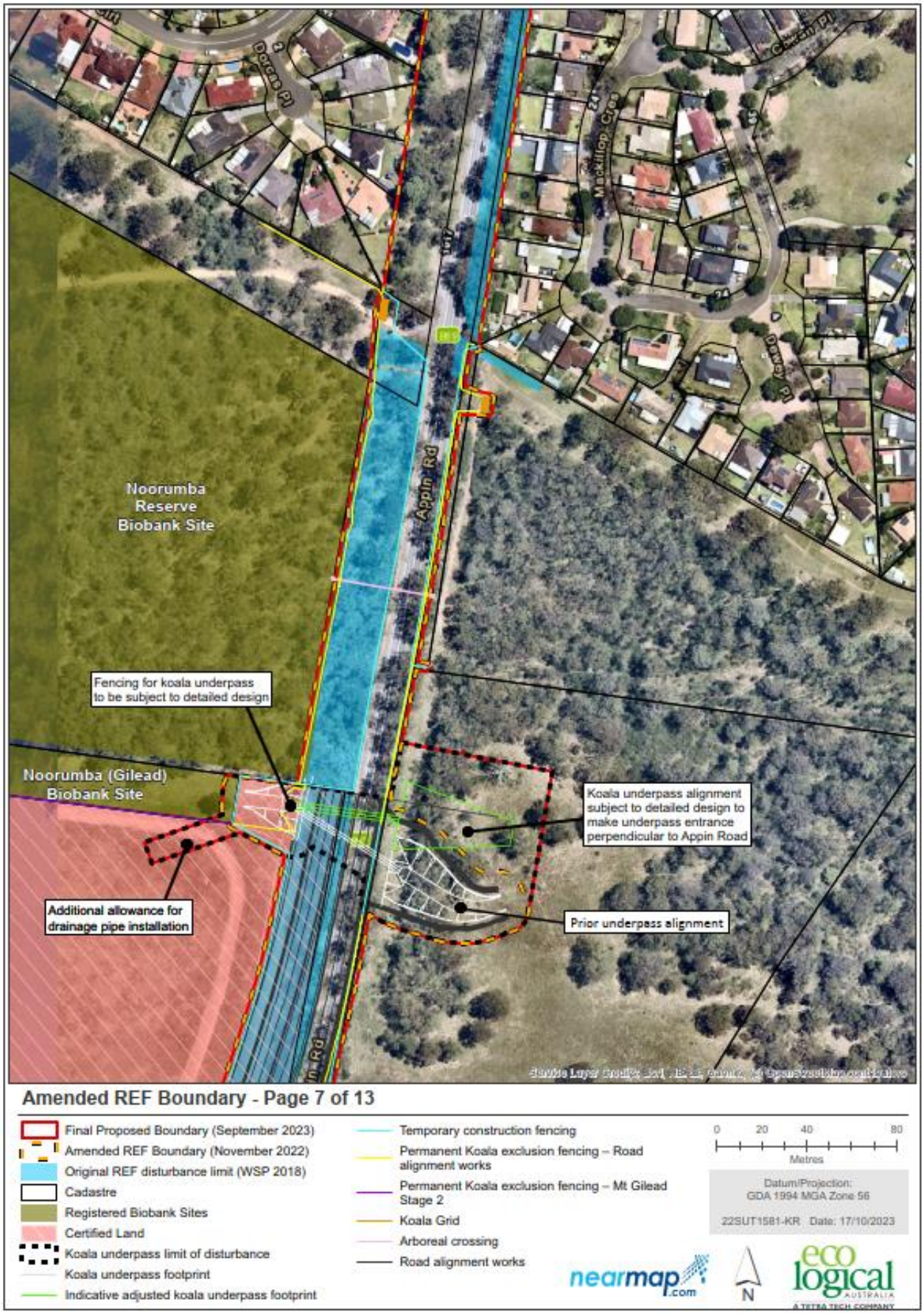

Figure 7(g): Page 7 of 13 Amended REF Boundary – (ELA 2023)

Figure 7(h): Page 8 of 13 Amended REF Boundary – (ELA 2023)

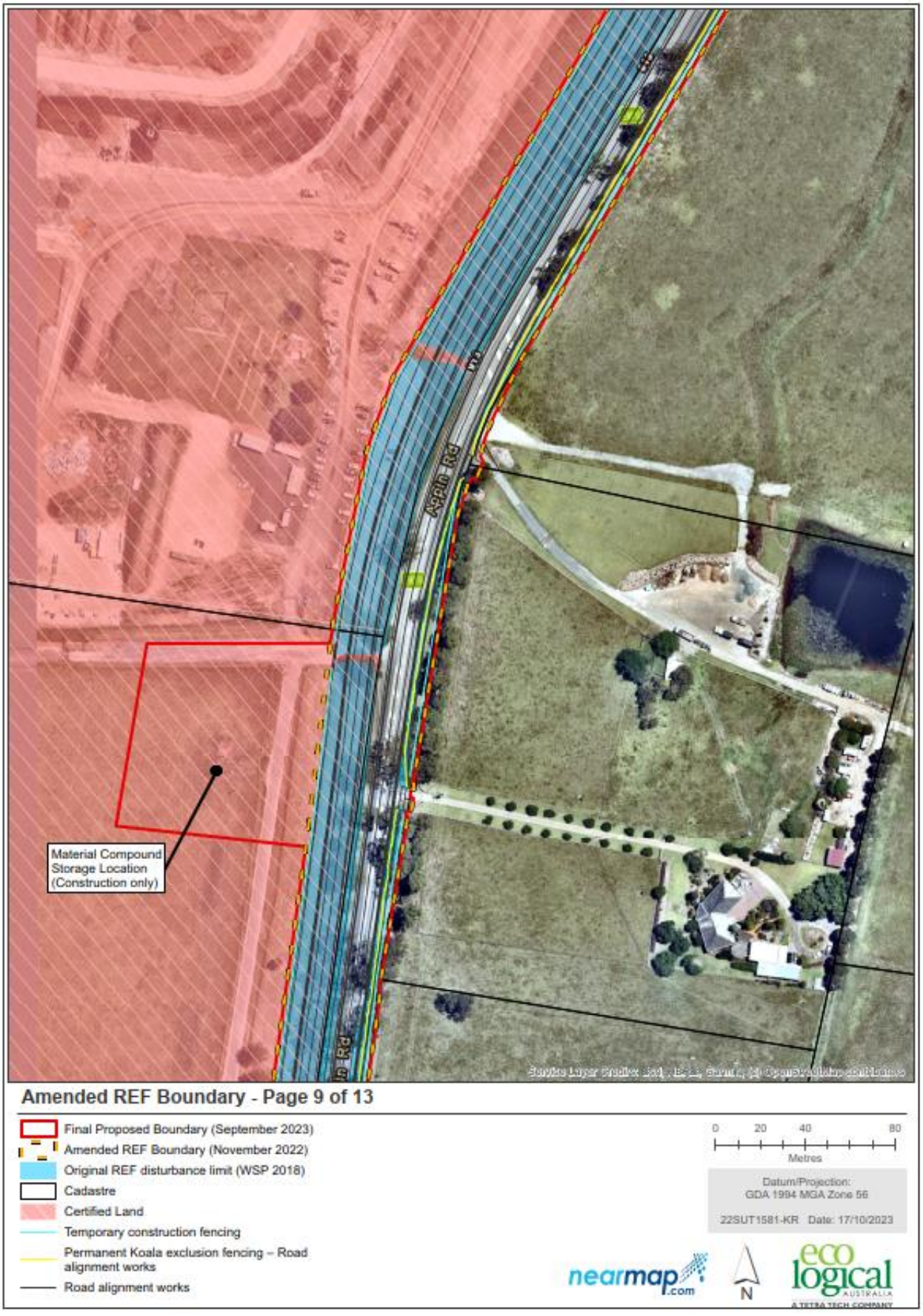

Figure 7(i): Page 9 of 13 Amended REF Boundary – (ELA 2023)

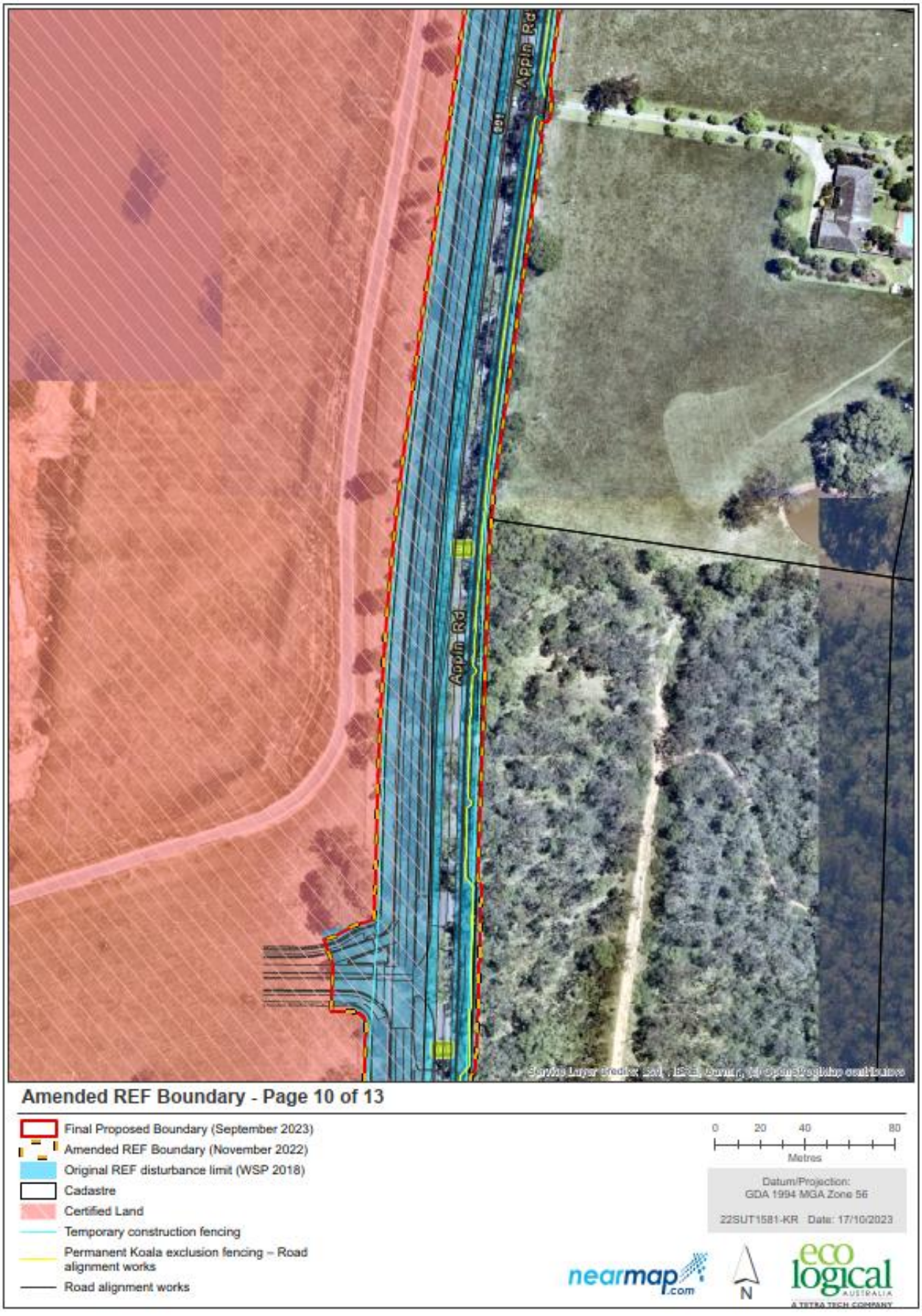

Figure 7(j): Page 10 of 13 Amended REF Boundary – (ELA 2023)

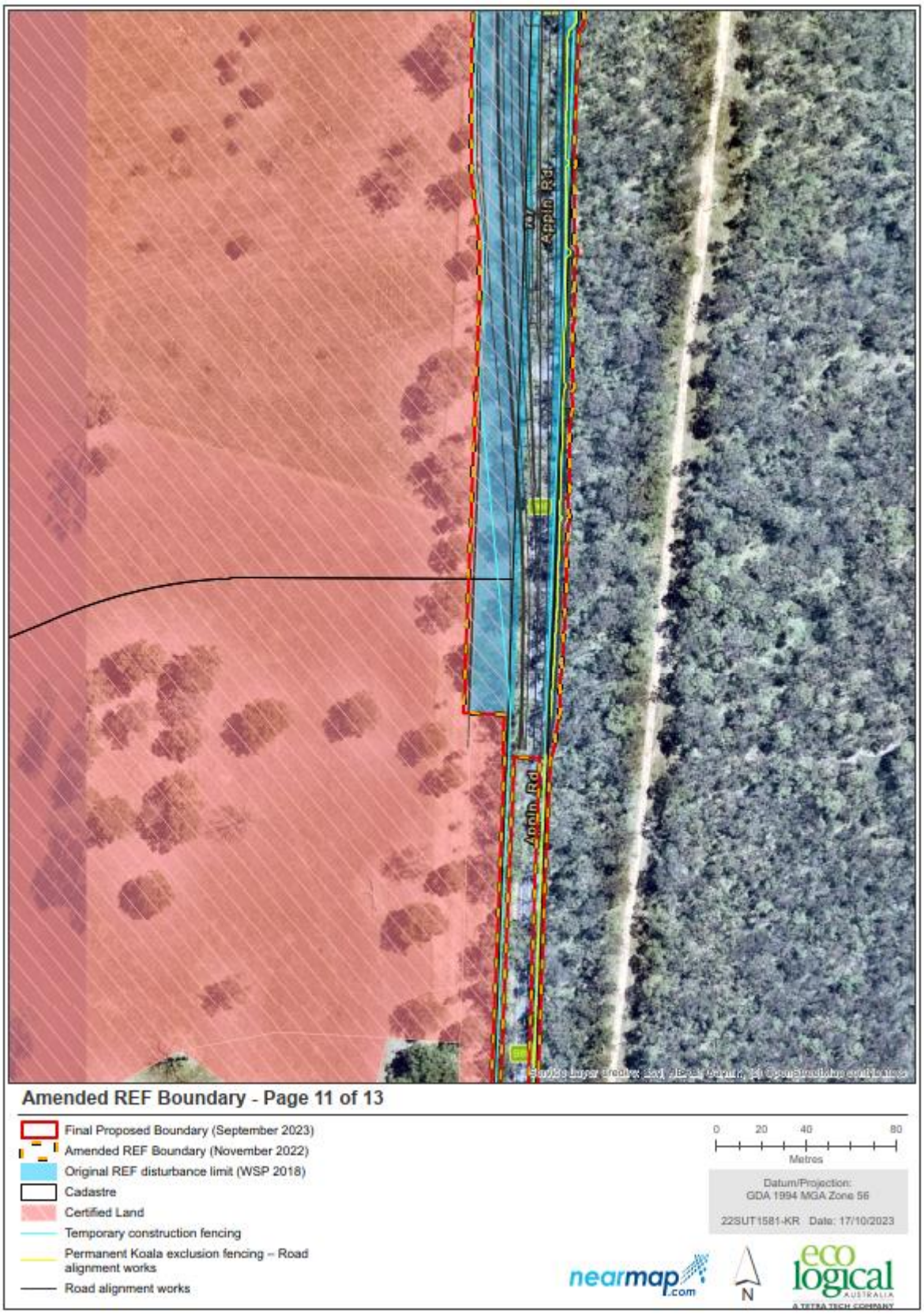

Figure 7(k): Page 11 of 13 Amended REF Boundary – (ELA 2023)

Figure 7(l): Page 12 of 13 Amended REF Boundary – (ELA 2023)

Figure 7(m): Page 13 of 13 Amended REF Boundary – (ELA 2023)

Figure 8(a): Page 1 of 13 Plant Community Types – (ELA 2023)

Figure 8(b): Page 2 of 13 Plant Community Types – (ELA 2023)

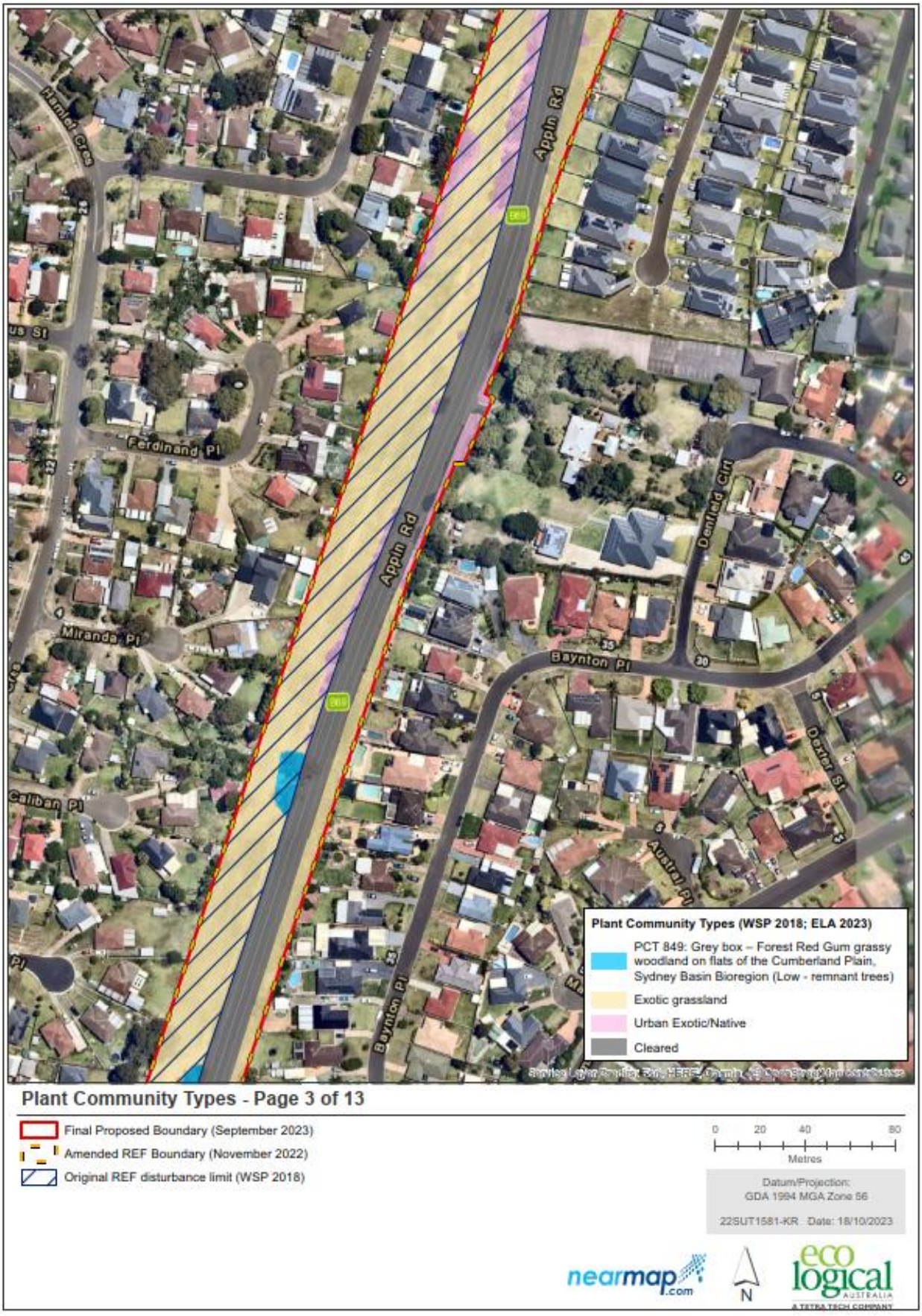

Figure 8(c): Page 3 of 13 Plant Community Types – (ELA 2023)

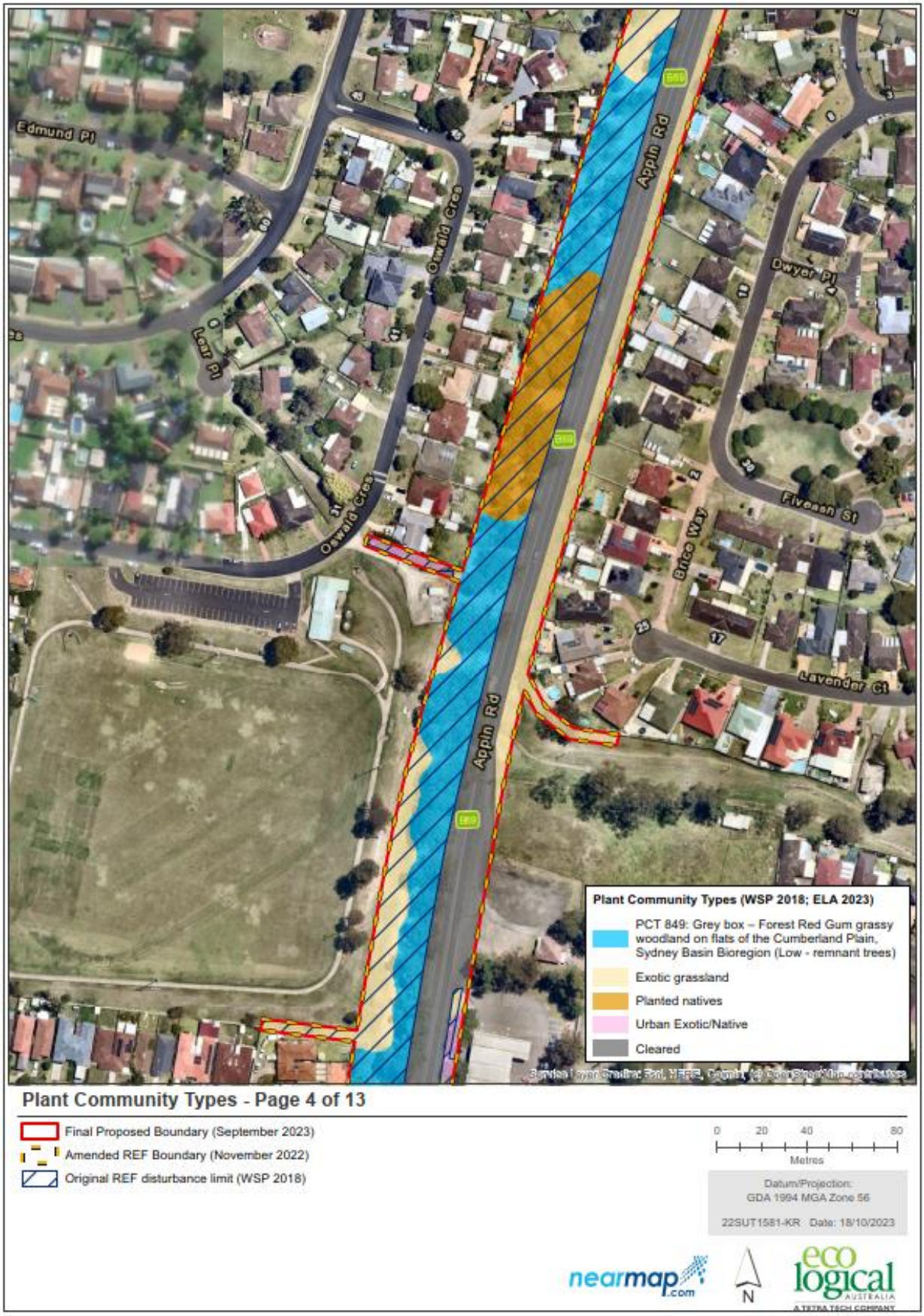

Figure 8(d): Page 4 of 13 Plant Community Types – (ELA 2023)

Figure 8(e): Page 5 of 13 Plant Community Types – (ELA 2023)

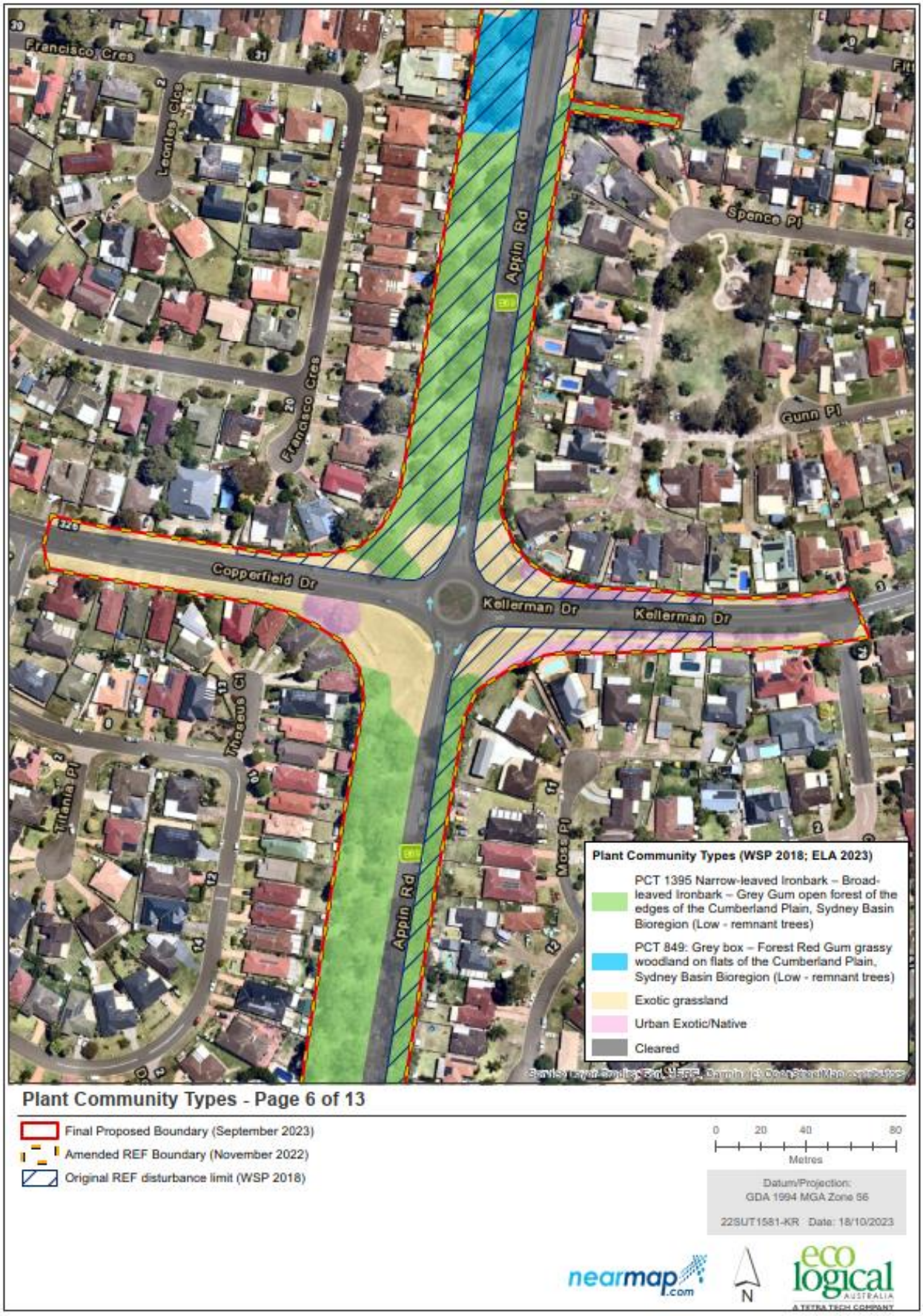

Figure 8(f): Page 6 of 13 Plant Community Types – (ELA 2023)

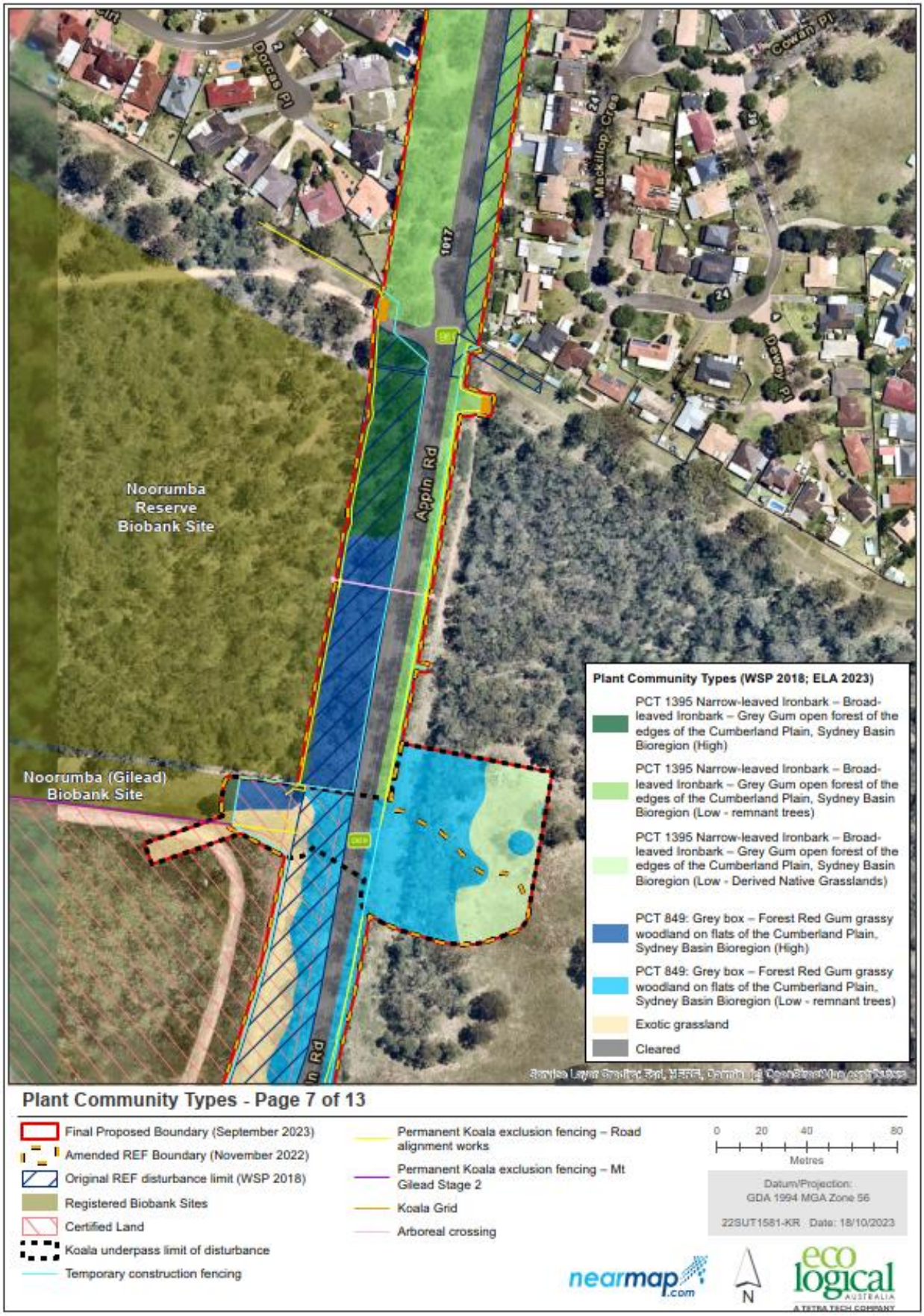

Figure 8(g): Page 7 of 13 Plant Community Types – (ELA 2023)

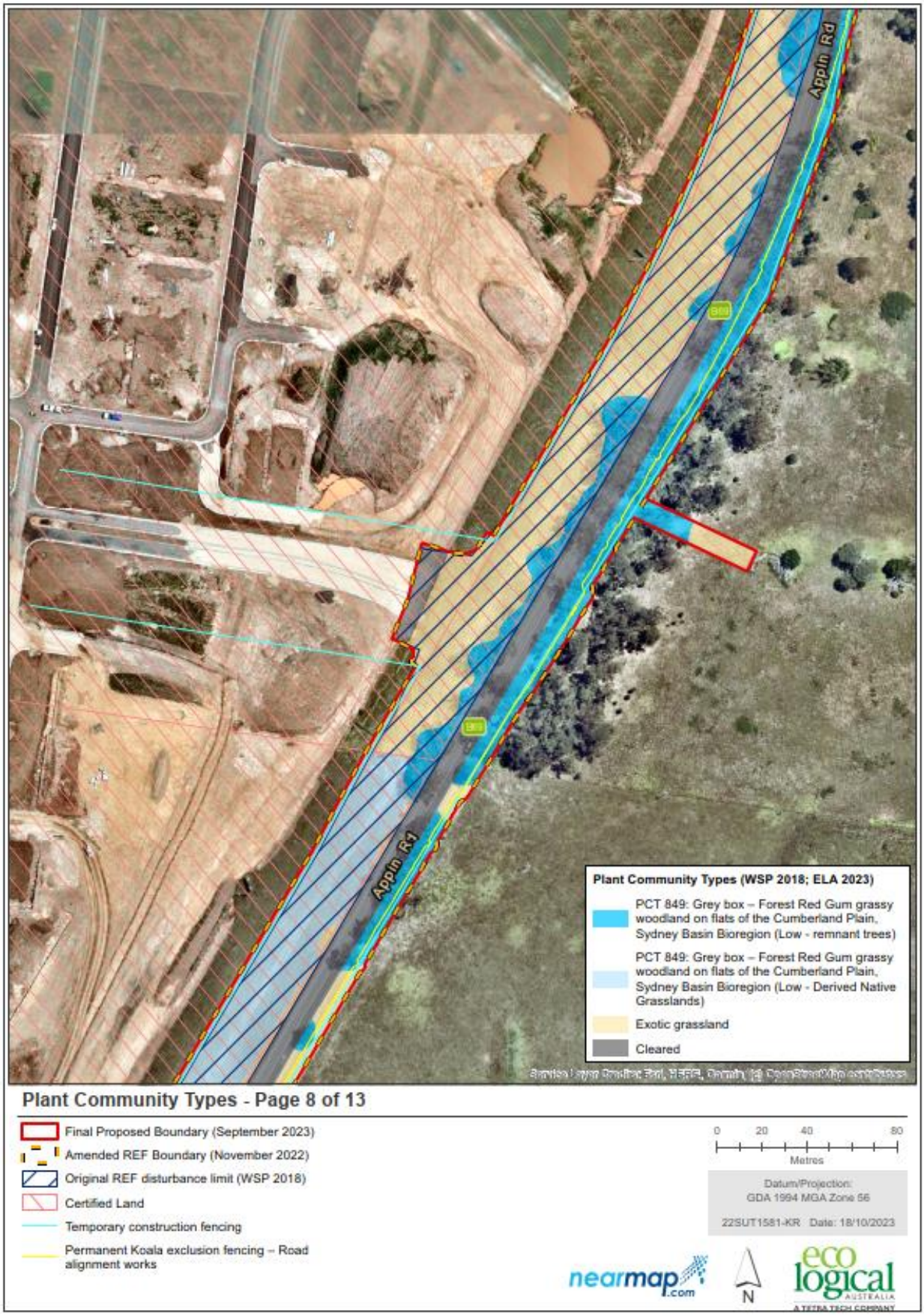

Figure 8(h): Page 8 of 13 Plant Community Types – (ELA 2023)

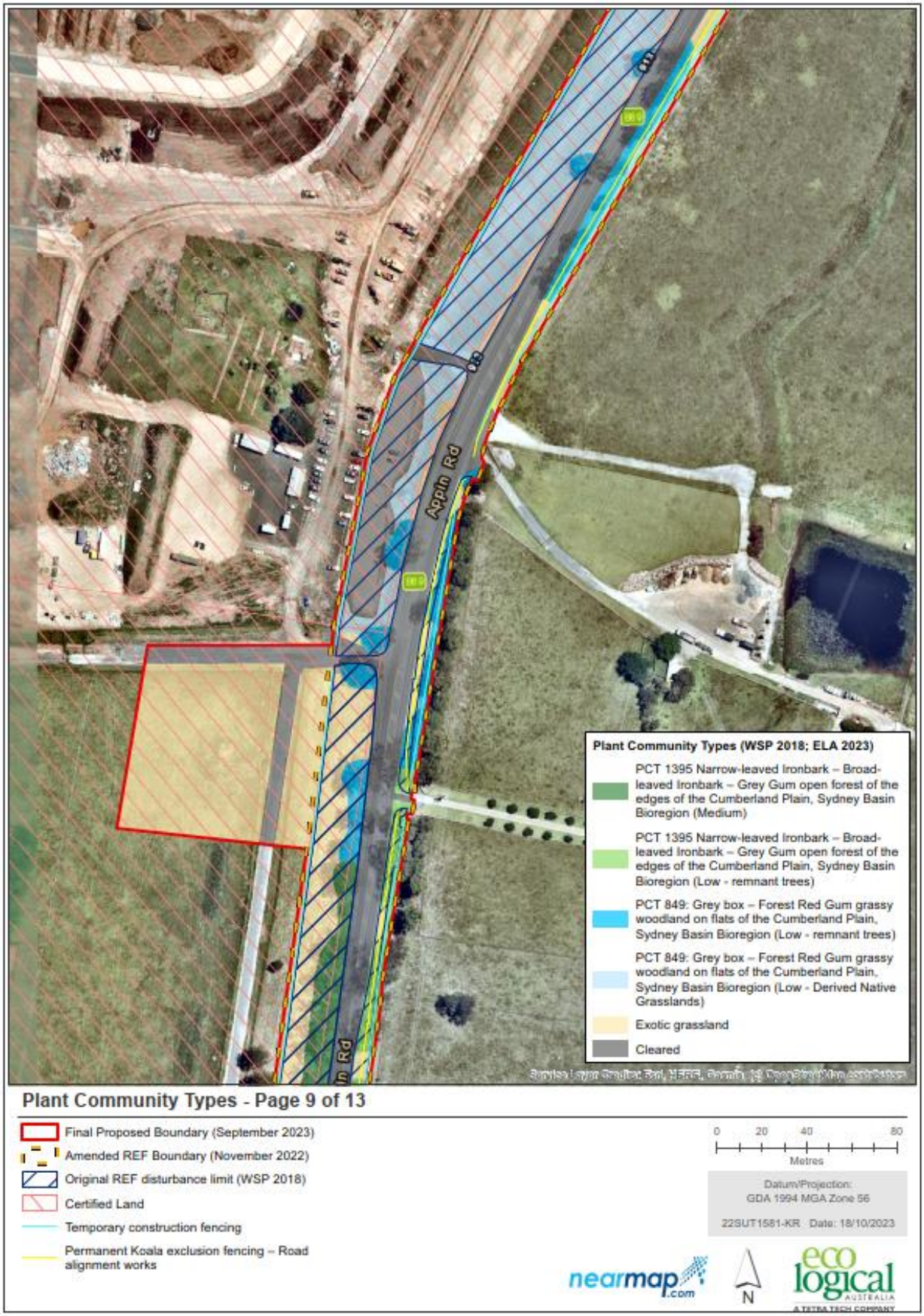

Figure 8(i): Page 9 of 13 Plant Community Types – (ELA 2023)

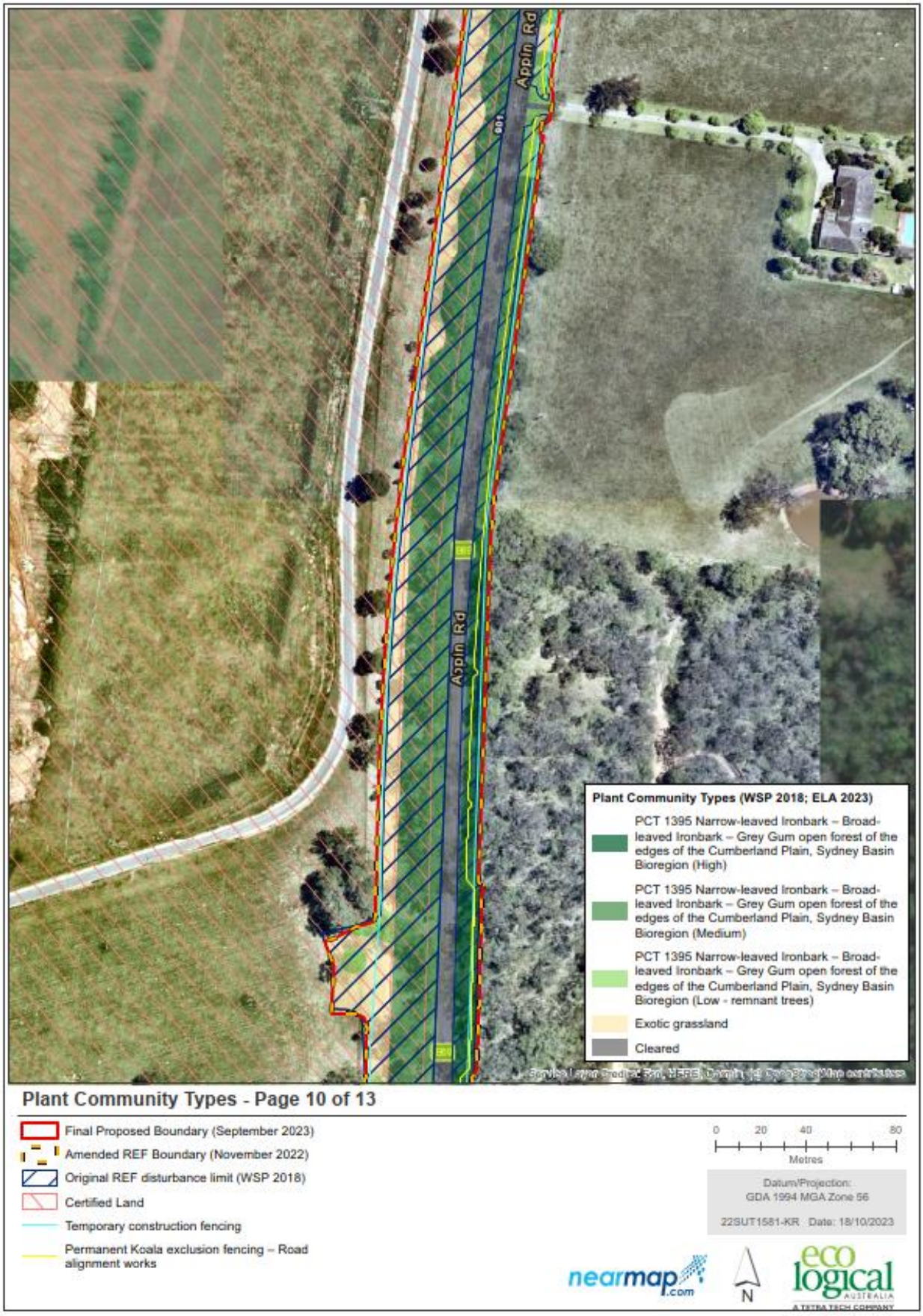

Figure 8(j): Page 10 of 13 Plant Community Types – (ELA 2023)

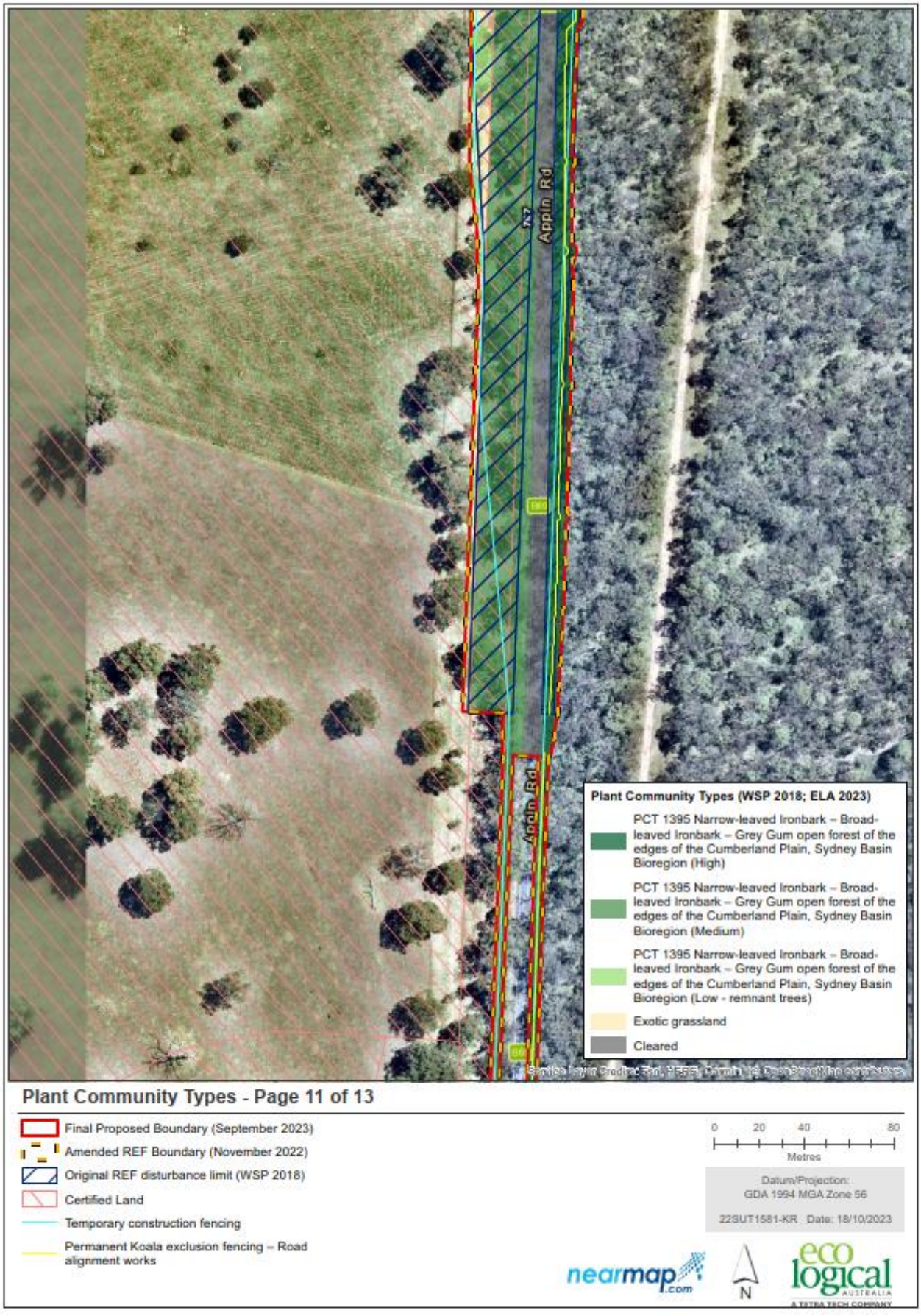

Figure 8(k): Page 11 of 13 Plant Community Types – (ELA 2023)

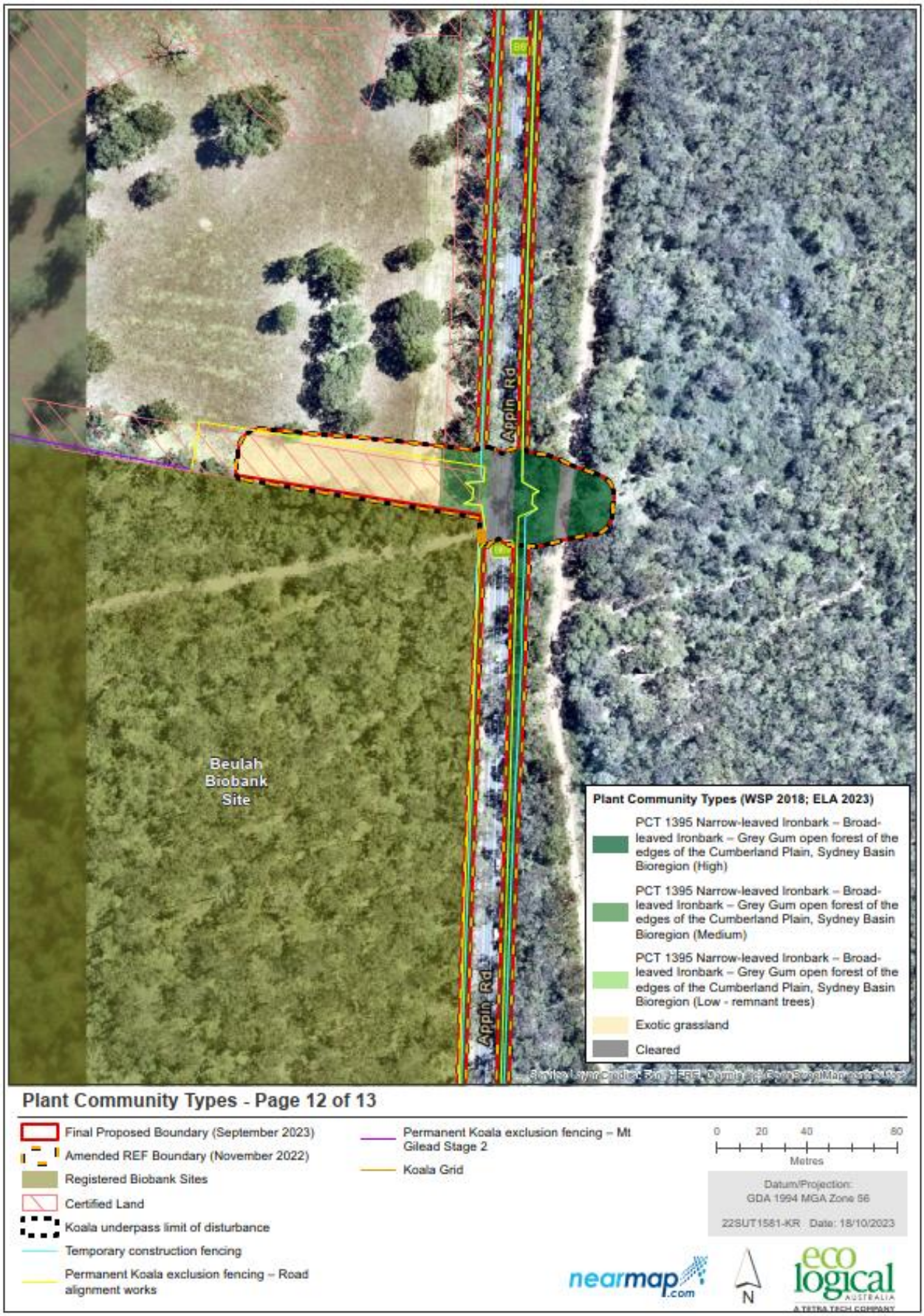

Figure 8(l): Page 12 of 13 Plant Community Types – (ELA 2023)

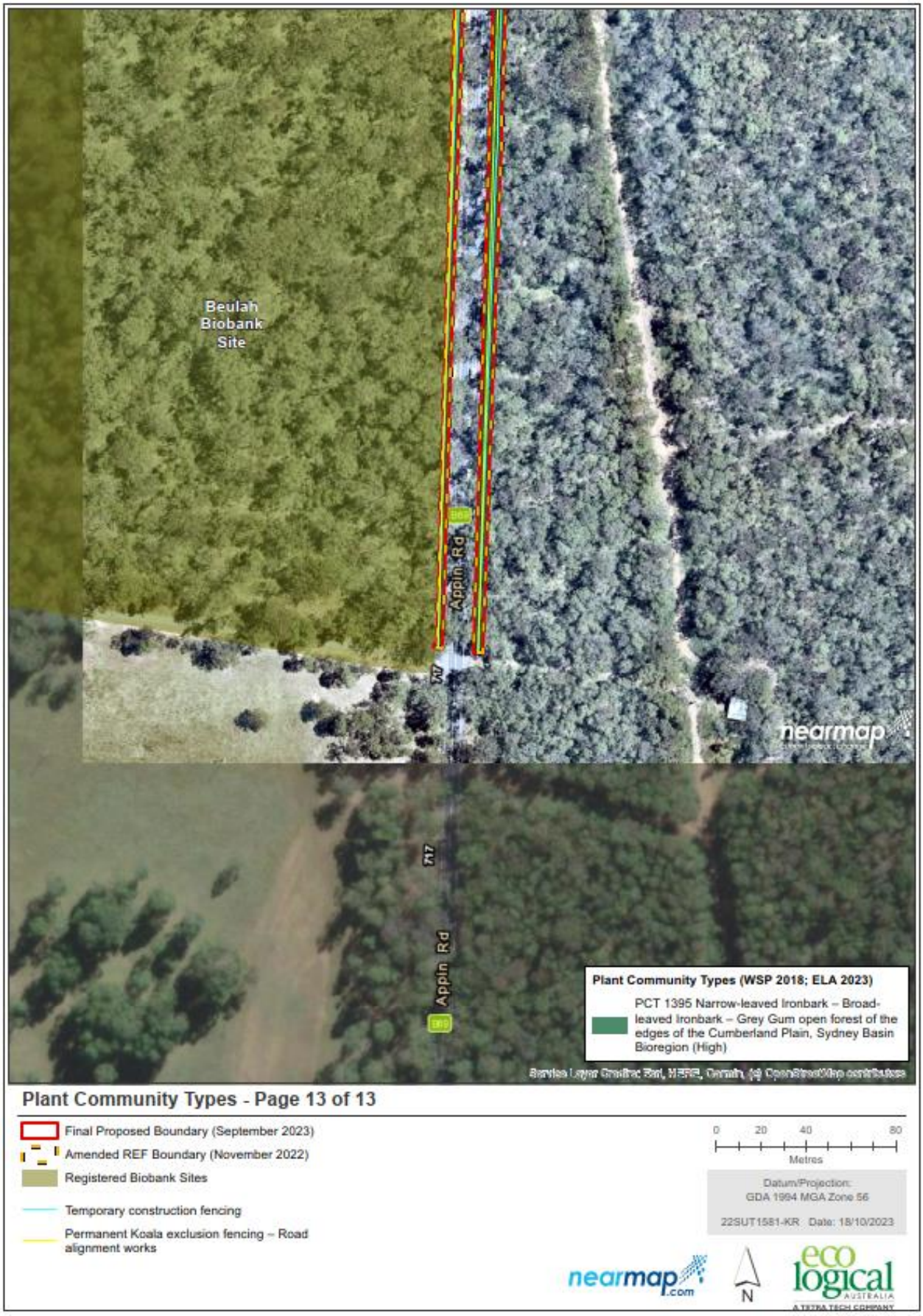

Figure 8(m): Page 13 of 13 Plant Community Types – (ELA 2023)

Figure 9(a): Page 1 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Figure 9(b): Page 2 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

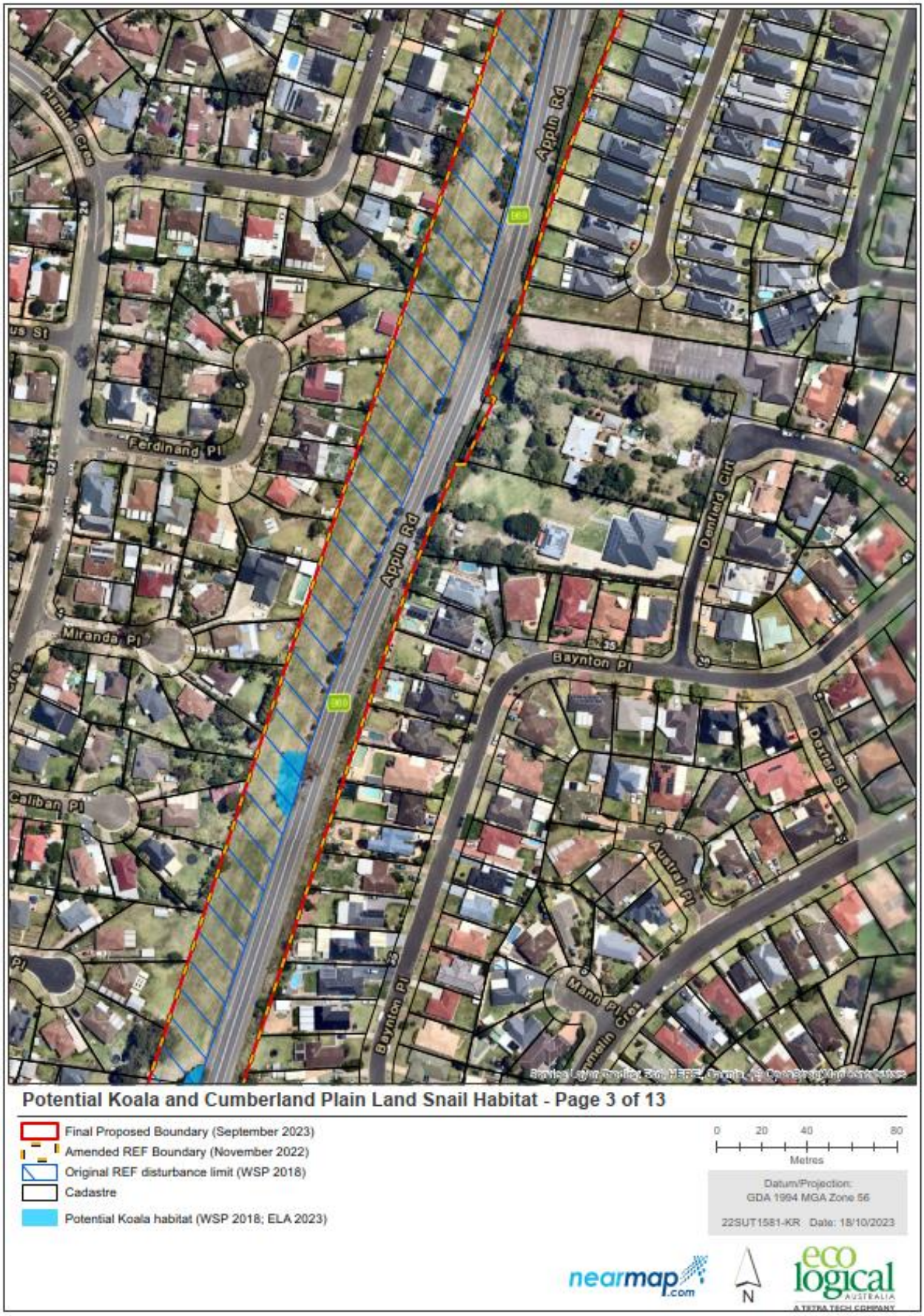

Figure 9(c): Page 3 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Figure 9(c): Page 3 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Figure 9(d): Page 4 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

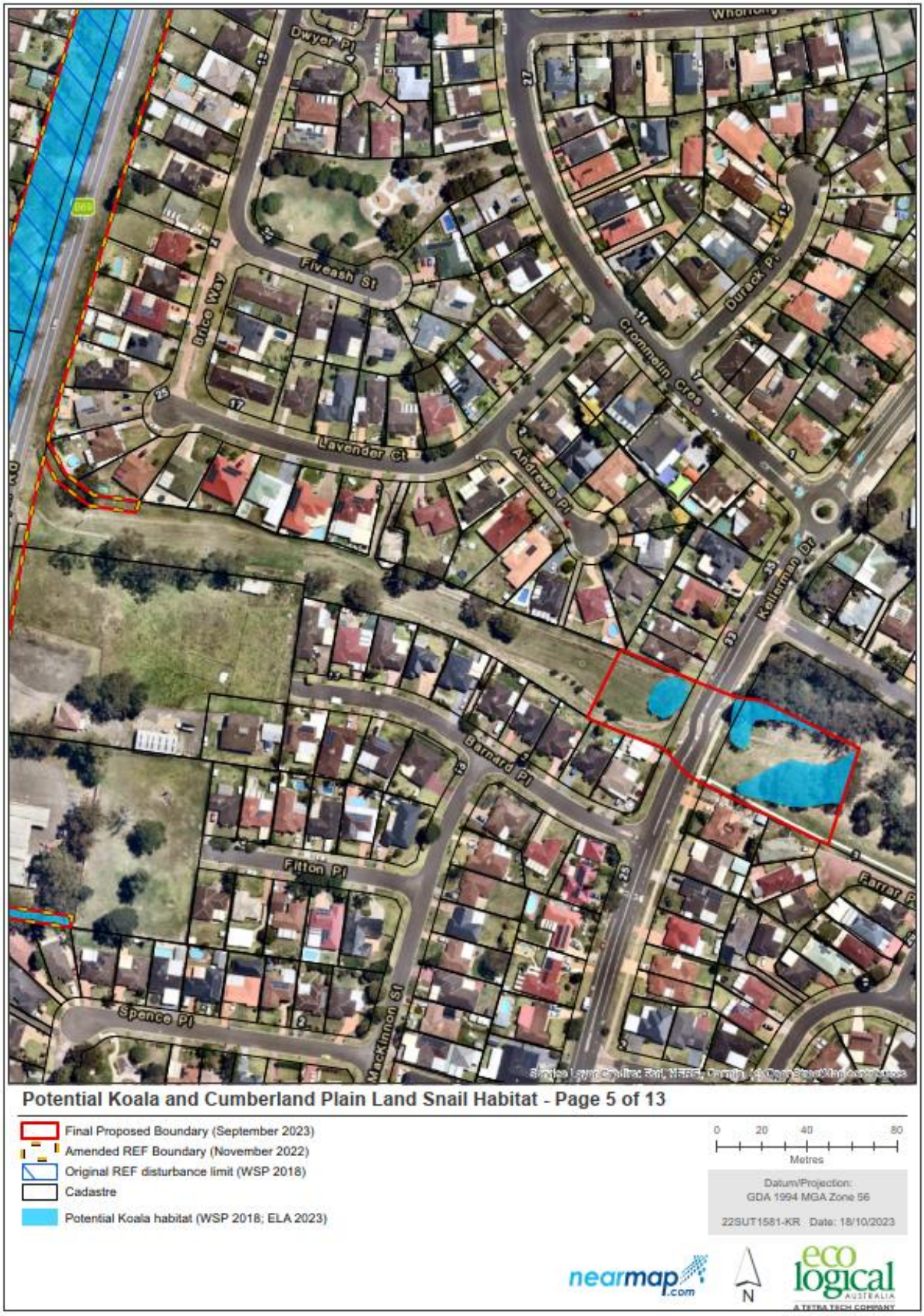

Figure 9(e): Page 5 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

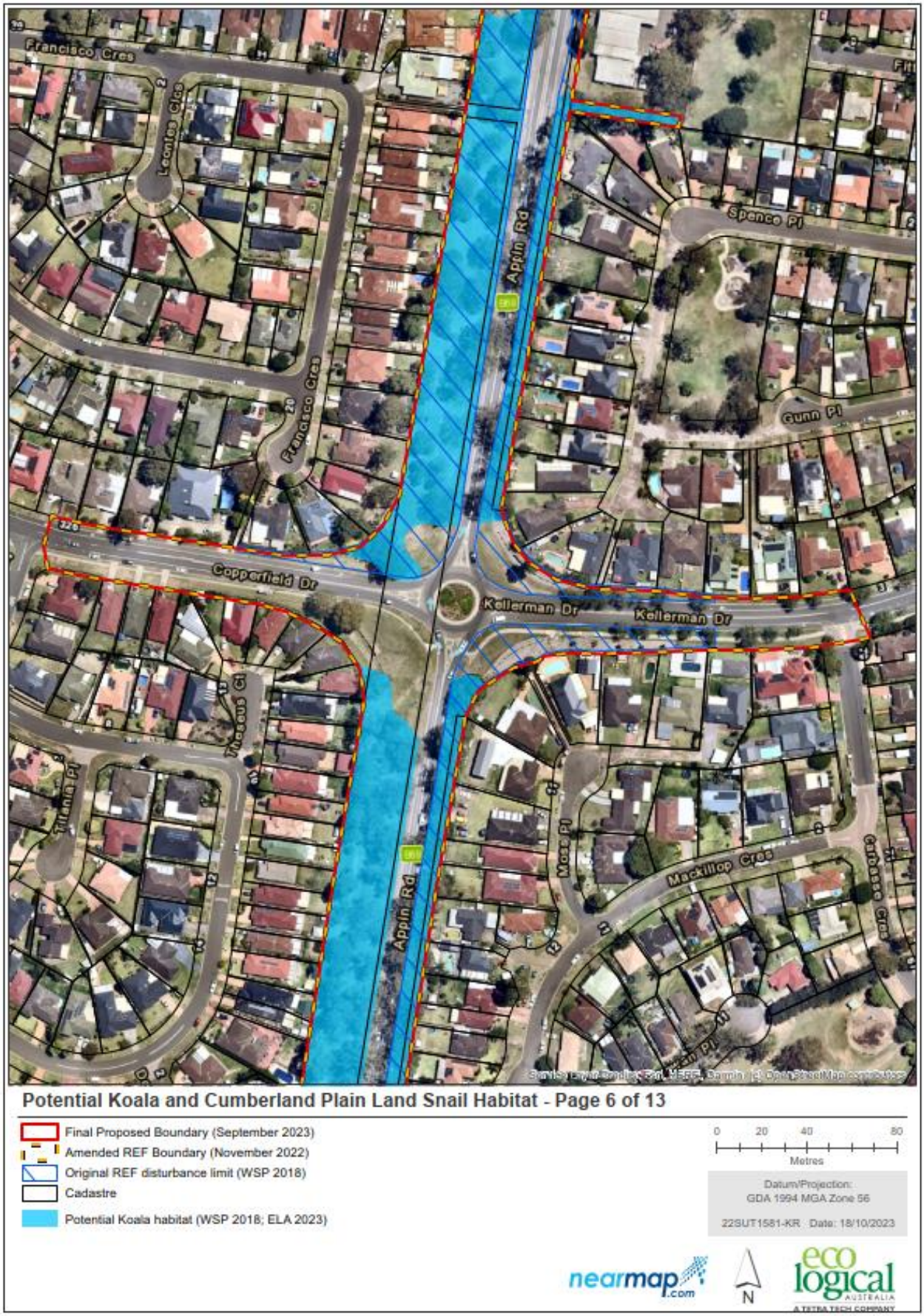

Figure 9(f): Page 6 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

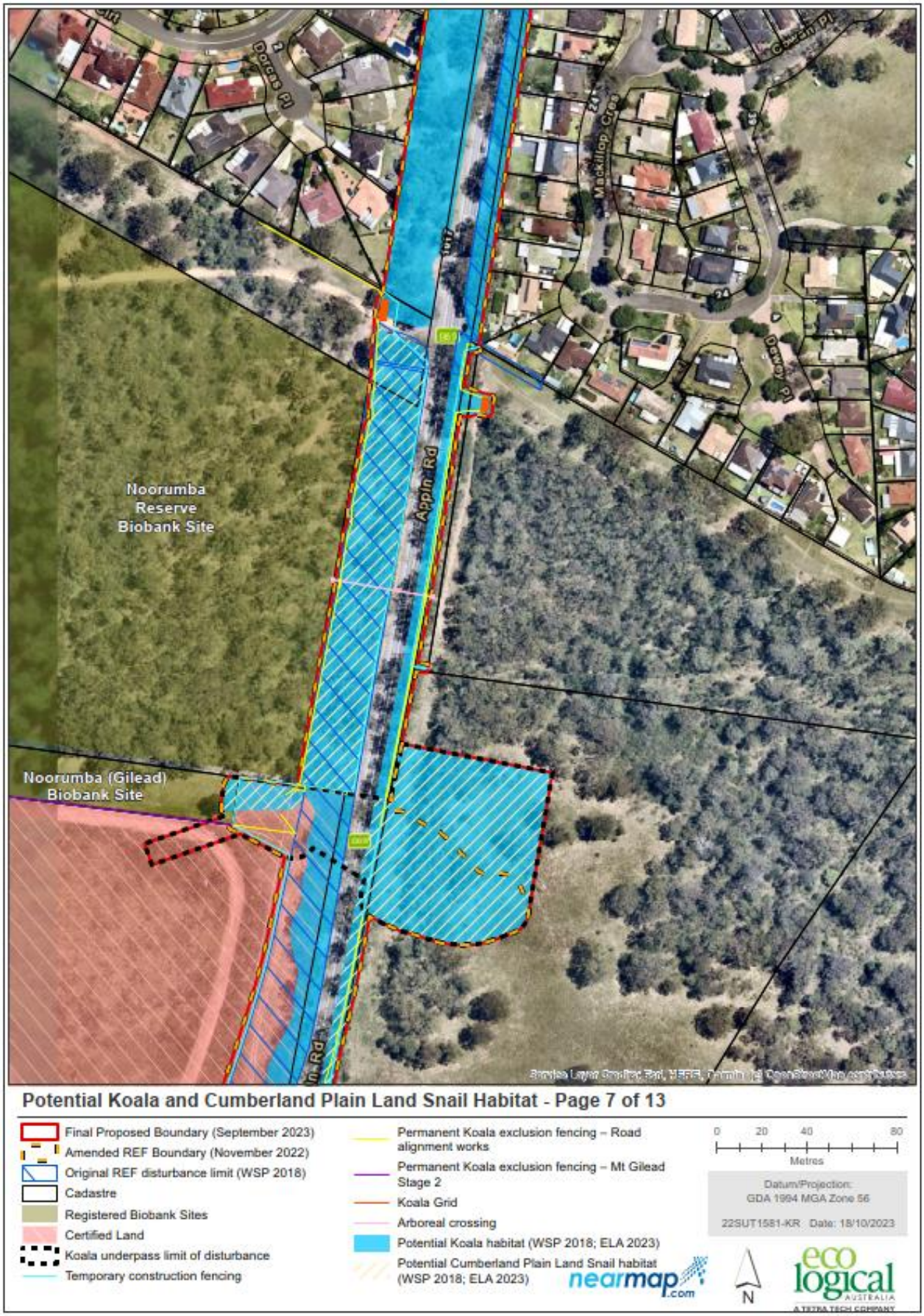

Figure 9(g): Page 7 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Figure 9(h): Page 8 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Figure 9(i): Page 9 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

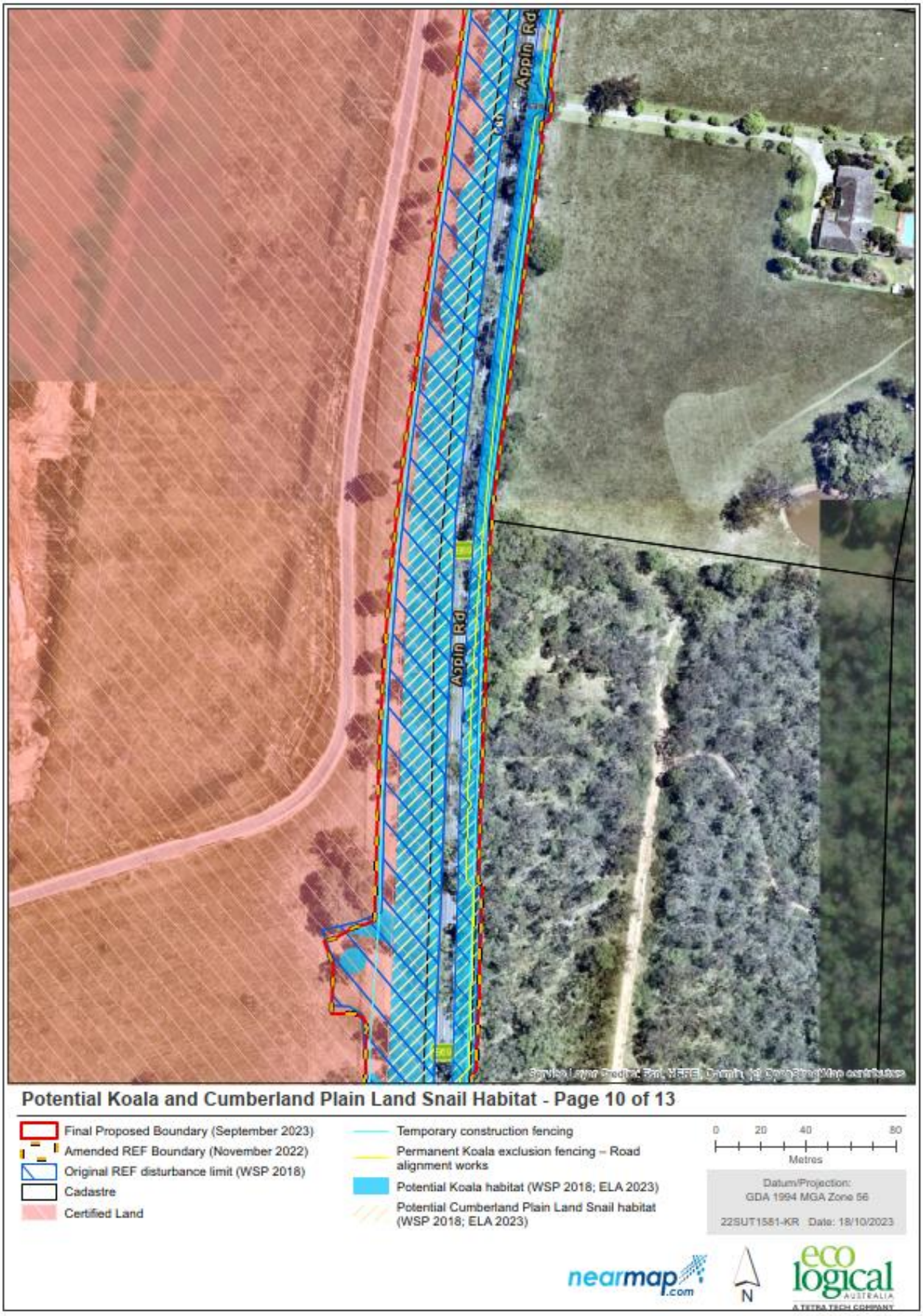

Figure 9(j): Page 10 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

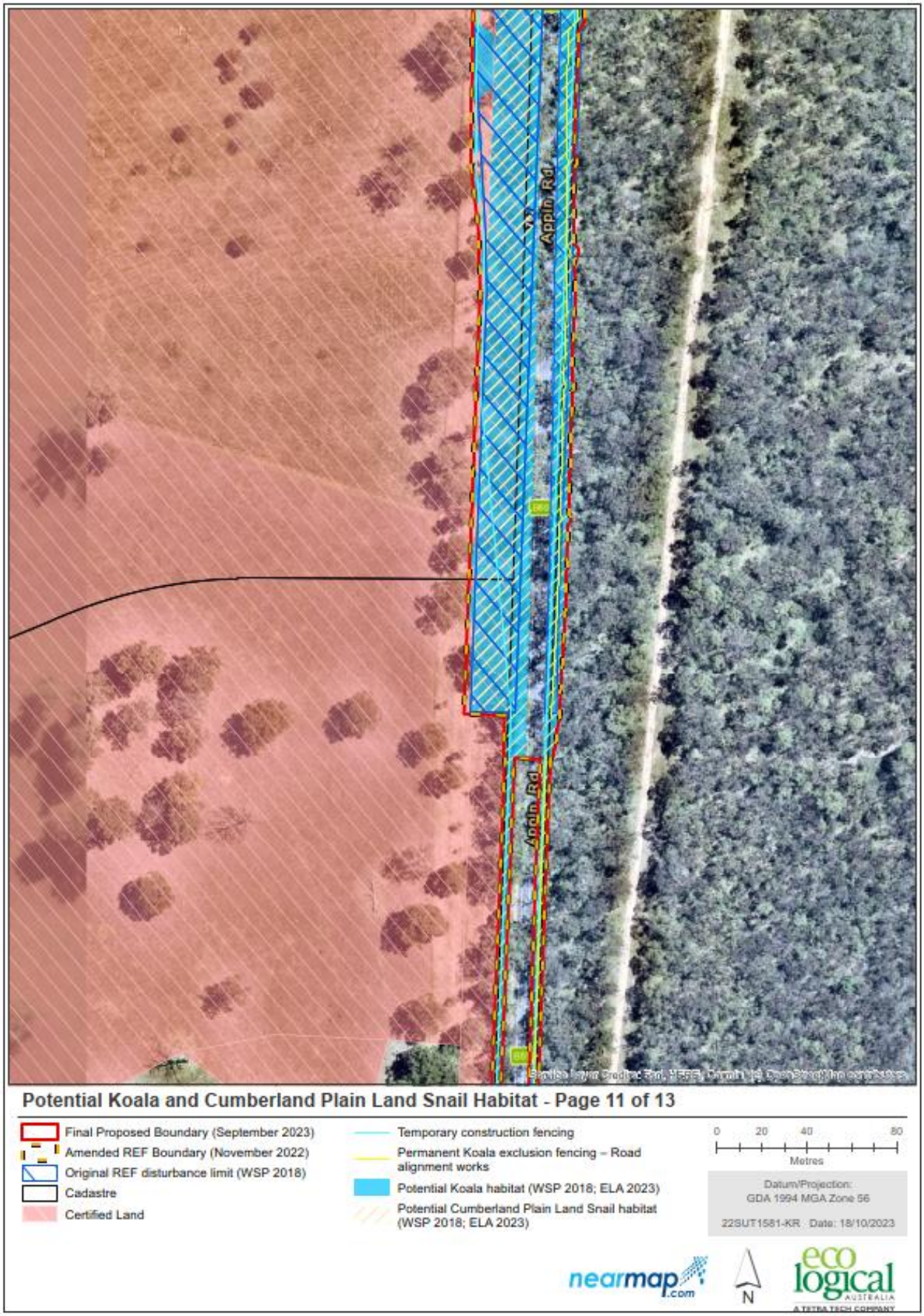

Figure 9(k): Page 11 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Figure 9(l): Page 12 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Figure 9(m): Page 13 of 13 Potential Koala and Cumberland Plain Snail Habitat – (ELA 2023)

Appendix B – Likelihood Table

The table below identifies the threatened species that are known or considered likely to occur within or adjacent to the study area based on NSW BioNet and EPBC Act Protected Matters Search (PMST), BAM-C Tool in September 2023 and the results of previous surveys undertaken in the general area by ELA (2014, 2018a, b and c, 2019, 2020 & 2022) and by WSP for the Appin Road Upgrade REF (WSP 2018). Based on database records along with field survey results, an assessment is made as to whether assessment of significance (5 part test) is required (last column).

Threatened flora

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey Result and need for '5 part test'
Acacia bynoeana	Bynoe's Wattle	E	V	NSW BioNet & PMST Search	*Acacia bynoeana* is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains, and has recently been found in the Colymea and Parma Creek areas west of Nowra. It is found in heath and dry sclerophyll forest, typically on a sand or sandy clay substrate, often with ironstone gravels (OEH 2015d).	Potential, recorded approximately 3km south east of study area. Survey required	Not recorded and unlikely to occur given extent of surveys.
Acacia pubescens	Downy Wattle	V	V	NSW BioNet & PMST Search	*Acacia pubescens* occurs on the NSW Central Coast in Western Sydney, mainly in the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. It is associated with Cumberland Plains Woodlands, Shale / Gravel Forest and Shale / Sandstone Transition Forest growing on clay soils, often with ironstone gravel (OEH 2015d).	Potential as suitable habit present, no nearby records	Not recorded and unlikely to occur given extent of surveys.
Allocasuarina glareicola		-	E	PMST Search	*Allocasuarina glareicola* is primarily restricted to the Richmond district on the north-west Cumberland Plain, with an outlier population found at Voyager Point. It grows in Castlereagh woodland on lateritic soil (OEH 2015d).	Unlikely	No. Marginal habitat present and outside of known range.

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey Result and need for '5 part test'
Asterolasia elegans		E	E	PMST Search	*Asterolasia elegans* is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests on mid- to lower slopes and valleys, in or adjacent to gullies (OEH 2015d).	Unlikely	No. No suitable habitat present and outside of known range.
Caladenia tessellata	Thick Lip Spider Orchid	E	V	PMST Search	*Caladenia tessellata* occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight. It flowers from September to November (OEH 2015d).	Unlikely	No. No suitable habitat present and outside of known range.
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	PMST Search	*Cryptostylis hunteriana* is known from a range of vegetation communities including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). Flowers between November and February, although may not flower regularly (OEH 2015d).	Unlikely	No. No suitable habitat present and outside of known range.
Cynanchum elegans	White-flowered Wax Plant	E	E	PMST Search	*Cynanchum elegans* is a climber or twiner with a variable form, and flowers between August and May, peaking in November. It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest. The species has also been found in littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia* subsp. *integrifolia* coastal scrub; *Eucalyptus*	Potential, survey required	Not recorded

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey Result and need for '5 part test'
					tereticornis open forest/ woodland; *Corymbia maculata* open forest/woodland; and *Melaleuca armillaris* scrub to open scrub (OEH 2015d).		
Dillwynia tenuifolia		V		Biobanking Tool	The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays (OEH 2015d).	Potential, survey required	Not recorded.
Epacris purpurascens var. *purpurascens*		V		Biobanking Tool	Found in a range of habitat types, most of which have a strong shale soil influence (OEH 2015d).	Potential, survey required	Not recorded.
Genoplesium baueri	Bauer's Midge Orchid	E	E	PMST Search	Recorded from locations between Nowra and Pittwater. Dry sclerophyll forest and moss gardens over sandstone.	Unlikely	No. No suitable habitat present.
Grevillea juniperina subsp. *juniperina*	Juniper-leaf Grevillea	V		Biobanking Tool	Endemic to Western Sydney. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest (OEH 2015d).	Potential, survey required	Not recorded

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey Result and need for '5 part test'
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	NSW BioNet & PMST Search	*Grevillea parviflora* subsp. *parviflora* is sporadically distributed throughout the Sydney Basin mainly around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie and Cessnock and Kurri Kurri. It grows in sandy or light clay soils over thin shales, often with lateritic ironstone gravels. It often occurs in open, slightly disturbed sites such as tracks (OEH 2015d).	Potential, recorded 2km east of subject site, survey required	Not recorded
Haloragis exalata subsp. *exalata*	Wingless Raspwort	V	V	PMST Search	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. It appears to require protected and shaded damp situations in riparian habitats (OEH 2015d).	Unlikely	No. No suitable habitat present.
Leucopogon exolasius	Woronora Beard-heath	V	V	NSW BioNet & PMST Search	*Leucopogon exolasius* is found along the upper Georges River area and in Heathcote National Park. It is associated with Sydney Sandstone Gully Forest on rocky hillsides and creek banks (OEH 2015d).	Unlikely	No. No suitable habitat present.
Melaleuca deanei	Deane's Paperbark	V	V	NSW BioNet & PMST Search	Found in heath on sandstone, and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (OEH 2015d).	Unlikely	No. No suitable habitat present. Not recorded by previous ELA survey within locality.
Pelargonium sp. *striatellum*	Omeo's Stork's Bill	E	E	PMST Search	The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise	Unlikely	No. No suitable habitat present.

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey Result and need for '5 part test'
					exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought (OEH 2015d).		
Persoonia bargoensis	Bargo Geebung	E	V	PMST Search	Associated with woodland to dry sclerophyll forest, on sandstone and clayey laterite on heavier, well-drained, loamy, gravelly soils of the Hawkesbury Sandstone and Wianamatta Shale in the catchments of the Cataract, Cordeaux and Bargo Rivers (OEH 2015d).	Unlikely	No. Marginal habitat present. Not recorded by previous ELA survey within locality.
Persoonia hirsuta	Hairy Geebung	E	E	NSW BioNet & PMST Search	*Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west. It grows in dry sclerophyll eucalypt woodland and forest on sandstone (OEH 2015d).	Potential, recorded 2-3 km southeast of study area, survey required	Not recorded
Persoonia nutans	Nodding Geebung	E	E	PMST Search	Associated with dry woodland, Castlereagh Scribbly Gum Woodland, Agnes Banks Woodland and sandy soils associated with tertiary alluvium, occasionally poorly drained. Endemic to the Western Sydney (OEH 2015d).	Unlikely	No. No suitable habitat present. Not recorded by previous ELA survey within locality.
Pimelea curviflora var. *curviflora*		V	V	PMST Search	*Pimelea curviflora* var. *curviflora* is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone	Unlikely	No. Marginal habitat present. Not recorded by

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey Result and need for '5 part test'
					and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (OEH 2015d).		previous ELA survey within locality.
Pimelea spicata	Spiked Rice-flower	E	E	PMST Search	In western Sydney, *Pimelea spicata* occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported CPW (OEH 2015d).	Potential recorded east of Appin Rd (north of Glen Lorne), 2019. Survey required.	Not recorded and unlikely to occur given condition of study area and extent of surveys
Pomaderris brunnea	Rufous Pomaderris	V	V	NSW BioNet & PMST Search	*Pomaderris brunnea* occurs in a limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria It grows in moist woodland or forest on clay or alluvial soils of floodplains and creek lines (OEH 2015d).	Potential, recorded nearby on Mt Gilead and east of Browns Bush, survey required	Not recorded in study area but recorded nearby.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	PMST Search	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated (OEH 2015d).	Unlikely as micro habitat (rock shelves) not present. Recorded north of study area at Kentlyn and Macquarie	Not recorded

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey Result and need for '5 part test'
						fields and west of Gilead at Menangle 2020 survey required	
Pultenaea aristata	Prickly Bush-pea	V	V	PMST Search	Dry sclerophyll woodland or wet heath on sandstone. Restricted to the Woronora Plateau.	Unlikely	No. Marginal habitat present and outside of known range.
Pultenaea pedunculata	Matted Bush-pea	E	-	NSW BioNet & PMST Search	In NSW, *Pultenaea pedunculata* is known from three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. It grows in woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area (OEH 2015d).	Likely, recorded south of Mt Gilead, survey required	Not recorded
Thesium australe	Austral Toadflax	V	V	PMST Search	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast (OEH 2015d).	Unlikely	No. No suitable habitat present and outside known range.

Threatened fauna

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	NSW BioNet, previous surveys	Associated with open eucalypt forests, particularly Cumberland Plain Woodland. Found under fallen logs, debris and in bark and leaf litter around the trunk of gum trees or burrowing in loose soil around clumps of grass. Urban waste may also form suitable habitat (OEH 2015d).	Known. Recorded in study area and adjacent Noorumba Reserve.	5 -part test undertaken re potential habitat (Appendix D)
Heleioporus australiacus	Giant Burrowing Frog	V	V	NSW BioNet & PMST Search	Forages in woodlands, wet heath, dry and wet sclerophyll forest. Associated with semi-permanent to ephemeral sand or rock based streams, where the soil is soft and sandy so that burrows can be constructed (OEH 2015d).	Unlikely	No. No suitable habitat present.
Litoria aurea	Green and Golden Bell Frog	E	V	NSW BioNet & PMST Search	This species has been observed utilising a variety of natural and man-made waterbodies such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water. Preferable habitat for this species	Unlikely	No. No suitable habitat present.

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading. Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable. Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*) (OEH 2015d). Recorded at Birwiri Creek, 7km to north of BCAA, in 2015		
Litoria littlejohnii	Littlejohn's Tree Frog	V	V	PMST Search	Littlejohn's Tree Frog occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (OEH 2015d).	Unlikely	No. No suitable habitat present.
Litoria raniformis	Southern Bell Frog	E	V	PMST Search	Relatively still or slow-flowing sites such as billabongs, ponds, lakes or	Unlikely	No. No suitable

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					farm dams, especially where Typha sp., Eleocharis sp. and Phragmites sp. (Bulrushes) are present. This species is common in lignum shrublands, black box and River Red Gum woodlands, irrigation channels and at the periphery of rivers in the southern parts of NSW. This species occurs in vegetation types such as open grassland, open forest and ephemeral and permanent non-saline marshes and swamps. Open grassland and ephemeral permanent non-saline marshes and swamps have also been associated with this species (OEH 2015d).		habitat present.
Mixophyes balbus	Stuttering Frog	E	V	PMST Search	Rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Breed in streams during summer after heavy rain.	Unlikely	No. No suitable habitat present.
Pseudophryne australis	Red-crowned Toadlet	V		NSW BioNet	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone	Unlikely	No. No suitable

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					ridges that often have shale lenses or cappings (OEH 2015d).		habitat present.
Hoplocephalus bungaroides	Broad-headed Snake	E	V	NSW BioNet & PMST Search	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin. They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (OEH 2015d).	Unlikely	No. No suitable habitat present.
Varanus rosenbergi	Rosenberg's Goanna	V	-	NSW BioNet	Associated with Sydney sandstone woodland and heath land. Rocks, hollow logs and burrows are utilised for shelter (OEH 2015d).	Unlikely	Not observed or recorded by previous ELA survey within study area.
Anthochaera phrygia	Regent Honeyeater	E	CE & M	NSW BioNet & PMST Search	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised.	Potential foraging habitat	Marginal habitat present. Not recorded by previous ELA survey within locality. Likely occasional visitor

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes. As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (OEH 2015d).		Pre-cautionary 5-part test undertaken (**Appendix D)**
Artamus cyanopterus	Dusky Woodswallow	V	-	NSW BioNet, previous survey	Prefers dry, open eucalypt forests and woodlands with an open to spare understory. Widespread in eastern, southern and western Australia. Species occurs throughout most of NSW with breeding activity mainly on the western slopes of the Great Dividing Range.	Likely, previously recorded in locality (Biolink 2018)	Previously recorded in locality. 5-part test undertaken **Appendix D**
Botaurus poiciloptilus	Australasian Bittern	V	-	PMST Search	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats. Reedbeds, swamps, streams, estuaries (OEH 2015d).	Unlikely	No. No suitable habitat present. Not recorded by previous ELA survey within study area.
Burhinus grallarius	Bush Stone-curlew	E	-	NSW BioNet	Associated with dry open woodland with grassy areas, dune scrubs, in savanna areas, the fringes of	Unlikely	No. No suitable habitat

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					mangroves, golf courses and open forest / farmland. Forages in areas with fallen timber, leaf litter, little undergrowth and where the grass is short and patchy. Is thought to require large tracts of habitat to support breeding, in which there is a preference for relatively undisturbed in lightly disturbed (OEH 2015d).		present. Not recorded by previous ELA survey within study area.
Calidris ferruginea	Curlew Sandpiper	E	CE, M	PMST Search	Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Unlikely	No. No suitable habitat present. Not recorded by previous ELA survey within study area.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	NSW BioNet	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands. In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages. They sometimes inhabit woodland, farms and suburbs in autumn/winter (OEH 2015d).	Potential foraging habitat only. Recorded breeding at St Helens Park 2020 and 2021	Previously recorded in locality. 5-part test undertaken (**Appendix 3**). EPBC Assessment undertaken (**Appendix 4**)

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	V	NSW BioNet	Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils. Intact drier forest types with less rugged landscapes are preferred. Nests in large trees with large hollows (OEH 2015d).	Potential foraging habitat.	Previously recorded in locality. 5-part test undertaken (**Appendix D**). EPBC Assessment undertaken (Appendix E)
Circus assimillis	Spotted Harrier	V		NSW BioNet	Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands.	Unlikely	No. Marginal suitable habitat. Not recorded by previous ELA survey within study area.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	NSW BioNet	Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys. The Brown Treecreeper occupies eucalypt woodlands, particularly open woodland lacking a	Potential	Previously recorded in locality. 5-part test undertaken (**Appendix 3**).

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					dense understorey. It is sedentary and nests in tree hollows within permanent territories (OEH 2015d).		
Daphoenositta chrysoptera	Varied Sittella	V	-	NSW BioNet and previous survey	Distribution includes most of mainland Australia except deserts and open grasslands. Prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods from bark, dead branches, or small branches and twigs (OEH 2015d).	Likely, recorded in broader Gilead study area (Biolink 2018)	Previously recorded in locality. 5 Part test undertaken.
Dasyornis brachypterus	Eastern Bristlebird	E	E	PMST Search	Habitat is characterised by dense, low vegetation and includes sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest, as well as open woodland with a heathy understorey. In northern NSW occurs in open forest with tussocky grass understorey. All of these vegetation types are fire prone, aside from the rainforest habitat as utilised by the northern population as fire refuge. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities	Unlikely	No. No suitable habitat present. Not recorded by previous ELA survey within study area.

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously (OEH 2015d).		
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	NSW BioNet	Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands floodplains. Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (OEH 2015d).	Unlikely	No. No suitable habitat present.
Falco subnider	Black Falcon	V		NSW BioNet	Woodland, shrubland and grassland, especially riparian woodland and	Unlikely	No. Marginal suitable habitat.

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					agricultural land. Often associated with streams or wetlands.		
Grantiella picta	Painted Honeyeater	V	V	PMST Search	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	Unlikely	No. No suitable habitat present.
Glossopsitta pusilla	Little Lorikeet	V	-	NSW BioNet	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including	Recorded in broader Gilead study area by ELA 2014.	5-part test undertaken (**Appendix 3**)

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					melaleucas and mistletoes (OEH 2015d).		
Haliaeetus leucogaster	White-bellied Sea Eagle	V	M	NSW BioNet & PMST Search	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away.	Unlikely	No. Marginal habitat present. Not recorded by previous ELA survey within study area. No nests recorded
Hieraaetus morphnoides	Little Eagle	V	-	NSW BioNet	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion (OEH 2015d).	Potential	Suitable foraging habitat present. 5-part test undertaken (Appendix D).
Lathamus discolor	Swift Parrot	CE	CE & M	NSW BioNet & PMST Search	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. Hence, in this region, autumn and winter flowering eucalypts are	Potential, recorded foraging in Browns Bush 2018.	Previously recorded in locality Suitable habitat present. 5-

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (OEH 2015d).	foraging habitat present	part test undertaken (**Appendix D**). EPBC Assessment undertaken (**Appendix E**)
Lophoictinia isura	Square-tailed Kite	V	-	NSW BioNet	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses (OEH 2015d).	Potential	Suitable habitat present. No nest observed. 5-part test undertaken (**Appendix D**).
Ninox strenua	Powerful Owl	V	-	NSW BioNet	The Powerful Owl is associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes. Large trees with hollows at least 0.5m deep are required for shelter and breeding (OEH 2015d).	Potential foraging habitat present	Previously recorded in locality. No suitable breeding hollows present. Suitable foraging habitat

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
							present. 5-part test undertaken (**Appendix D**).
Petroica boodang	Scarlet Robin	V	-	NSW BioNet	Occurs from the coast to the inland slopes in NSW. After breeding (July-Jan), some disperse to the lower valleys and plains of the tablelands and slopes. Primarily resides in dry eucalypt forests and woodlands, with usually open and grassy understorey, with scattered shrubs. Abundant logs and fallen timber are important habitat components. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees, and may join mixed flocks of other small insectivorous birds (OEH 2015d).	Potential	No. Marginal habitat present. Not recorded by previous ELA survey within locality. 5-part test undertaken (**Appendix D)**.
Rostratula australis	Painted Snipe (Australian subspecies)	E	V	NSW BioNet & PMST Search	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Breeding is often in response to local	Unlikely	No. No suitable habitat present. Not recorded by previous ELA

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter (OEH 2015d).		survey with study area.
Stagonopleura guttata	Diamond Firetail	V	-	NSW BioNet	Typically found in grassy eucalypt woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. It is often found in riparian areas and sometimes in lightly wooded farmland. Appears to be sedentary, though some populations move locally, especially those in the south (OEH 2015d).	Potential	No. Marginal habitat present. Not recorded by previous ELA survey within locality. 5-part test undertaken (Appendix D)
Tyto novaehollandiae	Masked Owl	V	-	NSW BioNet	Lives in dry eucalypt forests and woodlands from sea level to 1100 m (OEH 2015d).	Potential	No suitable breeding hollows present. Suitable foraging habitat present. 5-part test undertaken

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
							(**Appendix D**).
Cercartetus nanus	Eastern Pygmy-possum	V	-	NSW BioNet	Found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath. Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit. Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old birds nests and in the branch forks of tea-trees (OEH 2015d).	Unlikely, not recorded in previous surveys of study area	No. No suitable habitat present.
Dasyurus maculatus *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE mainland population)	V	E	NSW BioNet & PMST Search	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (OEH 2015d).	Potential	Previously recorded in locality. Not recorded by previous ELA survey within study area but may occasionally use the study area. EPBC Assessment undertaken

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
							(**Appendix D**).
Isoodon obesulus	Southern Brown Bandicoot	E	E	PMST Search	This species is associated with heath, coastal scrub, heathy forests, shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (OEH 2015d).	Potential	Previously recorded in locality. Not recorded by previous ELA survey within study area
Petauroides volans	Greater Glider	E	E	NSW BioNet & PMST Search	This species is a nocturnal arboreal marsupial, predominantly solitary and largely restricted to eucalypt forest and woodlands of eastern Australia. It is typically found in highest abundance in taller, montane, moist eucalypt forest on fertile soils with relatively old trees and abundant hollows, but also occurs in drier habitats.	Potential	Previously recorded east of study area in Georges River corridor but not recorded in study area despite extensive survey effort.
Petaurus norfolcensis	Squirrel Glider	V	-	NSW BioNet	Associated with dry hardwood forest and woodlands. Habitats typically include gum barked and high nectar producing species, including winter flower species. The presence of	Potential. Recorded by ELA (2016) less than 1 km to the west	Previously recorded in locality. 5-part test undertaken

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					hollow bearing eucalypts is a critical habitat value (OEH 2015d).		(**Appendix D**).
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	PMST Search	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (OEH 2015d).	Unlikely	No. No suitable habitat present.
Phascolarctos cinereus	Koala	E	E	NSW BioNet & PMST Search	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis* (OEH 2015d)	Known adjacent to site in Browns Bush, Noorumba Reserve and Beulah Biobank site	Recorded in Browns Bush, Noorumba Reserve and Beulah Biobank site, preferred browse species present. 5-part test and SIC undertaken (**Appendix D**). EPBC Assessment undertaken (**Appendix E**)
Pseudomys novaehollandiae	New Holland Mouse	-	V	PMST Search	A small burrowing native rodent with a fragmented distribution across	Unlikely	No. No suitable

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (OEH 2015d).		habitat present.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	NSW BioNet & PMST Search	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces. Found in well-timbered areas containing gullies (OEH 2015d).	Likely. Recorded by ELA (2014) on adjacent MDP lands.	Foraging habitat present, no breeding habitat 5-part test undertaken (**Appendix D**). EPBC Assessment undertaken (**Appendix E)**
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	NSW BioNet	Prefers moist habitats with trees taller than 20m. Roosts in tree hollows but has also been found roosting in	Likely. Recorded by ELA (2014) on	5-part test undertaken

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					buildings or under loose bark (OEH 2015d).	adjacent MDP lands.	(**Appendix D**).
Miniopterus australis	Little Bentwing Bat	V	-	NSW BioNet	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub (OEH 2015d).	Likely. Recorded by ELA (2014) on adjacent MDP lands.	5-part test undertaken (**Appendix E**).
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	NSW BioNet	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. It forages above and below the tree canopy on small insects. Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (OEH 2015d).	Likely. Recorded by ELA (2014) on adjacent MDP lands.	5-part test undertaken (**Appendix D**).
Mormopterus norfolkensis	Eastern Freetail Bat	V	-	NSW BioNet	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or	Likely. Recorded by ELA (2014) on adjacent MDP lands.	5-part test undertaken (Appendix D).

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (OEH 2015d).		
Myotis macropus	Southern Myotis	V	-	NSW BioNet	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, close to water. While roosting (in groups of 10-15) is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains, however with specific roost requirements. Forages over streams and pools catching insects and small fish. In NSW females have one young each year usually in November or December (OEH 2015d)	Likely. Recorded by ELA (2014) on adjacent MDP lands.	5-part test undertaken (**Appendix D**).

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V & M	NSW BioNet & PMST Search	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (OEH 2015d).	Likely. Recorded by ELA (2014) on adjacent MDP lands.	5-part test undertaken (**Appendix D**). EPBC Assessment undertaken (**Appendix E**)
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V		Previous surveys (ELA 2014)	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock and in abandoned sugar glider nests. The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (OEH 2015d).	Likely. Recorded by ELA (2014) on adjacent MDP lands.	5-part test undertaken (**Appendix D**).
Scoteanax rueppellii	Greater Broad-nosed Bat	V		NSW BioNet	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range, tending to be more frequently located	Likely. Recorded by ELA (2014) on	5-part test undertaken (**Appendix D**).

Scientific name	Common name	BC Act	EPBC Act	Source of Record	Habitat association	Likelihood	Survey result and need for '5 part test'
					in more productive forests. Within denser vegetation types use is made of natural and man-made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (OEH 2015d).	adjacent MDP lands.	

Appendix C - General site photos showing structure and condition of vegetation at proposed Koala underpass locations

Refer to Figure 1 for the location of Koala underpasses

Glen Lorne Northern Underpass

Young regrowth Cumberland Plain Woodland

Exotic pasture grass under existing powerline corridor

Browns Bush Southern Underpass

Intact, regrowth Shale Sandstone Transition Forest

Existing, highly modified Powerline Easement which underpass will intersect

Rubbish dumping at location of proposed underpass

Appendix D – BC Act Assessment of Significance

The Assessment of Significance (five-part test) is applied to species, populations and ecological communities listed on Schedules 1 and 2 of the BC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out 5 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS) or Biodiversity Assessment Report (BDAR). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 5-part test, an action is considered likely to have a significant impact on a threatened species, populations or ecological communities.

The assessment of significance was undertaken for the following communities and threatened species:

Threatened ecological communities:

- Cumberland Plain Woodland (CPW)
- Shale Sandstone Transition Forest (SSTF)

Fauna:

- *Phascolarctos cinereus* (Koala)
- *Meridolum corneovirens* (Cumberland Plain Land Snail)
- *Petaurus norfolcensis* (Squirrel Glider)
- Woodland bird group
    - Artanus cyanopterus *(*Dusky Wood Swallow)
    - *Climacteris picumnus victoriae* (Brown Treecreeper)
    - Daphoenositta chrysoptera (Varied Sittella)
    - *Melanodryas cucullata* ssp. *cucullata* (Hooded Robin)
    - Stagonopleura guttata (Diamond Firetail)
- Blossom Nomads
    - Anthochaera phrygia (Regent Honeyeater)
    - *Glossopsitta pusilla* (Little Lorikeet)
    - *Lathamus discolor* (Swift Parrot)
    - *Pteropus poliocephalus* (Grey-headed Flying-fox)
- Large forest owls and Cockatoos
    - *Callocephalon fimbriatum* (Gang-gang Cockatoo)
    - *Calyptorhynchus lathami (Glossy Black Cockatoo)*
    - *Ninox strenua* (Powerful Owl)
    - *Tyto novaehollandiae* (Masked Owl)
- Microchiropteran bats
    - *Chalinolobus dwyeri* (Large-eared Pied Bat)
    - *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
    - *Miniopterus australis* (Little Bentwing-bat)
    - *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
    - *Myotis macropus* (Large-footed Myotis)
    - *Mormopterus norfolkensis* (Eastern Freetail-bat)
    - *Scoteanax rueppellii* (Greater Broad-nosed Bat)

- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)

- Raptors
  - *Hieraaetus morphnoides* (Little Eagle)
  - *Lophoictinia isura* (Square-tailed Kite)

Cumberland Plain Woodland (CPW)

Cumberland Plain Woodland (CPW) is listed as a Critically Endangered Ecological Community on Schedule 2 of the BC Act. CPW occurs on soils derived from Wianamatta Shale, and throughout the driest part of the Sydney Basin.

The subject site was assessed as including 3.66 ha of CPW (0.33 ha in good condition and 3.32 ha in poor condition), of which 1.38 ha has already been biodiversity certified as part of the Mt Gilead Stage 1 residential development (June 2019). The proposal, as amended, will have residual impacts to up to 2.28 ha of CPW during the construction of the road, underpasses and koala exclusion fences (**Table 2**).

The 'Local Occurrence' of an ecological community is defined in the Assessment of Significance Guidelines (OEH 2018) as being "*the community that exists within the study area and may include adjacent areas if the ecological community in the study area forms part of larger contiguous area and the movement of individuals and exchange of genetic material across the boundary can be clearly demonstrated*".

The majority of the CPW to be impacted is immediately adjacent to larger, contiguous patches of CPW (and SSTF) in the Noorumba and Beulah Biobank sites (80+ ha) and proposed Browns Bush Biodiversity Stewardship site (approx. 27 ha) which in turn are adjacent to other areas of CPW (and SSTF) in the Georges and Nepean River corridors with over 500 ha of combined CPW and SSTF. It is reasonable to assume that individuals and genetic material of the flora and fauna of these communities cross the boundary of the REF study area as they are immediately adjacent.

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

Not applicable for CPW.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed action or activity action:

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

The local occurrence of CPW extends outside of the study area to the adjacent Noorumba and Beulah Biobank sites and proposed offset areas at Browns and other proposed protected areas along the Georges and Nepean River corridors over 500 ha of CPW in either already or will be protected and managed for conservation (CPCP, DPE 2022).

Given this context, the loss of up to 2.28 ha of CPW (in various condition states) from the study area is unlikely to have an adverse effect on the extent of the community such that its local occurrence is placed at risk of extinction.

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

The loss of up to 2.28 ha of CPW (in various condition states from the study area is unlikely to substantially and adversely modify the composition of the CPW such that it's local occurrence is likely to be placed at risk of extinction. The composition of CPW in these adjacent areas (the local occurrence of the community) will not be substantially modified as they either already are or will be actively managed for conservation.

c. in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed development tor activity, and

The proposed development will impact up to 2.28 ha of CPW in various condition states.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The proposed activity will not result in the further fragmentation or isolation of the remaining patch of CPW in the study area from other areas.

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

The remaining areas of CPW in the locality are considered important for the conservation of the community and are either already protected and managed for conservation (Noorumba and Beulah Biobank sites) or proposed to be registered as offset areas (Mt Gilead Stage 2 residential development and Georges River Koala National Park).

The loss of up to 2.28 ha of CPW (in various condition states) from the study area is unlikely to affect the long term survival of the community in the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The study area is not a declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed development constitutes a key threatening process of relevance to CPW i.e. clearing of native vegetation. The proposed development would result in the clearing of up to 2.28 ha of CPW (in various condition states).

Conclusions

The proposed activity, as amended is unlikely to result in a significant impact to CPW. Consequently, a Species Impact Statement or BDAR, is not required for the proposed development with respect to this CEEC.

Shale/Sandstone Transition Forest

Shale/Sandstone Transition Forest is a critically endangered ecological community (CEEC) under the BC Act. This community occurs on the edges of the Cumberland Plan where the clay soils from the shale rock intergrade with the soils from the sandstone. Prior to European settlement, SSTF was represented throughout western Sydney. Less than 22.6 % of its original extent remains today (OEH 2014). Presently, this community occurs in the Hawkesbury, Baulkham Hills, Bankstown, Blue Mountains, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly LGA (NSW SC 2011).

The subject site was assessed as including 7.30 ha of SSTF (4.91 ha in moderate and good condition and 2.40 ha in poor condition), of which 2.47 ha has already been biodiversity certified as part of the Mt Gilead Stage 1 residential development (June 2019). The proposal, as amended, will have residual impacts to up to 4.83 ha of SSTF during the construction of the road, underpasses and koala exclusion fences (**Table 2**).

The 'Local Occurrence' of an ecological community is defined in the Assessment of Significance Guidelines (OEH 2018) as being "*the community that exists within the study area and may include adjacent areas if the ecological community in the study area forms part of larger contiguous area and the movement of individuals and exchange of genetic material across the boundary can be clearly demonstrated*".

The majority of the SSTF to be impacted is immediately adjacent to larger, contiguous patches of SSTF (and CPW) in the Noorumba and Beulah Biobank sites (80+ ha) and proposed Browns Bush Biodiversity Stewardship site (approx. 27 ha) which in turn are adjacent to other areas of SSTF (and CPW) in the Georges and Nepean River corridors with over 500 ha of combined CPW and SSTF (see map series at Attachment B, **Appendix A**). It is reasonable to assume that individuals and genetic material of the flora and fauna of these communities crosses the boundary of the REF study area as they are immediately adjacent.

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

Not applicable for SSTF.

b. in the case of an endangered ecological community or critically endangered ecological community whether the proposed action or activity action:

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

The local occurrence of SSTF extends outside of the study area to the adjacent Noorumba and Beulah Biobank sites and proposed offset areas at Browns and other proposed protected areas along the Georges and Nepean River corridors where over 500 ha of SSTF and CPW is either already or will be protected and managed for conservation (CPCP, DPE 2022).

Given this context, the loss of up to 4.83 ha of SSTF (in various condition states) from the study area is unlikely to have an adverse effect on the extent of the community such that its local occurrence is placed at risk of extinction.

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

The loss of up to 4.83 ha of SSTF (in various condition states from the study area is unlikely to substantially and adversely modify the composition of the SSTF such that it's local occurrence is likely to be placed at risk of

extinction. The composition of SSTF in these adjacent areas (the local occurrence of the community) will not be substantially modified as they either already are or will be actively managed for conservation.

c. in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed works will result in the removal of up to 4.83 ha of SSTF (in various condition states).

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The proposed activity will not result in the further fragmentation or isolation of the remaining patches of SSTF in the study area from other areas as the SSTF to be removed is located on the edge of a larger area of less disturbed SSTF.

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

The remaining areas of SSTF in the locality are considered important for the conservation of the community and are either already protected and managed for conservation (Noorumba and Beulah Biobank sites) or proposed to be registered as offset areas (Mt Gilead Stage 2 residential development and Georges River Koala National Park).

The loss of up to 4.83 ha of SSTF (in various condition states) from the study area is unlikely to affect the long term survival of the community in the locality.

d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly) (either directly or indirectly),

The study area is not a declared area of outstanding biodiversity value.

e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

A number of Key Threatening Processes (KTP) are relevant to this proposal with respect to SSTF. These include:

- clearing of native vegetation
- invasion of native plant communities by exotic perennial grasses
- removal of dead wood and dead trees.

The proposed development constitutes a key threatening process of relevance to SSTF i.e. clearing of native vegetation. The proposed development would result in the clearing of up to 4.83 ha of SSTF (in various condition states.

Conclusion

The proposed activity, as amended is unlikely to result in a significant impact to SSTF. Consequently, a Species Impact Statement or BDAR, is not required for the proposed development with respect to this CEEC.

Phascolarctos cinereus (Koala)

The Koala is listed as an endangered species under the BC and EPBC Acts.

Koalas have been recorded using habitats within the broader locality (Biolink 2018a) and the study area (ELA 2014, 2018 a, b and c, 2019 and 2022; Biolink 2018b; WSP 2018),and are likely to utilise the trees within the subject site for foraging and shelter from time to time.

The "Campbelltown" Koala population is recognised as one of a few Koala populations in NSW known to be stable and increasing (Close et al. 2017) or recovering and expanding (Biolink 2018a) and has an estimated populations size of 300-400 individuals (Phillips 2019). DPIE (2019) refers to the "Regional Koala population" being a single, contiguous koala population extending from Campbelltown through Wollondilly to Wingecarribee and estimates the population at over 400 individuals in the Campbelltown, Appin and Wilton area.

The broader "Campbelltown" Koala population extends from the Georges River National Park north of Heathcote Road in the Liverpool LGA, to Heathcote National Park in the east (Sutherland LGA), and along the Georges River Catchment in the Campbelltown LGA through the Holsworthy Military Area, Wedderburn Plateau to Gilead and the Nepean River catchment. Koalas are also present to the south of Appin and Wilton within the Wollondilly LGA, and further south in the Wingecarribee LGA (BioNet data). The presence of chlamydial disease within Koalas within Wollondilly and Wingecarribee LGAs, and the absence to date within Campbelltown Koalas indicates that there may have been some functional separation of these populations, though that may change if the populations continue to increase and expand.

For the purpose of impact assessment, the Test of Significance Guidelines (OEH 2018) defines the 'Local Population' of resident fauna species as being "*those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (whether contiguous or otherwise) that are known or likely to utilise habitats in the study area*". For this assessment of significance that means any Koala's using habitat in the REF study areas shown in Appendix A and any additional individuals whose home ranges (which average around 35 ha (Biolink 2018b)) overlap with the study area. It is unknown how many individuals this represents but based on recent drone surveys undertaken by Wild Conservation (2021 & 2022), where 25 Koalas were recorded in Noorumba Reserve, Beulah Biobank site and Browns Bush (which adjoin the REF study area), the 'Local Population' of Koala's, as defined by the Test of Significance Guidelines, is likely to exceed 25 individuals.

Up to 10.05 ha of Koala habitat will be directly impacted by the works proposed in the final proposal comprising 5.24 ha of CPW and SSTF in moderate to good condition, 4.57 ha of CPW and SSTF as scattered remnant paddock trees and 0.24 ha of planted native trees (**Table 3**). Of this 10.05 ha, 2.91 ha has already been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in **Appendix A Figure 1**. The residual impacts resulting from the REF are accordingly 7.14 ha.

This habitat occurs on the verges of Appin Rd and on the margins of larger, more continuous habitat (Browns Bush, Noorumba Reserve and Beulah BioBank site), which are connected to the Georges River and the proposed Koala National Park, and the proposed Koala Conservation Areas in Mt Gilead Stage 2 residential development (ELA 2023).

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

The proposed works will result in the permanent loss of up 7.14 ha of intact, regrowth and scattered Koala habitat trees over an approximate 6km length of Appin Road. This represents a relatively minor loss of habitat area for each of the estimated 25 Koala's representing the local population in the study area (ie loss of a narrow strip of trees up to 25m wide in places, on the edge of an existing road) and is considered unlikely to adversely affect the

life cycle of the species such that a viable local population is likely to be placed at the risk of extinction. This conclusion is made in the context that the proposed action will include two Koala underpasses (a northern underpass at Glen Lorne / Noorumba Reserve and a southern underpass at Browns Bush / Beulah Biobank site), koala exclusion fencing on both sides of Appin Road, and Koala grids at all property access points. (These measures mitigate the significant impacts associated with vehicle strike on Appin Road, maintain an important connectivity link for the local koala population between the Georges and Nepean Rivers and provide 'safe passage' for Koalas using this corridor from dog attack.

The design of the Koala underpasses is consistent with similar structures used by TfNSW on other road projects, with evidence of Koala usage, provided within monitoring reports and data (See **Table 1**). Data also supports usage by koalas of underpass structures located on the edge of vegetated areas (See **Table 2**). The expected improved connectivity, and reduced mortality of Koala's on Appin Rd will lead to a more viable local Koala population due to reduction of Koala roadkill, and facilitation of Koala movements across Appin Road to access habitat proposed for permanent conservation on either side (ELA 2023 a & b).

This section of Appin Road is a significant vehicle strike hotspot with 31 recorded Koala deaths and one reported Koala injury between Rosemeadow and Appin township reported to the NSW BioNet between 2012 and 2021. The proposal will also reduce Koala roadkill through the proposed Koala exclusion fencing on both sides of Appin Road and Koala grids at driveways and fence end points.

Table 1: Evidence of Koala use of similar TfNSW underpass structures in NSW

Updated Design	**Relevant records**	**Reference**
1.5m (h) x 2.4m (w), 27m long reinforced concrete box culvert at Browns Bush / Beulah Reserve under Appin Road (2 lanes)	Confirmed using a 1m diameter pipe under Wardell Road (2 lane)	TfNSW Woolgoolga to Ballina Pacific Highway Upgrade, Koala and Threatened Mammals Connectivity Structure Monitoring 2021/22 *in prep*
	Confirmed using a combined underpass 1.8m x 2.4m box culvert under Oxley Highway near Port Macquarie	Oxley Highway upgrade Port Macquarie monitoring of wildlife road crossing structures June 2013 to September 2016 (nsw.gov.au) Combined underpass
2.4m (h) x 3.0m (w), 53m long reinforced concrete box culvert at Glen Lorne / Noorumba Reserve under widened Appin Road (4 lanes)	Confirmed using a 2.4m x 3m box culvert 38m length under Oxley Highway near Kempsey	Oxley Highway to Kempsey Fauna Underpass Monitoring (2018-2019) Annual Ecological Monitoring Report Roads and Maritime Services Sept 2019 Appendix A: Koala

Updated Design	Relevant records	Reference
	Confirmed using a 3m x 3m box culvert box 100m length under Pacific Highway near Bonville	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
	Confirmed using a 2.1x 3m box culvert 27m length under Pacific Highway near Tyson's Flat	Nambucca Heads to Urunga Operational Phase - Biodiversity Monitoring – Year 3 (2019)
	Confirmed using a 1.8m x 3m box culvert under Oxley Highway near Port Macquarie	Oxley Highway upgrade Port Macquarie monitoring of wildlife road crossing structures June 2013 to September 2016 (nsw.gov.au) – Underpass West
	Confirmed using 2.4m x 3m box culverts near Nambucca Heads.	Warrell Creek to Nambucca Heads Interim Underpass Monitoring - Spring-Summer Year 1 (2019)
	Confirmed using three separate 2.4 x 2.4m box culverts near Nambucca Heads.	Warrell Creek to Nambucca Heads Annual (Ecological) Underpass Monitoring Report - Year 2 (2019-2020)
	Confirmed using a 2.4m x 2.4m box culvert 15m length under Wardell Road (2 land road). Confirmed using a 2.4m x 2.4m box culvert 66m in length under the existing Pacific Highway.	Woolgoolga to Ballina Koala Monitoring Program - Year 3 (2019-2020)[1]

Table 2: Evidence of Koala use of underpasses located at the edges of habitat

Location	Relevant Records	References
Pacific Highway, Taree. The T1 underpass is situated on the southern edge of a vegetated block of land within Kiwarrak State Forest. The eastern and western entrance has been largely cleared of vegetation and is largely grassland within 25 m of the entrance.	Record of a koalas using a 2.8m x 2.8m arch steel culvert 47.8m in length.	AMBS (2002) Fauna Underpass Monitoring Final Report Stage Two, Episode Five, Taree.
Pacific Highway, south of Broadwater. The M42/K29 underpass adjoins cleared land, near the forest end on the southern side and a narrow section of vegetation on the northern side.	Record of koala using a 2.4m x 2.4m box culvert 39m in length.	An email (S. Wilson, TfNSW personal communication, June 18, 2023) confirming that results are accurate.
Skyline Road, Lismore Six underpasses of varying sizes, under the road which is located within a fragmented agricultural landscape. The koala underpasses adjoin private properties comprised scattered koala food trees through cleared grazing land.	Record of koalas using several box culverts of varying sizes and lengths.	Miller, A. (June 2021) 'Investigating the spatial movements of koalas in relation to an exclusion fence on Skyline Road, Monaltrie' Unpublished report prepared for NSW Department of Planning and Environment (NSW Koala Strategy)

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Not applicable. The Koala is not an endangered ecological community.

c. in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed and amended works will result in the removal of up to 7.14 ha of foraging and shelter habitat spread over an approximate 6km length of Appin Road.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The loss of up to 7.14 ha of foraging habitat will not result in the remaining patches of Koala habitat on either side of Appin Road becoming more fragmented or isolated from other areas than they already are, other than an increase in the width of the separation by 25m at Noorumba Reserve. This habitat separation is currently traversed by Koalas, leading to vehicle strike. The proposed action, as amended, is proposed to improve this connectivity between protected habitat areas by providing two strategically located Koala underpasses (at locations generally identified/recommended by Biolink (2018b and 2018c), Philips 2019, and the NSW Chief Scientist (2020, 2021a & 2021b)) and combined with temporary and permanent Koala exclusion fencing, will guide Koala's to where safe crossings can be made. It is noted that the fencing will create a barrier to koala movement across Appin Road until functioning underpasses are installed. The gap between fence and RCBC installation is expected to be less than 12 months and while short term impacts to the movement of individual animals may occur, this would be offset by the anticipated reduction in vehicle strike achieved by fencing Appin Road.

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

The patches of Koala habitat from which the up to 7.14 ha will be removed is recognised as important habitat for Koalas (it is mapped as Core Koala Habitat in the Campbelltown Comprehensive Koala Plan of Management Biolink (2018a)). It is however, a relatively small, dispersed area of habitat loss, distributed across a 6km length of Appin Road and is adjacent to over 6,000 ha of protected (Dharawal Nature Reserve) and proposed to be protected (Georges River Koala National Park and Mt Gilead Koala Conservation Area).

The proposed action, as amended, is proposed to improve the connectivity between these patches and provide safe passage for Koala crossings by guiding Koala's to where safe crossings can be made with temporary and permanent Koala exclusion fencing.

d. whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value have been declared for the Koala in NSW.

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

The proposed works constitute one key threatening processes of relevance to the Koala, namely Clearing of Native Vegetation, which would result in a relatively small loss of foraging habitat. It is considered unlikely that

the proposal would significantly exacerbate this key threatening processes at this location given the extent of protected and proposed to be protected Koala habitat in the area. Whilst not listed as a key threatening process, vehicle strike and the resulting roadkill is a significant threat to the local population at this location. The proposed action, as amended, is proposed to mitigate this threat by guiding Koala's to where safe crossings can be made with temporary and permanent Koala exclusion fencing.

Conclusion

Taking into consideration all of the factors above, the Appin Road Upgrade project, as amended by the addendum REF (to include two Koala underpasses, Koala exclusion fencing on both sides of Appin Road and Koala grids at driveways and fence end points), is unlikely to result in a 'significant impact' on the Koala or local Koala population. The proposed activity is designed to mitigate a major threat to Koala, that being road mortality on Appin Rd and improving connectivity between areas of important habitat by providing safe crossing points for Koala movement between patches of habitat in the locality.

Consequently a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not required for this species.

Meridolum corneovirens (Cumberland Plain Land Snail)

Meridolum corneovirens (Cumberland Plain Land Snail; CPLS) is listed as endangered under the BC Act.

Current knowledge suggests that CPLS is restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River-flat Eucalypt Forest, especially where it meets Cumberland Plain Woodland. It is currently known from well over 100 locations in western Sydney with 1,166 records in BioNet. However, most of these populations are scattered throughout the region and are often small and isolated (OEH 2012). There are numerous records of this species within 5 km of the study area (Figure 4). Cumberland Plain Land Snail typically occurs under logs and other debris, amongst leaf and bark accumulations and sometimes under grass clumps. Where possible it will burrow into loose soil (OEH 2012).

CPLS has previously been recorded adjacent to the proposed impact area (ELA 2022) and in the Noorumba Bushland Reserve (ELA 2018c and **Figure 3**).

For the purpose of impact assessment, the Test of Significance Guidelines (OEH 2018) define the 'Local Population' of resident fauna species as being "*those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (whether contiguous or otherwise) that are known or likely to utilise habitats in the study area*". For this assessment of significance that means any CPLSs using habitat in the REF study areas shown in Appendix A and any additional individuals whose home ranges overlap with the study area.

Up to 7.83 ha of CPLS habitat will be directly impacted by the final proposed Project comprising 5.24 ha of CPW and SSTF in moderate to good condition, 2.38 ha of CPW as scattered remnant trees and 0.21 of SSTF as derived native grassland (**Table 4)**. Of this 7.83 ha, 2.75 ha has been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in Appendix **A Figure 1.** The residual impacts resulting from the REF are accordingly 5.08 ha.

This habitat occurs on the verges of Appin Rd and on the margins of larger, more continuous habitat (Browns Bush, Noorumba Reserve and Beulah BioBank site), which are connected to the Georges River and the proposed Koala National Park, and the proposed Koala Conservation Area in Mt Gilead Stage 2 residential development.

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

The proposed works will result in the loss of up to 5.08 ha of habitat for this species over an approximate 6km length of Appin Road.

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

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

Not applicable. The CPLS is not an endangered ecological community.

c. in relation to the habitat of a threatened species, population or ecological community:

- **i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

The proposal will remove up to 5.08 ha of habitat from much larger patches of occupied habitat that is either already protected and managed for conservation (Noorumba Reserve, Beulah Biobank site) or will be permanently protected and managed for conservation (Browns Bush BSA site, ELA 2022).

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The location of the vegetation/habitat to be impacted is on the edge of an existing road and surrounded by larger patches of more suitable habitat. In this context it is considered unlikely that the proposed works will result in an area of habitat becoming fragmented or isolated from other areas of habitat.

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

The proposal will temporarily remove up to 5.08 ha of habitat for CPLS. This represents a very small area of habitat, compared with the extent of habitat remaining within the locality which is protected and managed for conservation.

It is considered unlikely that the habitat to be removed would be considered important to the long-term survival of the species within the locality.

d. whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No areas of outstanding biodiversity value have been declared for this species.

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

The proposed works constitutes one key threatening processes of relevance to CPLS, Clearing of Native Vegetation, which would result in the loss of a very small area of potential habitat. Therefore, it is unlikely that the proposal would exacerbate any key threatening processes.

Conclusion

The proposed works are unlikely to result in a significant impact to CPLS in the locality as the area of habitat to be impacted is very small compared to the extent of existing protected habitat adjacent to the impact areas.

- a very small area of the potential habitat for this species would be removed;
- no areas of potential habitat would become further isolated as a consequence of the proposal; and
- potential habitat would remain for this species within the study area and wider landscape.

Consequently, a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not required for this species.

Petaurus norfolcensis (Squirrel Glider)

Petaurus norfolcensis (Squirrel Glider) is a vulnerable species listed under the BC Act. It is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland, where it occurs in dry sclerophyll forest and woodland (DECC 2005). Suitable habitat for this species requires abundant hollow-bearing trees and a mix of eucalypts including some smooth barked and winter flowering species (NPWS 1999).

Squirrel Gliders are nocturnal and dependent upon hollows for shelter. They feed on nectar, pollen, flowers, acacia gum and insects, but may also eat sap from feeding scars from other species of Glider (NPWS 1999). Mean home range for this species is 3-9 ha in coastal habitats and 3-4 ha in productive inland habitat fragments (NSW Scientific Committee 2008).

The species has been recorded from the Mt Gilead Biocertification Assessment Area within structural diverse riparian vegetation with abundant hollows and within part of the proposed Browns Bush BSA site (ELA 2022) although there are relatively few HBTs in the Browns Bush area and the existing vegetation is largely regrowth woodland. Squirrel Gliders have not been recorded in Noorumba Reserve.

For the purpose of impact assessment, the Test of Significance Guidelines (OEH 2018) define the 'Local Population' of resident fauna species as being "*those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (whether contiguous or otherwise) that are known or likely to utilise habitats in the study area*". For this assessment of significance that means any Squirrel Glider's using habitat in the final project study areas shown in Appendix A and any additional individuals whose home ranges (which average around 4-5 ha overlap with the study area). It is unknown how many individuals this represents but based on the linear length of the Project (6km) and widening in some areas by up to 25m, this could represent part of the habitat for up to 4 or 5 individual Squirrel Glider's.

Up to 9.80 ha of Squirrel Glider habitat will be directly impacted by the works proposed in the Project comprising 5.24 ha of CPW and SSTF in moderate to good condition, and up to 4.57 ha of CPW and SSTF as scattered remnant trees (**Table 3**). Of this 9.80 ha, 2.91 ha has been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in **Figure 1** and **Appendix A**. The residual impacts resulting from the REF are accordingly 6.89 ha.

This habitat occurs on the verges of Appin Rd and on the margins of larger, more continuous habitat (Browns Bush, Noorumba Reserve and Beulah BioBank site).

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

Factors likely to have an adverse effect on the life cycle of the Squirrel Glider would include a substantial loss and/or fragmentation of foraging habitat, loss of hollows and increased presence of foxes and cats.

The final proposed works will result in the permanent loss of up 6.89 ha of intact, regrowth and scattered Squirrel Glider habitat trees over an approximate 6km length of Appin Road. The habitat includes a relatively low number of hollow bearing trees that may provide breeding habitat for the species. This represents a relatively minor loss of habitat area for each of the estimated four or five Squirrel Glider's representing the local population in the study area (ie loss of a narrow strip of trees up to 25m wide in places, on the edge of an existing road) and is considered unlikely to adversely affect the life cycle of the species such that a viable local population is likely to be placed at the risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Not applicable. The Squirrel Glider is not an endangered ecological community.

c. in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed works will result in the removal of up to 6.89 ha of potential foraging and breeding habitat within a contiguous patch of forest/woodland area in excess of 200 ha.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposed works will lead to an increase in the fragmentation and isolation of areas of potential habitat (Noorumba and Beulah Reserves) from other areas of habitat used by the Squirrel Glider (Browns Bush). Rope bridges will be provided at the final design stage (EMM 2022) to help mitigate these impacts. The suitability of these structures in providing safe passage for arboreal mammals has been reviewed by Goldingay and Taylor (2016).

The loss of up to 6.89 ha of foraging habitat will not result in the remaining patches of Squirrel Glider habitat on either side of Appin Road becoming more fragmented or isolated from other areas than they already are, other than an increase in the width of the separation by 25m at Noorumba Reserve.

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

The patches of Squirrel Glider habitat to be removed (up to 6.89 ha) is regarded as important habitat for Squirrel in the locality (being one of the few know locations for Squirrel Gliders remaining on the Cumberland Plain (BioNet data)). However, the project will only impact a relatively small area of this larger habitat, the projected impacts are distributed across a 6km length of Appin Road and is adjacent to over 6,000 ha of protected (Dharawal Nature Reserve) and proposed to be protected (Georges River Koala National Park and Mt Gilead Conservation Area) that are known or likely to provide habitat for the Squirrel Glider in the locality therefore the proposed work is unlikely to negatively impact the long term survival of the species.

e. whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value have been declared for this species.

d. The action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed works constitutes one key threatening processes of relevance to the Squirrel Glider, namely Clearing of Native Vegetation, which would result in a relatively small loss of potential foraging habitat. It is unlikely that the proposal would exacerbate any key threatening processes.

Conclusions

The proposal is unlikely to impose a significant effect on the Squirrel Glider given that:

- a small amount of potential foraging and breeding habitat in the locality will be impacted;
- the habitat to be impacted is located on the edge of an existing road and will not lead to further isolation or fragmentation of this habitat; and
- potential habitat would remain for this species adjacent to the study area and wider landscape.

Consequently a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not required for this species.

Large Forest Owls and Cockatoos

The Powerful and Masked Owl and Gang-gang and Glossy Black Cockatoo are all listed as vulnerable species under the BC Act and have all been recorded in the locality and will likely use resources, breeding sites and foraging areas, in the locality from time to time (**Figure 3**).

Of particular importance for these species is suitable breeding sites comprising large hollows (> 20cm diameter) in the trunks and limbs of tall living or dead trees and extensive areas in which to forage for prey. A number of hollow bearing trees (HBTs) have been recorded in the project area (WSP 2018), but these do not have hollows that are suitable as breeding sites for these threated owls and cockatoo species. Gang-gang Cockatoos were recorded breeding in large HBTs in the St Helens Park area in 2022.

For the purpose of impact assessment, the Test of Significance Guidelines (OEH 2018) define the 'Local Population' of resident fauna species as being "*those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (whether contiguous or otherwise) that are known or likely to utilise habitats in the study area*". For this assessment of significance that means any threatened owls or cockatoos using habitat in the REF study areas shown in Appendix A and any additional individuals whose home ranges (which are very large and exceed 200ha) overlap with the study area. It is unknown how many individuals this represents but based on the linear length of the Project (6km) and widening in some areas by up to 25, this could represent part of the habitat for up to two or three pairs of owls or cockatoos.

Up to 10.05 ha owl and cockatoo foraging habitat will be directly impacted by the works proposed in the Project comprising 5.24 ha of CPW and SSTF in moderate to good condition, 4.57 ha of CPW and SSTF as scattered remnant trees and 0.24 ha of planted native trees (**Table 3**). Of this 10.05 ha, 2.91 ha has been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in **Figure 1** and **Appendix A**. The residual impacts resulting from the REF are accordingly 7.14 ha.

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

Factors likely to have an adverse effect on the life cycle of the Barking Owl, Powerful Owl and Masked Owl would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable nesting and roosting habitat (e.g. large hollow bearing trees).

The final proposed works will result in the permanent loss of up to 7.14 ha of intact, regrowth and scattered tree owl and cockatoo foraging habitat over an approximate 6km length of Appin Road. There are no known or suitable breeding trees in the impact area for these species. This loss represents a minor loss of habitat area for any individuals using the Project area given the very large size of their territories (owls) and high mobility (cockatoos) representing the local population in the study area (ie loss of a narrow strip of trees up to 25m wide in places, on the edge of an existing road) and is considered unlikely to adversely affect the life cycle of the species such that a viable local populations are likely to be placed at the risk of extinction.

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

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

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

Not applicable. These species are not listed as endangered ecological communities.

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

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

The proposed works will result in the removal of up to 7.14 ha of potential foraging and breeding habitat within a contiguous patch of forest/woodland area in excess of 5,000 ha.

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

The loss of up to 7.14 ha of foraging habitat will not result in the remaining patches of owl and cockatoo habitat on either side of Appin Road becoming more fragmented or isolated from other areas than they already are, other than an increase in the width of the separation by 25m at Noorumba Reserve, which is unlikely to affect these species given their high levels of mobility.

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

The patches of habitat from which the up to 7.14 ha will be removed is not regarded as important habitat for these species in the locality. Further the project will only impact a small area of this habitat, is distributed across a 6km length of Appin Road and is adjacent to over 6,000 ha of protected (Dharawal Nature Reserve) and proposed to be protected (Georges River Koala National Park and Mt Gilead Conservation Area) that are known or likely to provide habitat for these species in the locality.

d. whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity values have been declared for these species.

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

The proposed works constitute one key threatening processes of relevance to these species, 'Clearing of Native Vegetation', which would result in the loss of a small area (7.14 ha) of potential foraging habitat. However, given the large areas used by these species and the extent of habitat in the locality, it is unlikely that the proposal would exacerbate any key threatening processes.

Conclusion

The proposal is unlikely to constitute a significant effect on the Barking Owl, Powerful Owl, Gang-gang Cockatoo or Glossy Black Cockatoo given that the proposed works:

- the area is not suitable breeding habitat for these species;
- would only impact a small area of potential foraging habitat within the locality;
- would not isolate or fragment any currently connecting areas of habitat; and
- does not impact larger areas of more suitable potential foraging habitat that are present within the surrounding landscape.

Consequently, a Species Impact Statement is not required for the proposal with respect to these species.

Blossom Nomads

The Little Lorikeet, Grey-headed Flying Fox, Swift Parrot, and Regent Honeyeater, have been recorded (Little Lorikeet, Flying-fox) or may occur (Swift Parrot/Regent Honeyeater) within the study area from time to time (ELA 2018, 2022) (**Figure 3**). They have been grouped together for this Assessment of Significance because they have similarities in their foraging behaviours (highly nomadic and move great distances to forage on flowering eucalypts when in season) and accordingly are likely to use foraging resources within the study area intermittently. Consequently predicted impacts are considered to be the same or similar. None of the species have been recorded breeding on the study area.

For the purpose of impact assessment, the Test of Significance Guidelines (OEH 2018) define the 'Local Population' of resident fauna species as being "*those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (whether contiguous or otherwise) that are known or likely to utilise habitats in the study area*". For this assessment of significance that means any Blossom Nomads using habitat in the REF study areas shown in Appendix A and any additional individuals whose home ranges (movements) overlap with the study area. It is unknown how many individuals this represents as these species will only visit the Project area when there is suitable habitat flowering and the number of animals will vary between seasons.

Up to 10.05 ha of blossom nomad foraging habitat will be directly impacted by the works proposed in the Project comprising 5.24 ha of CPW and SSTF in moderate to good condition, 4.57 ha of CPW and SSTF as scattered remnant trees and 0.24 ha of planted native trees (**Table 3**). Of this 10.05 ha, 2.911 ha has been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in **Appendix A**. The residual impacts resulting from the REF are accordingly 7.14 ha.

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

Impacts likely to have an adverse effect on the lifecycle of these species includes the loss or degradation of significant areas of suitable foraging habitat, in particular, high quality foraging habitat with an abundance of winter flowering species.

The final proposed works will result in the permanent loss of up 7.14 ha of intact, regrowth and scattered habitat for these species over an approximate 6km length of Appin Road. This represents a minor loss of habitat area for these highly mobile species representing the local population in the study area (ie loss of a narrow strip of trees up to 25m wide in places, on the edge of an existing road) and is considered unlikely to adversely affect the life cycle of the species such that viable local population are likely to be placed at the risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

Not applicable. These species are not listed as endangered ecological communities.

c. in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The final proposed works will result in the removal of up to 7.14 ha of potential foraging and breeding habitat within a contiguous patch of forest/woodland area in excess of 6,000 ha.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The final proposed works will not result in the fragmentation or isolation of areas of habitat from other areas of habitat for these species. The loss of up to 7.14 ha of foraging habitat will not result in the remaining patches of habitat on either side of Appin Road becoming more fragmented or isolated from other areas of habitat than they already are, other than an increase in the width of the separation by 25m at Noorumba Reserve. Given the high mobility of these species, this separation is not likely to adversely affect the ability of these species to access adjacent foraging habitat.

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

The 7.14 ha to be impacted is not considered to be an important area of habitat for these species in relation to the long-term survival of the species in the locality.

The Project area does not include any roost sites for Grey-headed Flying Fox and is not mapped as "important habitat" for the Swift Parrot or Regent Honeyeater.

d. whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity values have been declared for these species.

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

The proposed works constitute one key threatening processes of relevance to these species, namely 'Clearing of Native Vegetation', which would result in the loss of a small area of potential foraging habitat. Given the highly mobile nature of these species, that the majority of potential habitat for this species will be conserved within the locality and wider landscape, it is unlikely that the proposal would exacerbate any key threatening processes.

Conclusions

The proposal is unlikely to constitute a significant impact to these species given that:

- the proposed works would only disturb a small (7.14 ha) area of potential foraging habitat within the study area;
- the proposed works would not isolate or fragment any currently connecting areas of habitat; and
- larger areas of suitable potential foraging habitat are present within the surrounding landscape.

On the basis of the above considerations, it is unlikely that the proposal will constitute a significant impact on these species.

Microchiropteran bats

For the purpose of this assessment the microchiropteran bat species *Chalinolobus dwyeri* (Large-eared Pied Bat), *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Myotis macropus* (Southern Myotis), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) and *Scoteanax rueppellii* (Greater Broad-nosed Bat) have been assessed together. This is due to the similarities in their habitat associations and biology.

Most species forage along edges of forests, cleared paddocks, tree-lined water courses and above or just below the tree canopy. The Large-footed Myotis forages along streams and pools, feeding on insects and small fish caught by raking their long feet across the water surface.

These species are threatened by a number of processes including loss of trees for foraging and hollow-bearing trees for roosting, disturbance to winter roosting and breeding sites, and application of pesticides in or adjacent to foraging areas (DECC 2005).

These seven microchiropteran bat species have all been recorded foraging within the study area. Collectively, these species are known to roost in tree hollows, under loose bark on trees, in buildings, caves, tunnels, abandoned mines, stormwater drains, culverts and bridges. The impact area has a small number of HBTs that may be used for roosting purposes by these species.

For the purpose of impact assessment, the Test of Significance Guidelines (OEH 2018) define the 'Local Population' of resident fauna species as being "*those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (whether contiguous or otherwise) that are known or likely to utilise habitats in the study area*". For this assessment of significance that means any of these species using habitat in the REF study areas shown in Appendix A and any additional individuals whose home ranges overlap with the study area. It is unknown how many individuals this represents given the high mobility of these species but based on the linear length of the Project (6km) and widening in some areas by up to 25, this could represent numerous individuals.

Up to 10.05 ha of foraging and potential roosting habitat for these species will be directly impacted by the final works proposed in the Project comprising 5.24 ha of CPW and SSTF in moderate to good condition, 4.57 ha of CPW and SSTF as scattered remnant trees and 0.24 ha of planted native trees (**Table 3**). Of this 10.05 ha, 2.91 ha has been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in **Figure 1** and **Appendix A**. The residual impacts resulting from the REF are accordingly 7.14 ha.

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

Factors likely to have an adverse effect on the life cycle of these species would include a substantial loss and/or fragmentation of foraging habitat, including water bodies, and a loss of suitable roosting or breeding habitat.

The final proposed works will result in the permanent loss of up 7.14 ha of intact, regrowth and scattered habitat for these species over an approximate 6km length of Appin Road. This represents a minor loss of habitat area for these highly mobile species representing the local population in the study area (ie loss of a narrow strip of trees up to 25m wide in places, on the edge of an existing road) and is considered unlikely to adversely affect the life cycle of the species such that viable local population are likely to be placed at the risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Not applicable. These species are not listed as endangered ecological communities.

c. in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed works will result in the removal of up to 7.14 ha of potential foraging and breeding habitat within a contiguous patch of forest/woodland area in excess of 6,000 ha.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposed works will not result in the fragmentation or isolation of areas of habitat from other areas of habitat for these species. The loss of up to 7.14 ha of foraging habitat will not result in the remaining patches of microchiroteran bat habitat on either side of Appin Road becoming more fragmented or isolated from other areas of habitat than they already are, other than an increase in the width of the separation by 25m at Noorumba Reserve. Given the high mobility of these species, this separation is not likely to adversely affect the ability of these species to access adjacent foraging habitat.

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

The habitat to be removed is not considered to be an important area of habitat for these species within the locality. There are no known breeding sites for these species nearby other than for the Large-eared Pied Bat that is likely to breed in the steep, rocky parts of the Georges River to the east of the Project area.

d. whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

No areas of outstanding biodiversity values have been declared for these species.

e. The action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed works constitutes one key threatening processes of relevance to these species, 'Clearing of Native Vegetation', which would result in the loss of a small area of potential foraging habitat. Given the majority of potential habitat for these species will be conserved within the study area and locality it is unlikely that the proposal would exacerbate any key threatening processes.

Conclusions

The proposal is unlikely to impose a significant effect on these microchiropteran bat species given that:

- the proposed works would only disturb a small area of foraging habitat within the study area;
- the proposed works would not isolate or fragment any currently connected areas of habitat; and
- larger areas of suitable potential foraging habitat are present within the surrounding landscape.

Consequently a Species Impact Statement (SIS) or BDAR is not required for these species.

Threatened diurnal Woodland birds

Five threatened forest and woodland birds (Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Hooded Robin and Diamond Firetail) have been recorded or are likely to occur within the study area (ELA 2018, Biolink 2018, WSP 2018) (**Figure 3**). They have been grouped together for this Assessment of Significance because they have certain similarities in their foraging and/or roosting behaviours, habitat requirements and consequently predicted impacts are considered to be the same or similar.

Up to 7.96 ha of foraging and potential nesting habitat for these species will be directly impacted by the final works proposed in the Project (**Table 3**). Of this 7.96 ha, 1.73 ha has been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in **Figure 1** and **Appendix A**. The residual impacts resulting from the REF are accordingly 6.23 ha.

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

Impacts likely to have an adverse effect on the lifecycle of these species includes the loss or degradation of significant areas of forest and woodland habitat.

The final proposed works will result in the loss of up to 6.23 ha of habitat. Therefore, it is considered highly unlikely that the removal of a small area of potential foraging habitat will significantly disrupt the life cycle of these species such that viable local populations are placed at risk of extinction.

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

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

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

Not applicable. These species are not listed as an endangered ecological community.

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

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

The proposed works will result in the removal of up to 6.23 ha of potential foraging and breeding habitat within a contiguous patch of forest/woodland area in excess of 6,000 ha.

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

The loss of up to 6.23 ha will not result in the remaining areas of woodland bird habitat in the study area becoming fragmented or isolated from other areas.

The proposed works will not result in the fragmentation or isolation of areas of habitat from other areas of habitat for these species. The loss of up to 6.23 ha of foraging habitat will not result in the remaining patches of habitat on either side of Appin Road becoming more fragmented or isolated from other areas of habitat than they already are, other than an increase in the width of the separation by 25m at Noorumba Reserve. Given the high mobility

of these species, this separation is not likely to adversely affect the ability of these species to access adjacent foraging habitat.

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

The 6. ha to be impacted is not considered to be an important area of habitat for these species in relation to the long-term survival of the species in the locality.

d. **whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)**

No areas of outstanding biodiversity values have been declared for these woodland bird species.

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

The proposed works constitute one key threatening processes of relevance to these species, namely 'Clearing of Native Vegetation', which would result in the loss of a small area of potential foraging habitat. Given the mobile nature of these species, that the majority of potential habitat for this species will be conserved within the locality and wider landscape, it is unlikely that the proposal would exacerbate any key threatening processes.

Conclusion

The proposal is unlikely to constitute a significant impact to any threatened woodland bird species given that:

- the proposed works would remove only a small area of potential foraging habitat relative to the amount available in the wider landscape;
- larger areas of suitable foraging and roosting habitat are present within the surrounding landscape; and
- the proposal would not isolate or fragment any currently connecting areas of habitat.

Consequently, a SIS or BDAR is not required for the proposal with respect to these species.

Raptors

The following two raptor bird species are regarded as having potential to occur within the study area and consequently have been grouped together for this Assessment of Significance. This is because they have certain similarities in their foraging and/or roosting behaviours, habitat requirements and consequently predicted impacts are considered to be the same or similar. Where obvious differences are apparent between each species, they are discussed separately.

The Little Eagle and Square-tailed Kite are listed as vulnerable under the BC Act. The Square-tailed Kite has previously been recorded within the study area and both species both have been recorded within 5 km of the study area (**Figure 3**). Potential foraging and roosting habitat for these species was identified within the study area although no nests have been recorded despite several years of survey in the locality.

Hieraaetus morphnoides (Little Eagle)

The Little Eagle occupies many habitats including open forest, woodland and scrub communities, as well as open agricultural land (Simpson & Day 2004). Little Eagles are known to nest in canopy trees during spring and early summer, in open woodland or riparian zones, where open areas are available to forage for birds, reptiles and mammals (Morcombe 2004; Marchant & Higgins 1993).

Lophoictinia isura (Square-tailed Kite)

The Square-tailed Kite is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. This species is found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs (DECC 2008e). When foraging, this species typically glides just above the tree canopy in search of prey and, therefore, they are more likely to forage above timbered areas rather than open country.

Up to 10.96 ha of foraging and potential nesting habitat for these species (including derived native grasslands) will be directly impacted by the final works proposed in the Project (**Table 3**). Of this 10.96 ha, 3.85 ha has been 'biodiversity certified' as part of the Mt Gilead Stage 1 residential development as shown in **Figure 1**, **Appendix A**. The residual impacts resulting from the REF are accordingly 7.11 ha.

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

The proposed works will result in the loss of up to 7.11 ha of foraging habitat for these species. No characteristic nests were observed in any of the trees to be removed or nearby that may be affected by noise and other disturbances.

It is considered highly unlikely that the removal of a small area of potential foraging habitat will significantly disrupt the life cycle of these species such that viable local populations are placed at risk of extinction.

b. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Not applicable. The Little Eagle and Square-Tailed Kite are not an endangered ecological community.

c. in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed works will result in the loss of up to 7.11 ha of potential foraging and breeding habitat within a contiguous patch of forest/woodland area in excess of 6,000 ha. Given the highly mobile nature of these species, the proposed removal of potential habitat is minimal when compared to the large areas of undisturbed habitat within the study area and wider landscape.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposed works will not result in the fragmentation or isolation of areas of habitat from other areas of habitat for these species. The loss of up to 7.11 ha of foraging habitat will not result in the remaining patches of habitat on either side of Appin Road becoming more fragmented or isolated from other areas of habitat than they already are, other than an increase in the width of the separation by 25m at Noorumba Reserve. Given the high mobility of these species, this separation is not likely to adversely affect the ability of these species to access adjacent foraging habitat.

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

The 7.11 ha to be impacted is not considered to be an important area of habitat for these species in relation to the long-term survival of the species in the locality.

d. whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity values have been declared for these woodland bird species.

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

The proposed works constitute one key threatening processes of relevance to these species, namely Clearing of Native Vegetation, which would result in a small loss of potential foraging habitat. Given the highly mobile nature of these species, that the majority of potential habitat for these species will be conserved within the study area and wider landscape, and that vegetation to be cleared is within the most disturbed portion of the study area, it is unlikely that the proposal would exacerbate any key threatening processes.

Conclusion

The proposal is unlikely to constitute a significant effect on the Little Eagle or Square-tailed Kite given that the proposed works:

- would only disturb a small area of potential foraging habitat within the study area;
- not isolate or fragment any currently connecting areas of habitat; and
- do not impact larger areas of more suitable potential foraging habitat are present within the surrounding landscape.

Consequently, a SIS or BDAR is not required for the proposal with respect to these species.

Appendix E – EPBC Act MNES Assessment of Significance

The EPBC Act Administrative Guidelines on Significance set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance (MNES). Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World heritage properties
- National heritage places
- Nuclear actions.

Specific 'Significant Impact Criteria' are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as critically endangered, endangered and vulnerable under the EPBC Act. The following MNES were assessed for the proposed action:

Threatened Ecological Communities:

- Cumberland Plain Woodland (CPW)
- Shale Sandstone Transition Forest (SSTF)

Fauna:

- *Phascolarctos cinereus* (Koala)
- Gang-gang Cockatoo
- Glossy Black Cockatoo
- Spot-tailed Quoll
- *Lathamus discolour* (Swift Parrot)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)

Flora:

- No threatened flora species recorded in or adjacent to impact areas

Migratory species:

- *Ardea ibis* (Cattle Egret)
- *Merops ornatus* (Rainbow Bee-eater)

Cumberland Plain Woodland (CPW)

The subject site was assessed as including 3.66 ha of CPW of which only 0.33 ha meets the EPBC Act condition thresholds for CPW (Category A). Of this 0.33 ha, 0.04 ha of impact has already been approved as part of the Mt Gilead Residential Development (EPBC 2015-7599 - approved on 21 December 2018 (**Table 2**). The final proposal, as amended, will have additional impacts of 0.29 ha to Category A CPW.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- **reduce the extent of an ecological community**

The proposed action would involve removal of 0.29 ha of CPW at various locations along an approximate 6km length of Appin Rd, adjacent to much larger, contiguous patches of intact CPW and SSTF in the Noorumba and Beulah Biobank sites (80+ ha) and proposed Browns Bush Biodiversity Stewardship site (approx. 27 ha) which in turn are adjacent to other areas of CPW (and SSTF) in the Georges and Nepean River corridors with over 500 ha of combined CPW and SSTF (see map series in Appendix A).

The CPW to be removed is along an existing road. While the proposed action would involve clearing a small, area of the ecological community, the extent to which the action will reduce the extent of the community is considered negligible.

- **fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**

The proposed action would involve disturbance adjacent to an existing road and powerline easement and would therefore not fragment any currently interconnected areas of the ecological community.

- **adversely affect habitat critical to the survival of an ecological community**

Habitat critical to the survival of the community includes areas necessary for the long-term maintenance of the ecological community. The small area within the footprint is not considered critical to the survival of the ecological community particularly in the context of the larger patch of CPW within the study area which would not be impacted.

- **modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**

The proposed action would not involve modification or destruction of abiotic factors necessary for the survival of the ecological community in the study area or broader locality. Erosion and sediment control measures will be established before work begins and maintained in effective working order throughout the duration of the works, and until the site has been stabilised to mitigate potential indirect impacts to soil and run-off by the proposed works.

- **cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

The proposed action would involve clearing and loss of the community across a very small area (0.29 ha) which forms part of a greater than 50 ha patch of the ecological community. The proposed action would not have any impacts such as altered species composition or loss of functionally important species outside of the subject site and will be restored to CPW as part of the management of the BSA site.

Weed species currently occur within the action area. Mitigation measures recommended to prevent further weed invasion and/or spread have been included in the REF. They include washing down machinery before conducting works to limit weed spread or introduction of weed species.

- **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
  - **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
  - **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or**

The proposed action would involve clearing and loss of the community across a very small area (0.29 ha) which forms part of a greater than 50 ha patch of the ecological community. The proposed works are unlikely to assist invasive species becoming established as the subject site is already vulnerable to weed invasion, due to its location adjacent to the powerline easement and road. Once registered as a BSA site, the prevalence of invasive weeds will be reduced by annual conservation management.

- **interfere with the recovery of an ecological community.**

The proposed action would involve clearing and loss of the community across a very small area (0.29 ha) which forms part of a greater than 50 ha patch of the ecological community and will be restored on completion of works. Given the relatively small scale of the impacts and that no impacts are proposed to adjacent areas of CPW within the study area, the proposed action is considered unlikely to interfere with the recovery of the ecological community.

Conclusion

The final proposed action is unlikely to have a significant impact on the listed ecological community, CPW.

Shale Sandstone Transition Forest (SSTF)

The subject site was assessed as including 7.30 ha of SSTF of which 4.90 ha meets the EPBC Act condition thresholds for Category D (1.40 ha) and Category C (3.51) EPBC condition threshold SSTF. Of this 7.30 ha, 2.47 ha of impact has already been approved as part of the Mt Gilead Residential Development (EPBC 2015-7599 - approved on 21 December 2018 (**Table 2**). The proposal, as amended, will have additional impacts to 1.40 ha of Category D SSTF and 1.19 ha to category C SSTF.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- **reduce the extent of an ecological community**

The proposed action would involve removal of 2.59 ha of SSTF at various locations along an approximate 6km length of Appin Rd, adjacent to much larger, contiguous patches of intact SSTF and CPW in the Noorumba and Beulah Biobank sites (80+ ha) and proposed Browns Bush Biodiversity Stewardship site (approx. 27 ha) which in turn are adjacent to other areas of SSTF (and CPW) in the Georges and Nepean River corridors with over 500 ha of combined CPW and SSTF (see map series in Appendix A).

The SSTF to be removed is along an existing road. While the proposed action would involve clearing a small, area of the ecological community, the extent to which the action will reduce the extent of the community is considered negligible.

- **fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**

The proposed action would involve disturbance adjacent to an existing road and powerline easement and would therefore not fragment any currently interconnected areas of the ecological community.

- **adversely affect habitat critical to the survival of an ecological community**

Habitat critical to the survival of the community includes areas necessary for the long-term maintenance of the ecological community. The small area within the footprint is not considered critical to the survival of the ecological community particularly in the context of the larger patch of SSTF within the study area which would not be impacted.

- **modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**

The proposed action would not involve modification or destruction of abiotic factors necessary for the survival of the ecological community in the study area or broader locality. Erosion and sediment control measures will be established before work begins and maintained in effective working order throughout the duration of the works, and until the site has been stabilised to mitigate potential indirect impacts to soil and run-off by the proposed works.

- **cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

The proposed action would involve clearing and loss of the community across a relatively small area (2.59 ha) which forms part of a greater than 100 ha patch of the ecological community. The proposed action would not

have any impacts such as altered species composition or loss of functionally important species outside of the subject site and will be restored to SSTF as part of the management of the BSA site.

Weed species currently occur within the action area. Mitigation measures recommended to prevent further weed invasion and/or spread have been included in the REF. They include washing down machinery before conducting works to limit weed spread or introduction of weed species.

- **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
  - **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
  - **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or**

The proposed action would involve clearing and loss of the community across a small area (2.59 ha) which forms part of a greater than 100 ha patch of the ecological community. The proposed works are unlikely to assist invasive species becoming established as the subject site is already vulnerable to weed invasion, due to its location adjacent to the powerline easement and road. Once registered as a BSA site, the prevalence of invasive weeds will be reduced by annual conservation management.

- **interfere with the recovery of an ecological community.**

The proposed action would involve clearing and loss of the community across a small area (2.59 ha) which forms part of a greater than 100 ha patch of the ecological community and will be restored on completion of works. Given the relatively small scale of the impacts and that no impacts are proposed to adjacent areas of SSTF within the study area, the proposed action is considered unlikely to interfere with the recovery of the ecological community.

Conclusion

The final proposed action is unlikely to have a significant impact on the listed ecological community, SSTF.

Phascolarctos cinereus (Koala)

The Koala is listed as endangered under the EPBC Act. Koala's have been recorded using habitats within the broader locality (Biolink 2018a) and the study area (ELA 2014, 2018 a, b and c, 2019 and 2022; Biolink 2018c; WSP 2018) and are likely to utilise the trees within the subject site for foraging and shelter from time to time.

The "Campbelltown" Koala population is recognised as one of a few Koala populations in NSW known to be stable and increasing (Close et al. 2017) or recovering and expanding (Biolink 2018a) and has an estimated populations size of 300-400 individuals (Phillips 2020). DPIE (2019) refers to the "Regional Koala population" being a single, contiguous koala population extending from Campbelltown through Wollondilly to Wingecarribee and estimates the population at over 400 individuals in the Campbelltown, Appin and Wilton area.

The broader "Campbelltown" Koala population extends from the Georges River National Park north of Heathcote Road in the Liverpool LGA, to Heathcote National Park in the east (Sutherland LGA), and along the Georges River Catchment in the Campbelltown LGA through the Holsworthy Military Area, Wedderburn Plateau to Gilead and the Nepean River catchment. Koalas are also present to the south of Appin and Wilton within the Wollondilly LGA, and further south in the Wingecarribee LGA (BioNet data). The presence of chlamydial disease within Koalas within Wollondilly and Wingecarribee LGAs, and the absence to date within Campbelltown Koalas indicates that there may have been some functional separation of these populations, though that may change if the populations continue to increase and expand.

Criterion a: lead to a long-term decrease in the size of a population of a species

Up to 10.05 ha of Koala habitat will be directly impacted by the works in the final proposal comprising 5.24 ha of CPW and SSTF in moderate to good condition, 4.57 ha of CPW and SSTF as scattered remnant trees and 0.24 ha of planted native trees (**Table 3**). Of this 10.05 ha, 2.91 ha has been approved as part of the Mt Gilead Stage 1 residential development (EPBC 2015-7599) as shown in **Figure 1**, **Appendix A**. The residual impacts resulting from the final proposed Project are accordingly 7.14 ha.

This habitat occurs on the verges of Appin Rd and on the margins of larger, more continuous habitat (Browns Bush, Noorumba Reserve and Beulah BioBank site), which are connected to the Georges River and the proposed Koala National Park, and the proposed Koala Conservation Area in Mt Gilead Stage 2 residential development.

The proposed works will result in the permanent loss of up 7.14 ha of intact, regrowth and scattered Koala habitat trees over an approximate 6km length of Appin Road. Given the average size of the local population's home range is 35 ha, this is a small proportion of one individuals habitat requirements and accordingly, on its own, is highly unlikely to lead to a long-term decrease in the size of the local population. The impact area is part of a much larger (> 250ha) patch of Koala habitat in the locality, most of which is proposed as a Biodiversity Stewardship Agreement site (BSA) and/or a new National Park (Georges River Koala National Park). The koala underpasses included as part of the proposed works also endeavour to support the long-term increase in the size of the koala population by providing east-west connectivity across Appin Road.

Criterion b: reduce the area of occupancy of the species

The proposed works will result in the removal of 7.14 ha of intact, regrowth and scattered Koala habitat trees over an approximate 6km length of Appin Road). As the area is part of a much larger contiguous patch of habitat used by Koalas, the loss of this area is highly unlikely to have any long-term impacts on the area of occupancy of the local population.

Criterion c: fragment an existing population into two or more populations

The loss of up to 7.14 ha of foraging habitat will not result in the remaining patches of Koala habitat on either side of Appin Road becoming fragmented or isolated from other areas than they already are, other than an increase separation of up to 25m at Noorumba Reserve resulting from the road widening. This habitat separation is currently traversed by Koalas, leading to vehicle strike. The proposed action, as amended, is proposed to improve this connectivity between protected habitat areas by providing two strategically located Koala underpasses (at locations identified/recommended by Biolink (2018b and 2018c), Phillips (2019) and the NSW Chief Scientist (2020, 2021a & 2021b)) and combined with temporary and permanent Koala exclusion fencing to guide Koala's to where safe crossings can be made.

Criterion d: adversely affect habitat critical to the survival of the species

The impact area includes a number of 'factors' listed in the DCCEEW Koala Referral and Conservation Advice (DCCEEW 2022) that are considered 'habitat critical to the survival of the species', including habitat that is used for essential life cycle requirements (foraging, sheltering, dispersal), is used by an important population, assists in maintaining genetic diversity, used as a corridor).

Whilst the proposed action will adversely affect this habitat, it will have significant longer term benefits in terms of enhancing connectivity and reducing mortality thereby allowing the local population to disperse and maintain genetic diversity.

Criterion e: disrupt the breeding cycle of a population

As the proposed works will involve the removal of a small area of habitat over a 6 km length of Appin Road, that is within a larger area of habitat which will not become fragmented or isolated, it is unlikely the proposed work would disrupt the breeding cycle of the local population.

Criterion f: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The patches of Koala habitat from which the up to 7.14 ha will be removed is recognised as important habitat for Koalas (it is mapped as Core Koala Habitat in the Campbelltown Comprehensive Koala Plan of Management Biolink (2018a)). It is however, a relatively small area of habitat loss, distributed across a 6km length of Appin Road and is adjacent to over 6,000 ha of protected (Dharawal Nature Reserve) and proposed to be protected (Georges River Koala National Park and Mt Gilead Koala Conservation Area).

The proposed action, as amended, is proposed to improve the connectivity between these patches and provide safe passage for Koala crossings by guiding Koala's to where safe crossings can be made with temporary and permanent Koala exclusion fencing.

Criterion g: result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered species' habitat

The proposed works are unlikely to assist invasive species becoming established as the subject site is already vulnerable to weed invasion, due to its location adjacent to an existing road. The adjacent areas of habitat in Noorumba reserve, the Beulah Biobank site and proposed Brown's Bush BSA site, are/will be under in perpetuity, active conservation management where the prevalence of invasive weeds will be reduced by annual conservation management.

Criterion h: introduce disease that may cause the species to decline; or

The proposed works would be unlikely to introduce a disease that may cause this species to decline. Whilst chlamydia may move into the Campbelltown/Appin Koala population as the population continues to recover, this is likely regardless of the proposed action.

Criterion i: interfere substantially with the recovery of the species

One of the primary objectives of the National Koala Recovery Plan (DAWE 2022) is to stabilise the area of occupancy and population size of declining populations. The proposed action does not interfere with this objective as its primary purpose is to mitigate road mortality by providing a koala exclusion fence along Appin Road (a known road mortality hot spot) and enhance the connectivity between important habitat areas between the Georges and Nepean Rivers to allow safe passage and dispersal of an expanding local Koala population.

Conclusion: The final Appin Road Upgrade project, as amended by this addendum REF (to include Koala underpasses and Koala exclusion fencing) and further refined following exhibition of the AREF, is unlikely to result in a 'significant effect' on the Koala or local Koala population. The proposed activity is designed to mitigate a major threat to Koala, that being road mortality on Appin Rd and improving connectivity between areas of important habitat by providing safe passage for east-west and west-east movement of Koalas between the Georges and Nepean Rivers.

Callocephalon fimbriatum (*Gang-gang Cockatoo*)

The Gang-gang Cockatoo is listed as endangered under the EPBC Act. It is an altitudinal migrant, occupying mature, wet sclerophyll forest at higher altitudes in summer and moving to lower altitude, coastal woodlands in winter where it breeds. It has been recorded in the study area foraging and breeding approximately 5-10 km north in St Helens Park. There are no large hollow bearing trees, that would provide potential breeding sites for the species in the Project area that will be impacted.

Criterion a: lead to a long-term decrease in the size of a population of a species

Up to 9.80 ha of Gang-gang Cockatoo habitat will be directly impacted by the Project comprising 5.24 ha of CPW and SSTF in moderate to good condition, 4.57 ha of CPW and SSTF as scattered remnant trees (**Table 3**). Of this 9.80 ha, 2.91 ha has been approved as part of the Mt Gilead Stage 1 residential development (EPBC 2015-7599) as shown in **Figure 1**, **Appendix A**. The residual impacts resulting from the proposed final Project are accordingly 6.89 ha.

This habitat occurs on the verges of Appin Rd and on the margins of larger, more continuous habitat (Browns Bush, Noorumba Reserve and Beulah BioBank site), which are connected to the Georges River and the proposed Koala National Park, and the proposed Koala Conservation Area in Mt Gilead Stage 2 residential development.

The proposed works will result in the permanent loss of up 6.89 ha of intact, regrowth and scattered habitat trees over an approximate 6km length of Appin Road. Given the large area that the species will forage over, this is a small proportion of each individuals habitat requirements and accordingly, on its own, is highly unlikely to lead to a long-term decrease in the size of the local population.

Criterion b: reduce the area of occupancy of the species

The proposed works will result in the removal of 6.89 ha of intact, regrowth and scattered habitat over an approximate 6km length of Appin Road. As the area is part of a much larger contiguous patch of habitat used by the species, the loss of this area is highly unlikely to have any long-term impacts on the area of occupancy of the local population.

Criterion c: fragment an existing population into two or more populations

The loss of up to 6.89 ha of foraging habitat along Appin Road will not result in the remaining patches of habitat becoming fragmented or fragmenting an existing population into two or more populations given the mobility of the species.

Criterion d: adversely affect habitat critical to the survival of the species

The Conservation Advice for the Gang-gang Cockatoo (DCCEEW 2022) states that 'habitat critical to the survival of the species', includes all foraging habitat during the breeding and non-breeding season. Accordingly the loss of 6.08 ha of habitat is considered habitat critical to the survival of the species. However, given the small area to be impacted, it is considered that this is unlikely adversely affected the species.

Criterion e: disrupt the breeding cycle of a population

As the proposed works will involve the removal of a small area of habitat over a 6 km length of Appin Road, that is within a larger area of habitat which will not become fragmented or isolated, it is unlikely the proposed work would disrupt the breeding cycle of the local population.

Criterion f: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As the proposed works will involve the removal of a small area of habitat over a 6 km length of Appin Road, that is within a much larger area of habitat, it is unlikely the proposed work would decrease the availability or quality of habitat to the extent that the species is likely to decline.

Criterion g: result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered species' habitat

The proposed works are unlikely to assist invasive species becoming established as the subject site. The adjacent areas of habitat are (Noorumba, Beulah) or will be (Browns Bush), managed for conservation where any invasive species will be required to be managed.

Criterion h: introduce disease that may cause the species to decline; or

The proposed works would be unlikely to introduce a disease that may cause this species to decline.

Criterion i: interfere substantially with the recovery of the species

DCCEEW (2022) states that the primary conservation objective for the species is to prevent further declines and support increases in the population size of the Gang-gang Cockatoo. The proposed action is unlikely to affect meeting this objective.

Conclusion: The proposed action is unlikely to have a significant impact on the endangered species, Gang-gang Cockatoo.

Calyptorhynchus lathami lathami (*Glossy Black Cockatoo*)

Calyptorhynchus lathami lathami (Glossy Black Cockatoo*)* is listed as a vulnerable species under the EPBC Act.

The species has been observed in the study area and broader locality. There are no large hollow bearing trees suitable as breeding sites in the impact area and very limited feed trees (Allocasuarina and Casuarina cones).

Criterion a: lead to a long-term decrease in the size of an important population of a species

Up to 9.80 ha of Glossy Black Cockatoo habitat will be directly impacted by the Project comprising 5.24 ha of CPW and SSTF in moderate to good condition, 4.57 ha of CPW and SSTF as scattered remnant trees (**Table 3**). Of this 9.80 ha, 2.91 ha has been approved as part of the Mt Gilead Stage 1 residential development (EPBC 2015-7599) as shown in **Figure 1**, **Appendix A**. The residual impacts resulting from the proposed final Project are accordingly 6.89 ha.

This habitat occurs on the verges of Appin Rd and on the margins of larger, more continuous habitat (Browns Bush, Noorumba Reserve and Beulah BioBank site), which are connected to the Georges River and the proposed Koala National Park, and the proposed Koala Conservation Area in Mt Gilead Stage 2 residential development.

The proposed works will result in the permanent loss of up 6.89 ha of intact, regrowth and scattered habitat trees over an approximate 6km length of Appin Road. Given the large area that the species will forage over, this is a small proportion of each individuals habitat requirements and accordingly, on its own, is highly unlikely to lead to a long-term decrease in the size of the local population.

Criterion b: reduce the area of occupancy of an important population

The area of occupancy for Glossy Black Cockatoo is estimated at 470,000 km².

The proposed works will result in the removal of 6.89 ha of intact, regrowth and scattered habitat over an approximate 6km length of Appin Road. As the area is part of a much larger contiguous patch of habitat used by the species, the loss of this area is highly unlikely to have any long-term impacts on the area of occupancy of the local population.

Criterion c: fragment an existing important population into two or more populations

The loss of up to 6.89 ha of foraging habitat along Appin Road will not result in the remaining patches of habitat becoming fragmented or fragmenting an existing population into two or more populations given the mobility of the species.

Criterion d: adversely affect habitat critical to the survival of a species

The Conservation Advice for the species (DCCEEW 2022) refers to areas necessary for foraging, breeding, roosting and dispersal. Accordingly the loss of 6.89 ha of habitat is considered habitat critical to the survival of the species. However, given the small area to be impacted, it is considered that this is unlikely adversely affected the species.

Criterion e: disrupt the breeding cycle of an important population

The proposed action will not disrupt the breeding cycle of the Glossy Black Cockatoo as there is no breeding habitat being impacted.

Criterion f: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposed works are unlikely to assist invasive species becoming established as the subject site. The adjacent areas of habitat are (Noorumba, Beulah) or will be (Browns Bush), managed for conservation where any invasive species will be required to be managed.

Criterion g: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As the proposed works will involve the removal of a small area of habitat over a 6 km length of Appin Road, that is within a much larger area of habitat, it is unlikely the proposed work would decrease the availability or quality of habitat to the extent that the species is likely to decline

Criterion h: introduce disease that may cause the species to decline; or

The proposed works would be unlikely to introduce a disease that may cause this species to decline.

Criterion i: interfere substantially with the recovery of the species

The proposed action is unlikely to affect meeting this objective.

Conclusion: The proposed action is unlikely to have a significant impact on the endangered species, Glossy Black Cockatoo.

Dasyurus maculatus (*Spot-tailed Quoll*)

The Spot-tailed Quoll is listed as endangered under the EPBC Act. Spot-tailed Quolls are mainly a forest dependent species, are solitary animals that occur at low densities and are difficult to detect. Males have very large home ranges of up to "a few thousand hectares in size (TSSC 2020).

It has not been recorded in the study area but has been recorded in the extensive areas of bushland to the east of the study area (Sydney Water Catchment areas, Dharawal National Park, Holsworthy Military area).

Criterion a: lead to a long-term decrease in the size of a population of a species

Up to 10.96 ha of Quoll habitat will be directly impacted by the final Project comprising CPW and SSTF in moderate to good condition, CPW and SSTF as scattered remnant trees and derived native grasslands (**Table 3**). Of this 10.96 ha, 3.85 ha has been approved as part of the Mt Gilead Stage 1 residential development (EPBC 2015-7599) as shown in **Figure 1 Appendix A**. The residual impacts resulting from the REF are accordingly 7.11 ha.

This habitat occurs on the verges of Appin Rd and on the margins of larger, more continuous habitat (Browns Bush, Noorumba Reserve and Beulah BioBank site), which are connected to the Georges River and the proposed Koala National Park, and the proposed Koala Conservation Area in Mt Gilead Stage 2 residential development.

The proposed works will result in the permanent loss of up 7.11 ha of intact, regrowth and scattered habitat trees over an approximate 6km length of Appin Road. Given the large area that the species will forage over, this is a small proportion of each individuals habitat requirements and accordingly, on its own, is highly unlikely to lead to a long-term decrease in the size of the local population.

Criterion b: reduce the area of occupancy of the species

The proposed works will result in the loss of a small area of foraging habitat (7.11 ha). This loss of habitat will have a very minor impact on the area of occupancy of the species.

Criterion c: fragment an existing population into two or more populations

The proposed works will result in the removal of a small area of vegetation (approximately 7.11 ha) which represents potential foraging habitat for the Spot-tailed Quoll. As the species is highly mobile, the proposed works are unlikely to result in the fragmentation or isolation of populations of Spot-tailed Quolls.

The loss of up to 7.11 ha of habitat along Appin Road will not result in the remaining patches of habitat becoming fragmented or fragmenting an existing population (as no individuals have been recorded in the Project area) into two or more populations given the mobility of the species.

Criterion d: adversely affect habitat critical to the survival of the species

The Recovery Plan for the Spot-tailed Quoll (DELWP) states that there is 'insufficient information to identify 'habitat critical to the survival of the species', and therefore all habitat is considered habitat critical to the survival of the species'.

Given the small area to be impacted, it is considered that habitat critical to the survival of the species is unlikely to be adversely affected by the action.

Criterion e: disrupt the breeding cycle of a population

The Spot-tailed Quoll shelters in fallen logs, boulder piles, burrows and trees, and uses these features for breeding purposes. However, as there have been no records of the species in the Project area, it is considered that the proposed action is unlikely to disrupt the breeding cycle of a population.

Criterion f: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As the proposed works will involve the removal of a small area of habitat over a 6 km length of Appin Road, that is within a much larger area of habitat, it is unlikely the proposed work would decrease the availability or quality of habitat to the extent that the species is likely to decline.

Criterion g: result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered species' habitat

The proposed works are unlikely to assist invasive species becoming established as the subject site. The adjacent areas of habitat are (Noorumba, Beulah) or will be (Browns Bush), managed for conservation where any invasive species will be required to be managed.

Criterion h: introduce disease that may cause the species to decline; or

The proposed works would be unlikely to introduce a disease that may cause this species to decline.

Criterion i: interfere substantially with the recovery of the species

The National Recovery Plan for the Spot-tailed Quoll states that the overall objective is to reduce the rate of decline of the Spot-tailed Quoll and ensure viable populations remain throughout its current range in eastern Australia (DEWLP 2016). The proposed action is unlikely to affect meeting this objective.

Conclusion: The proposed action is unlikely to have a significant impact on the endangered species, Spot-tailed Quoll.

Lathamus discolor (Swift Parrot)

The Swift Parrot is listed as a critically endangered species under the EPBC Act.

The Swift Parrot is a widespread highly mobile species which is endemic to South-Eastern Australia. The species breeds in Tasmania between September and January then migrates to the mainland in autumn to feed on eucalypt species in flower. It has been recorded foraging in Brown Bush in 2018 and there are historical records of foraging birds from the Gilead area including Beulah and Noorumba Reserves.

Criterion a, b and c: Lead to a long-term decrease in the size of a population; reduce the area of occupancy of a species; fragment an existing population into two or more populations

The proposed works will result in the removal of a small area of potential foraging habitat (up to 9.80 ha), of which 2.91 ha has been approved as part of the Mt Gilead Stage 1 residential development (EPBC 2015-7599) as shown in **Figure 1 Appendix A**. The residual impacts resulting from the REF are accordingly 6.89 ha.

area represents a very small proportion of foraging habitat for this highly mobile species, within the larger study area and wider landscape. Accordingly the proposed works are unlikely to lead to the long-term decrease in the area of occupancy or fragment an existing population into two or more populations.

Criterion d, e and f: Adversely affect habitat critical to the survival of a species; disrupt the breeding cycle of a population; modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

The National Recovery Plan for the Swift Parrot (Saunders and Tzaros 2011) states that the priority habitat for the Swift Parrot on mainland Australia (as the species breeds in Tasmania) is areas regularly used by a large proportion of the population and used for prolonged periods of time. The study area has only been used infrequently by a small number of birds (less than 10). The proposal will remove up to 6.89 ha of foraging habitat from a much larger area of suitable habitat for this species in the locality. The species is highly mobile and extensive areas of potential foraging habitat will remain within the locality. Therefore the proposal is unlikely to significantly modify, remove or decrease the availability of habitat or adversely affect habitat critical to the survival of the Swift Parrot to the 'extent that the species' is likely to decline.

Criterion g: Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat;

The proposed works are unlikely to result in the establishment of an invasive species that is harmful to the Swift Parrot.

Criterion h: Introduce disease that may cause the species to decline;

The proposed works are unlikely to result in the introduction of diseases causing the Swift Parrot to decline.

Criterion i: Interfere with the recovery of the species;

Given that the Swift Parrot does not breed on the mainland, forages widely and that extensive potential habitat for Swift Parrot will remain within the study area and surrounding landscape, the proposed works are unlikely to interfere with the recovery of this species.

Conclusion: it is unlikely that the proposed works will lead to a significant impact on the Swift Parrot.

Pteropus poliocephalus (Grey-headed Flying-fox)

Pteropus poliocephalus (Grey-headed Flying-fox) is listed as a vulnerable species under the EPBC Act.

This species inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).

This species was not recorded within the study area during field survey, but has been recorded frequently within 5 km of the study area and will likely use resources within the study area and subject site from time to time, the subject site therefore represents potential foraging habitat. The closest flying-fox camp is Campbelltown, approximately 10 km north of the study area. The latest count for this camp in November 2017 estimated a maximum population of up to 2, 500 individuals.

Criterion a: lead to a long-term decrease in the size of an important population of a species

An important population is defined as a population that is necessary for a species' long-term survival and recovery (DoE 2013). The GHFF is considered to be one population that intermixes up and down the east coast, therefore any bat population is a meta-population of this one "important population".

Under the final proposed action, up to 9.80 ha of vegetation representing foraging habitat for the species will be impacted. Of this 9.80 ha, 2.91 ha has been approved as part of the Mt Gilead Stage 1 residential development (EPBC 2015-7599) as shown in **Figure 1 Appendix A**. The residual impacts resulting from the REF are accordingly 6.89 ha.

The amount of habitat to be affected is relatively small given the large amount of foraging habitat available in the broader region. The removal of this potential foraging habitat would not lead to the long-term decrease in the size of an important population of GHFF.

Criterion b: reduce the area of occupancy of an important population

The distribution of the GHFF extends from Bundaberg in Queensland to Melbourne, Victoria and from the coast inland to the western slopes of New South Wales. The removal of potential foraging habitat from the study area would not reduce the area of occupancy of an important population of GHFF.

Criterion c: fragment an existing important population into two or more populations

The GHFF is a highly mobile species and forms one large intermixing population along the east Australian coast. No roosting habitat will be impacted and large areas of foraging habitat are present in the region. The proposed action will not fragment an existing important population into two or more populations.

Criterion d: adversely affect habitat critical to the survival of a species

The draft recovery plan for GHFF (DECCW 2009) identifies foraging habitat that is critical to the survival of GHFF as follows:

Foraging habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for GHFF. Natural foraging habitat that is:

1. productive during winter and spring, when food bottlenecks have been identified

2. known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult)

3. productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May)

4. productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions)

5. known to support a continuously occupied camp.

There are a small number GHFF camps within 50 km of study area (DoE 2017). While populations fluctuate between the camps, the Macquarie Fields bat camp has been known to have a population greater than 30,000 individuals and is situated approximately 25 km north of the study area.

The tree species within the study area includes native winter-flowering Eucalypts. While the vegetation on the site may form part of "habitat critical to survival, or essential habitat" based on the above criteria, the loss of 6.89 ha of foraging habitat, is unlikely to lead to a decline in the species or increase survival risk to the species.

Criterion e: disrupt the breeding cycle of an important population

The proposed action will not disrupt the breeding cycle of the GHFF. The closest camp is located 10 km north of the study area at Campbelltown. The proposed action is situated far enough away and is unlikely to disrupt this camp during construction.

Criterion f: Adversely affect habitat critical to the survival of a species; modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

No GHFF camps would be removed or disturbed, and extensive foraging habitat exists in the region within large conservation areas and in urban areas. The proposed works would be unlikely to modify, destroy, remove, or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Criterion g: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;

The subject site is already disturbed and modified and the proposed works will not result in the establishment of an invasive species that is harmful to the GHFF.

Criterion h: Introduce disease that may cause the species to decline;

Grey-headed Flying-foxes are reservoirs for the Australian bat lyssavirus (ABL) and can cause clinical disease and mortality in GHFF (DECCW 2009a). The proposed works is unlikely to present a significant ecological stress on known individuals or camps utilizing the subject site and therefore unlikely to affect this species. The proposed work would be unlikely to introduce a disease that may cause this species to decline.

Criterion i: Interfere substantially with the recovery of the species;

A Draft National Recovery Plan for the Grey-headed Flying-fox was developed in 2009. As no maternity camps would be removed, proposed works will only result in the removal of a small amount of potential foraging habitat, and that foraging habitat exists in the surrounding landscape it is therefore unlikely that the proposed works would interfere with the recovery of this species.

Conclusion

The proposed will result in impacts to 6.89 ha of native vegetation representing potential foraging habitat for this species. The proposed action is unlikely to impact the lifecycle of the GHFF or lead to a decline in the population of GHFF.

Based on the information provided above, the proposed works are unlikely to result in a significant impact for the Grey-headed Flying-fox.

Chalinolobus dwyeri (Large-eared Pied bat)

The Large-eared Pied-bat is listed as a vulnerable species under the EPBC Act.

This species occurs in sandstone cliffs and fertile woodland valley habitat within close proximity of each other habitat of importance (NSW DECC 2007d). The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging (Pennay 2010 pers. comm. cited in TSSC 2012ad). Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy Martin (*Hirundo ariel*) nests (Hoye & Dwyer 1995; Schulz 1998). It also possibly roosts in the hollows of trees (Duncan et al. 1999).

The diet and foraging behaviour of the Large-eared Pied Bat has not been well studied. The relatively short broad wings of this bat suggest that it is manoeuvrable and forages below the canopy (Hoye 2005).

This species has been recorded foraging within the Mt Gilead area (ELA 2018) and potential foraging habitat exists within the broader study area with likely breeding habitat to the east in the Georges River.

Under the final proposed action, up to 9.80 ha of vegetation representing foraging habitat for the species will be impacted. Of this 9.80 ha, 2.91 ha has been approved as part of the Mt Gilead Stage 1 residential development (EPBC 2015-7599) as shown in **Figure 1**, **Appendix A**. The residual impacts resulting from the REF are accordingly 6.89 ha.

Criterion a: lead to a long-term decrease in the size of an important population of a species

An important population is defined as a population that is necessary for a species' long-term survival and recovery (DoE 2013). The study site does not support key source populations for breeding or dispersal, populations necessary for maintaining genetic diversity, or populations near the limit of the species range.

Criterion b: reduce the area of occupancy of an important population

The distribution of the Large-eared Pied Bat extends from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. The removal of potential foraging habitat from the subject site would not reduce the area of occupancy of an important population of Large-eared Pied Bat. This species is not known to occupy the study site.

Criterion c: fragment an existing important population into two or more populations

This is not an important population. The proposed works will result in the removal of a small area of vegetation (approximately 6.89 ha) which represents known and potential foraging habitat for this species. The proposed works are unlikely to result in the fragmentation or isolation of areas of potential habitat as the proposed works are located on the edge of a larger existing vegetation patch and the Large-eared Pied Bat is a highly mobile species.

Criterion d: adversely affect habitat critical to the survival of a species

The proposed removal of a small area (6.89 ha) of potential foraging habitat is minimal when compared to the large areas of potential foraging habitat which are present within the study area and surrounding landscape, which would be accessible to this highly mobile species.

Given the small amount of habitat to be removed, that potential foraging habitat will be conserved with the study area and adjacent to the site and that this species is highly mobile, it is unlikely that the habitat to be removed would be considered important to the long-term survival of the species in the locality.

Criterion e: disrupt the breeding cycle of an important population

No important Large-eared Pied bat populations have been identified in the study area. The area of vegetation to be removed does not represent potential roosting habitat for this species, as it requires a combination of sandstone cliff/escarpment adjacent to higher fertility sites to provide roosting habitat, and has been observed in disused mine shafts, caves, overhangs, disused Fairy Martin nests and occasionally tree hollows. As such, the proposed works will not disrupt the breeding cycle of an important population.

Criterion f: Adversely affect habitat critical to the survival of a species; modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

The proposed works will result in the removal of a small area of vegetation (approximately 6.89 ha), which is considered minimal when compared to the large areas of potential foraging habitat which are present within the study area and surrounding landscape, which would be accessible to this highly mobile species. Given the small amount of habitat to be removed, that potential foraging habitat will be conserved with the study area and adjacent to the site and that this species is highly mobile, it is unlikely that the habitat to be removed would be considered important to the long-term survival of the species in the locality.

Given the highly mobile nature of the species and the fact that the vegetation on site does not represent primary roosting or foraging habitat the potential for fragmentation or isolation is minimal.

Criterion g: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;

The project will not result in the establishment of an invasive species that is harmful to the Large-eared Pied bat.

Criterion h: Introduce disease that may cause the species to decline;

The project will not result in the introduction of a disease that is harmful to the Large-eared Pied bat.

Criterion i: Interfere substantially with the recovery of the species;

Considering the above factors, the project will not interfere substantially with the recovery of this species.

The action is not likely to have a significant impact on the Large-eared Pied bat.

Ardea ibis (Cattle Egret)

Ardea ibis (Cattle Egret) is listed as a migratory species under the EPBC Act.

The Cattle Egret is widespread in Australia, though a relatively recent migrant to Australia. The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. The Cattle Egret has a diverse diet, which includes fish, macroinvertebrates, frogs, lizards, snakes and small birds and mammals (DEWHA, online).

This species has been recorded within 5 km of the study area, and the study area provides potential marginal foraging habitat.

Criterion a: substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

The study area does not represent important habitat for the Cattle Egret as it does not occur on the limit of the species' range, and does not support an ecologically significant proportion of the population of the species, is not of critical importance to the species at particular life cycle stages and is not within an area where the species is declining.

The proposal would result in the removal of marginal foraging habitat for this species. However, removal of vegetation would not represent a substantial loss of foraging habitat for this species, as it is unlikely to be reliant on the resources present in the study area and able to use other areas due to its highly mobile nature. The proposed works would not impact on wetland areas or water bodies. Therefore, the proposed loss of 6.32 ha of potential foraging habitat is not likely to substantially modify, destroy, or isolate an area of important habitat for this species.

Criterion b: result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or

The project will not result in the establishment of an invasive species that is harmful to the Cattle Egret.

Criterion c: seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The proposal is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of the Cattle Egret. The removal of vegetation within the study site represents a relatively small amount of potential marginal foraging habitat, compared with potential habitat remaining within the study area and wider landscape, and will not impact on wetland areas or water bodies. As such the proposed works would be unlikely to affect this species, which has a diverse diet and forages over a range of habitats.

Based on the information provided above, the proposed works are unlikely to result in a significant impact for the Cattle Egret. Therefore, a referral to the Commonwealth is not required.

Merops ornatus (Rainbow Bee-Eater)

The Rainbow Bee-eater is listed as a migratory species under the EPBC Act.

The Rainbow Bee-eater is distributed across the majority of mainland Australia, with the exception of the most arid zones of the central and western deserts. It can be found on several near-shore islands, but is not found in Tasmania. Southern populations of Rainbow Bee-eater are known to migrate following breeding to spend winter

in northern Australia. It is found mainly in open forests, woodlands and shrublands, and can tolerate some level of human disturbance or habitation, but has been found in a wide range of habitat types from vine thickets to sedgelands to dune systems. The Rainbow Bee-eater generally forages from open perches, from which it may scan for prey. Prey usually consists of flying insects, however they have been known to occasionally eat earthworms, spiders and tadpoles (DEWHA, online).

This species has not been recorded within 5 km of the study area, however the study area represents potential foraging habitat for this species.

Criterion a: substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

The study area does not represent important habitat for the Rainbow Bee-eater as it does not occur on the limit of the species' range, and does not support an ecologically significant proportion of the population of the species, is not of critical importance to the species at particular life cycle stages and is not within an area where the species is declining.

The proposal would result in the removal of potential foraging habitat for this species. However, rremoval of vegetation would not represent a substantial loss of foraging habitat for this species, as it is unlikely to be reliant on the resources present in the study area and able to use other areas due to its highly mobile nature. Therefore, the proposed loss of 6.32 ha of potential foraging habitat is not likely to substantially modify, destroy, or isolate an area of important habitat for this species.

Criterion b: result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or

The project will not result in the establishment of an invasive species that is harmful to the Rainbow Bee-eater.

Criterion c: seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The proposal is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of the Rainbow Bee-eater. The removal of vegetation within the study site represents a relatively small amount of potential foraging habitat, compared with potential habitat remaining within the study area and wider landscape, and as such would be unlikely to affect this species, which forages over a range of habitats including cleared areas.

Rainbow Bee-eaters nest predominantly in banks of rivers, creeks, or dams. No areas of potential breeding habitat occur within the study site. Therefore, the proposed works will not disrupt the lifecycle of the Rainbow Bee-eater.

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